This activity has been planned and implemented in accordance with the Essentials and Standards of the Accreditation Council for Continuing Medical Education (ACCME) through the joint sponsorship of the Society for Education in Anesthesia (SEA) and the Society for Obstetric Anesthesia and Perinatology (SOAP). The SEA is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.
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Scientific Program Committee

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Gary M.S. Vasdev, MD
Mayo Clinic
Rochester, MD

Accreditation
This activity has been planned and implemented in accordance with the Essentials and Standards of the Accreditation Council for Continuing Medical Education (ACCME) through the joint sponsorship of the Society for Education in Anesthesia (SEA) and the Society for Obstetric Anesthesia and Perinatology (SOAP). The SEA is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

The Society for Education in Anesthesia designates this continuing medical education activity for a maximum of 22 credit hours in category 1 credit towards the AMA Physician's Recognition Award. Each physician should claim only those hours of credit that he/she actually spent in the educational activity.

Mission of SOAP
The purpose of this Society is to provide a forum for discussion of medical problems unique to the peripartum period and to promote excellence in medical care, research, education in anesthesia, obstetrics, and neonatology.

Mission of SOAP Program Committee
The mission of the Society's Program Committee is to provide anesthesiologists, obstetricians, and other physicians and members of related allied health specialties with the knowledge and skills that will reinforce past learning as well as disseminate new concepts and practices involving anesthesia and analgesia for the pregnant woman.

Goals of the SOAP 2001 Program
1. To provide ongoing CME activities designed to teach our audience how to best provide analgesia for labor and anesthesia for cesarian section and other procedures during pregnancy and postpartum period;
2. To provide an Annual Scientific Meeting to the members as a forum for discussion that includes the opportunity for expression of new clinical insights, research results, applications and courses that will enhance the practice of obstetrical anesthesia;
3. To provide a forum for discussions dealing with specific issues that will enhance the effectiveness and cost efficiency of obstetrical anesthesia and analgesia;
4. To provide information and a forum for discussion on subjects which have been requested by members of the previous annual meeting and via needs assessment requests in the Society's newsletter.

Educational Format
CME activities may include the following formats: Plenary sessions, debates, lectures, poster discussions, problem-based learning, and refresher courses.

Participants in the SOAP 2001 Program
Attendance shall be open to all health practitioners, provided that they have registered for the meeting. CME credit will only be offered to MDs or DOs or equivalent. Certificate of Attendance will be offered to all registrants.
When hearing of this award, which honors the illustrious lifetime achievements of Dr. Mieczyslaw Finster, or Mike, as he is known to all of us, the first thought to occur is how superfluous introductions are. He is, and has been a familiar figure on an unusually wide stage, not only in anesthesia and obstetrical circles, but also across many generations within those fields. There is by this time almost nowhere in the world where he would not be professionally recognized and welcomed by old friends.

It was in 1967, when I came to Columbia Presbyterian Hospital that I first met Mike, and 1974 when I joined him to work in the labor room. Since then, we have maintained a long relationship, during which my trust in, and respect for his great abilities have only grown with the years.

Having both spent our early lives in Europe, we would talk at times about our experiences in the Second World War. While mine involved evacuation from home because of the danger of bombing raids, and a certain disruption of education, Mike spent a very important part of his youthful years fully immersed in a nightmare. In spite of isolation, family losses, hunger and a horrific journey, in which immediate survival was his only goal, Mike did eventually step out of one of civilization's worst atrocities. He came via a long winding road from Poland to Israel, then on to Switzerland, where he studied medicine, and at last to the United States in 1958.

One might think that such experiences would have produced an unreconstructed misanthrope, but that most certainly has not been the case. The most prominent feature of his personality has been his capacity to reach out to people to establish an exchange and effect a camaraderie which crosses cultural, language, professional and ideological lines. His office over the years has had an open-door policy; no colleague, resident or student was ever turned away. Countless generations of those within the hospital community could come in with their problems, be they related to career, academic goals, research or personal woes and be sure to receive encouragement and help or just reassurance that things could not be as bad as they seemed.

Mike's energy, exuberance, and optimism seem boundless, so I need only highlight his professional achievements. Being an Attending-in-charge of the Obstetrical Anesthesia Service at Sloan Hospital for Women since 1962, Professor of Anesthesiology, and Professor of Obstetrics and Gynecology at the College of Physicians and Surgeons of Columbia University since 1975, and 1978, respectfully, is only a beginning.

In his many years of research, publishing, editing, educating, and advising, Mike has truly evolved into something of a grandfather in his field, though like many modern-day grandfathers, he remains very young, and abreast of developments. As a lecturer he has a reputation and scope, which has moved well beyond New York City to an international audience. His polished, clearly articulated style is enhanced by his linguistic talents, which allow him to communicate fluently in several languages - with smatterings in a few more.

Mike's dedication to SOAP has been unfailing since its infancy, serving as he has on its Board of Directors from 1992-97, and as President in 1995-96. In the developing years of this new field of specialization, Mike soon came to be respected as one who could maintain his standards and hold his own, at a time when trans-disciplinary relations could be contentious, and sometimes downright volatile. His diplomatic and upbeat style was indispensable in defusing negative situations.

I believe that the fulcrum of Mike's life is his family; Lily his wife of more than forty years, a warm, charming, engaging woman, their son Victor, and daughter Evelyn both recently married; all are the spinal column on which his career has been built.

It is reassuring and in a way inspiring to see Mike, still today, active and in such good health. I would like to thank the editors for allowing me to jot down a few impressions of a very interesting and complex man - a scholar, lecturer, writer, mentor, administrator, and my friend.

Hilda Pedersen, MD
Faculty Disclosures

1. No relationship w/commercial supporters
2. Research Support
3. Speaker’s Bureau
4. Consultant
5. Shareholder (Directly Purchased)
6. Other Financial Support
7. Large Gift(s)
8. Did not receive disclosure information prior to printing. Disclosure will occur prior to presentation.
9. Unless otherwise indicated all faculty will comply with Trade/Unlabeled Use of products policy in their presentation.

Abstract Presenter Disclosures

Ingrid Browne
2 - B. Braun
Juergen Brueckner
2 - Organon Teknika-Akzo Nobel, The Netherlands
Pushkar Dadarkar
2 - 3M Corporation
Fernando Roshan
2 - Sysmex UK Ltd; SIMS Portex Lid, UK; Obstetric Anaesthetists' Association, UK; NeuroCom Inc, USA
David Gambling
2 - Sharp Health Foundation
Ashalatha Nair
2 - Dade Behring
Alex Pue
2 - Arrow International; B. Braun; Anesthesia Services Medical Group

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Brett B. Gutsche, MD
2 - AstraZeneca
3 - AstraZeneca
4 - AstraZeneca
Andrew P. Harris, MD - 1
Teresita T. Horlocker, MD
4 - AstraZeneca
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Gershon Levinson, MD - 8
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Mark C. Norris, MD
4 - AstraZeneca
David Nugent, JD - 8
Geraldine O’Sullivan, MD, FRCA - 1
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Laurence S. Reisner, MD - 1
Robert Resnik, MD - 1
Chris C. Rout, FFARCS - 8
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4 - Purdue National Advisory
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Columbus, OH
Scientific Program

Wednesday, April 25, 2001

8:00 am - 11:00 am  PreSOAP Hospital Tour (See Social Activities)
8:00 am - 2:00 pm  Executive Committee / Board of Directors Meeting
12:00 pm  Registration
2:00 - 2:15 pm  Opening Remarks & Welcome
Alex F. Pue, MD; Laurence S. Reisner, MD
2:15 - 3:40 pm  Lawsuits in OB Anesthesia
Moderator: Alex F. Pue, MD
The Expert Witness - Gershon Levinson, MD
The Plaintiff - Ken Sigelman, JD, MD
The Defendant - David Nugent, JD

| 3:45 - 5:00 pm | Politics and OB Anesthesia
Panel Discussion | Refresher Course Lectures |
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<td>Moderator: McCallum R. Hoyt, MD</td>
<td>3:45 - 4:25 pm CSE &amp; PCEA: Real World Experience</td>
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<td>Discussants: Andrew P. Harris, MD; Patricia A. Dailey, MD; Thomas A. Joas, MD</td>
<td>David R. Gambling, MBBS</td>
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| 5:30 - 7:00 pm | Welcome / California Wine and Cheese Reception |

Thursday, April 26, 2001

7:00 am  Registration
7:00 - 8:00 am  Continental Breakfast with Exhibitors & Posters
8:00 - 9:30 am  Gertie Marx Symposium - Alan Santos, MD (Moderator)

| 9:30 - 10:00 am | Coffee Break with Exhibitors & Posters |
| 10:00 - 11:00 am | Poster Review #1 |
| Moderator: David R. Gambling, MBBS |
| 11:00 am - 12:00 n | Oral Presentations |
| Moderator: Gary M.S. Vasdev, MD |
| 12:00 n - 1:00 pm | Lunch with Exhibitors and Posters |
| 1:00 - 2:00 pm | Debate No. 1  
An Anesthesia Provider Should be Present for Vaginal Delivery in All Patients Receiving Neuraxial Analgesia |
| Moderator: David J. Birnbach, MD | PRO: Brett B. Gutsche, MD |
| CON: William R. Camann, MD |
| 2:00 - 3:00 pm | What’s New in In Vitro Fertilization |
| Christo Zouves, MD |
| 3:00 - 3:30 pm | Break with Exhibitors and Posters |
| 3:30 - 4:30 pm | Poster Review #2 |
| Lawrence C. Tsen, MD |
Friday, April 27, 2001

6:30 - 8:00 am  Breakfast with Exhibitors

7:00 am  Registration

7:00 - 7:45 am  Refresher Course  
*Neurologic Complications of Regional Anesthesia in Obstetrics*  
Mark I. Zakowski, MD

7:00 - 11:30 am  Golf Tournament (See Social Activities)

8:00 - 11:30 am  Fun Run/Walk, Tennis Tournament and Tours (See Social Activities)

12:00 pm - 1:00 pm  Business Meeting

1:00 - 2:30 pm  Oral Presentations  
Moderator: H. Jane Huffnagle, DO

2:30 - 3:00 pm  Break with Exhibitors & Posters

3:00 - 4:00 pm  Zuspan Papers  
Moderator/Judge: Anne May, MBBS, FRCA  
Judges: Robert Resnik, MD; Frederick P. Zuspan, MD; Laurence S. Reisner, MD; Robert D'Angelo, MD

4:00 - 5:00 pm  What's New in Obstetrics?  
Robert Resnik, MD

5:00 - 5:15 pm  Presentation of Zuspan Award  
Frederick P. Zuspan, MD; Anne May, MBBS, FRCA

6:30 pm  Banquet — Sea World

**SOAP Sea World Banquet**

This may very well be the highlight of the meeting. On Friday evening, bus transportation will be provided to and from Sea World for the SOAP Annual Banquet and Awards. There, we will have a reception in the Penguin Patio and dinner in the Nautilus Pavilion. Adults will enjoy Chicken Dijon with Filet of Salmon. Of course a vegetarian dish will be available; this is California. Children will have their own special menu. During dinner, we will be entertained by strolling Mariachis and the awards ceremony. The evening will climax with our own private, breathtaking, Nighttime Shamu Show.
Saturday, April 28, 2001

6:30 am  Registration

7:00 - 8:15 am  Continental Breakfast in Plenary Session Room

7:00 - 8:15 am  Clinical Forum: Coagulopathies & Transfusion Medicine
Moderator: Shiv Kumar Sharma, MD, FRCA

LMWH & Neuraxial Anesthesia - Terese T. Horlocker, MD
Bleeding Disorders, Transfusion & Cell Saver in OB - Penny Ballem, MD

8:15 - 9:15 am  Fred Hehre Lecture
M. Joanne Douglas, MD

9:15 - 10:00 am  Debate No. 2
Most OB Patients with a “Wet Tap” Should Get a Prophylactic Epidural Blood Patch
Moderator: Geraldine O'Sullivan, MD
PRO: Theodore G. Cheek, MD
CON: Gary M.S. Vasdev, MD

10:00 - 10:30 am  Coffee Break with Exhibitors & Posters

10:30 am - 12:00 pm  Oral Presentations — Best Paper of the Meeting Award
Moderator/Judge: Donald H. Penning, MD, MSc, FRCPC
Judges: Edward R. Molina-Lamas, MD, FACA; Mark C. Norris, MD; David C. Campbell, MD, MSc, FRCPC; Hisayo O. Morishima, MD, PhD

12:00 pm - 1:00 pm  Lunch on own

1:00 - 2:00 pm  Gerard W. Ostheimer: What's New in Obstetric Anesthesia Lecture
B. Scott Segal, MD

2:00 - 3:00 pm  Oral Presentations
Moderator: Cheryl A. DeSimone, MD

3:00 - 4:15 pm  Poster Review #3
Moderator: Laurence S. Reisner, MD

4:15 pm  Best Paper of the Meeting Award / Adjournment
Moderators: Valerie A. Arkoosh, MD; Donald H. Penning, MD, MSc, FRCPC

Sunday, April 29, 2001

11:30 am - 5:30 pm  Post SOAP Wild Animal Park Photo Caravan (See Social Activities)
**Wednesday, April 25, 2001**

<table>
<thead>
<tr>
<th>Time</th>
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<tr>
<td>8:00 am - 11:00 am</td>
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<td>Alex F. Pue, MD; Laurence S. Reisner, MD</td>
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<td>Lawsuits in OB Anesthesia</td>
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<tr>
<td>3:45 - 5:00 pm</td>
<td>Panel Discussion</td>
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<td>3:45 - 5:10 pm</td>
<td>Refresher Course Lectures</td>
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<td>CSE &amp; PCEA: Real World Experience</td>
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<tr>
<td></td>
<td>David R. Gambling, MBBS</td>
</tr>
<tr>
<td>4:30 - 5:10 pm</td>
<td>Latex Allergy</td>
</tr>
<tr>
<td></td>
<td>Barbara Zucker-Pinchoff, MD</td>
</tr>
<tr>
<td>5:30 - 7:00 pm</td>
<td>Welcome / California Wine and Cheese Reception</td>
</tr>
</tbody>
</table>
Lawsuits in OB Anesthesia

Moderator: Alex F. Pue, MD

The Expert Witness - Gershon Levinson, MD
The Plaintiff - Ken Sigelman, JD, MD
The Defendant - David Nugent, JD

2:15 - 3:40 pm

Following this panel, the participants will be able to identify the elements of an obstetric anesthesia malpractice lawsuit and trial. The participants will understand how to prevent and defend against such an occurrence and how to be a good expert witness.
Panel Discussion

Politics and OB Anesthesia

Moderator: McCallum R. Hoyt, MD
Discussants: Andrew P. Harris, MD; Patricia A. Dailey, MD; Thomas A. Joas

3:45 - 5:00 pm

Following this panel, the participants will be able to explain how involvement in politics at different levels will affect their present and future practice of anesthesia. Current issues at local and national levels of both professional and governmental politics will be used as examples.
"Legislative Efforts at the State Level"

State legislatures, through their licensing authority, have the greatest say in the practice of medicine with regards to what practitioners can do within their “scope of practice”. Additionally, through their regulation of non-ERISA insurers, and through their administration of Medicaid programs, they yield considerable additional influence on the practice of medicine.

Important points to remember:

1) State legislative districts are much smaller than congressional districts- this means that you can get closer to your state legislators. They are more likely your “neighbors”, and listen more intently. Make efforts to get to know your legislator.

2) This is true for your legislative “opponents” as well!

3) It is easier to testify at the state level - use this to your advantage.

4) State legislatures consider thousands of bills in a given session. Anesthesia-related bills generally don’t get much attention, so your input on these bills will be significant. Make sure your legislators know at every step of the process how you and your colleagues feel about the legislation. If your state has a part-time legislature, know how the session limitation effects bill passage.

5) Write, write, write, call, call, call, email, email, email, visit, visit, visit.

6) Get involved with your state medical society - use their leverage, and get our issues on their “radar screen”.

7) Get involved and support your state specialty society - they will be your organized voice on there issues, and you need to be as well organized (or better) than your opponents.
A BILL ENTITLED

AN ACT concerning

Physician Assistants - Practice of Anesthesiology

FOR the purpose of prohibiting physician assistants from acting within the scope of practice of anesthesiology.

BY repealing and reenacting, with amendments,
Article - Health Occupations
Section 15-102
Annotated Code of Maryland (2000 Replacement Volume)

SECTION 1. BE IT ENACTED BY THE GENERAL ASSEMBLY OF MARYLAND, That the Laws of Maryland read as follows:

Article - Health Occupations

15-102.

(a) A physician assistant may not practice within the scope of practice of any of the following health occupations authorized under this article:

(1) ANESTHESIOLOGY;

(2) Nursing;

(3) Optometry;

(4) Physical therapy; or

(5) Psychology.

(b) This title does not limit the right of an individual to practice a health occupation that the individual is authorized to practice under this article.

SECTION 2. AND BE IT FURTHER ENACTED, That this Act shall take effect October 1, 2001.
A BILL ENTITLED

1 AN ACT concerning

2 Standards of Practice for Nurse Anesthetists - Collaboration

3 FOR the purpose of requiring a nurse anesthetist, in order to practice nurse
4 anesthesia, to collaborate with certain other health care providers in a certain
5 manner; and defining certain terms.

6 BY adding to
7 Article - Health Occupations
8 Section 8-509
9 Annotated Code of Maryland
10 (2000 Replacement Volume)

11 SECTION 1. BE IT ENACTED BY THE GENERAL ASSEMBLY OF
12 MARYLAND, That the Laws of Maryland read as follows:

13 Article - Health Occupations

14 8-509.

15 (A) (1) IN THIS SECTION THE FOLLOWING WORDS HAVE THE MEANINGS
16 INDICATED.

17 (2) “COLLABORATE” MEANS TO DEVELOP AND IMPLEMENT AN
18 AGREEMENT FOR SUPERVISION AND DIRECTION OF A NURSE ANESTHETIST BY
19 ANOTHER HEALTH CARE PROVIDER.

20 (3) “ON SITE” MEANS PHYSICALLY PRESENT IN THE FACILITY IN WHICH
21 THE NURSE ANESTHETIST ADMINISTERS ANESTHESIA.

22 (4) (I) “PRACTICE OF NURSE ANESTHESIA” MEANS THE
23 PERFORMANCE OF ACTS IN COLLABORATION WITH AN ANESTHESIOLOGIST,
24 LICENSED PHYSICIAN, OR DENTIST, WHICH REQUIRE SUBSTANTIAL SPECIALIZED
25 KNOWLEDGE, JUDGMENT, AND SKILLS RELATED TO THE ADMINISTRATION OF
26 ANESTHESIA.

1 (II) THE SKILLS REQUIRED TO PRACTICE NURSE ANESTHESIA

2 SHALL INCLUDE:

3 1. PERIOPERATIVE ASSESSMENT AND MANAGEMENT OF
4 PATIENTS REQUIRING ANESTHESIA SERVICES;

5 2. THE ADMINISTRATION OF ANESTHESIA;

6 3. THE MANAGEMENT OF FLUID IN INTRAVENOUS THERAPY;

7 AND

8 4. RESPIRATORY CARE.

9 (B) IN ORDER TO PRACTICE NURSE ANESTHESIA, A CERTIFIED NURSE
10 ANESTHETIST SHALL COLLABORATE WITH AN ANESTHESIOLOGIST, LICENSED
11 PHYSICIAN, OR DENTIST IN THE FOLLOWING MANNER:

12 (1) AN ANESTHESIOLOGIST, LICENSED PHYSICIAN, OR DENTIST SHALL
13 BE ON SITE AND PHYSICALLY AVAILABLE TO THE NURSE ANESTHETIST FOR
14 CONSULTATION AT ALL TIMES DURING THE ADMINISTRATION OF, AND RECOVERY
15 FROM, ANESTHESIA;

16 (2) AN ANESTHESIOLOGIST SHALL BE AVAILABLE FOR THE NURSE
17 ANESTHETIST TO CONSULT CONCERNING OTHER ASPECTS OF THE PRACTICE OF
18 NURSE ANESTHESIA; AND

19 (3) IF AN ANESTHESIOLOGIST IS NOT AVAILABLE, A LICENSED
20 PHYSICIAN OR DENTIST SHALL BE AVAILABLE FOR THE NURSE ANESTHETIST TO
21 CONSULT.

22 SECTION 2. AND BE IT FURTHER ENACTED, That this Act shall take effect
23 October 1, 2001.
A BILL ENTITLED

AN ACT concerning

Nurse Anesthetists

FOR the purpose of requiring the Board of Nursing to adopt and enforce regulations that conform to the intent of federal Health Care Financing Administration regulations governing the administration by nurse anesthetists of anesthesia in hospitals and ambulatory surgical centers.

BY adding to Article - Health Occupations Section 8-509 Annotated Code of Maryland (2000 Replacement Volume)

Preamble

WHEREAS, On January 17, 2001, the Health Care Financing Administration (HCFA) issued final regulations that removed the federal requirement for the physician supervision of certificated registered nurse anesthetists (CRNAs) who administer anesthesia in hospitals, critical access hospitals, and ambulatory surgical centers; and

WHEREAS, In eliminating this requirement, HCFA noted that advances in medical knowledge, the implementation of practice guidelines, better drugs, and safer equipment have all contributed to a drop in the number of deaths from errors in administering anesthesia from two deaths per 10,000 patients receiving anesthesia in the 1980s to one death per 200,000 to 300,000 patients today, a 40-fold to 60-fold improvement; and

WHEREAS, HCFA noted that its previous regulation did not require that the supervising physician have any expertise in the delivery of anesthesia; and

WHEREAS, HCFA declared in adopting the new regulations after 3 years of thorough investigation, deliberation, and comment from the health care community that "there is no evidence that CRNA independent practice would cause adverse outcomes"; and

WHEREAS, In eliminating this requirement, HCFA also noted its new regulation would "allow an appropriate level of regulatory flexibility without compromising patient health or safety"; and

WHEREAS, In eliminating this requirement, HCFA has changed its conditions of hospital participation in the Medicare Program and has stated its desire to move toward standards that are patient-centered and evidence-based; now, therefore,

SECTION 1. BE IT ENACTED BY THE GENERAL ASSEMBLY OF MARYLAND, That the Laws of Maryland read as follows:

Article - Health Occupations

8-509.

THE BOARD OF NURSING SHALL ADOPT AND ENFORCE REGULATIONS THAT CONFORM TO THE INTENT OF FEDERAL HEALTH CARE FINANCING ADMINISTRATION REGULATIONS GOVERNING THE ADMINISTRATION BY NURSE ANESTHETISTS OF ANESTHESIA IN HOSPITALS AND AMBULATORY SURGICAL CENTERS.

SECTION 2. AND BE IT FURTHER ENACTED, That this Act shall take effect October 1, 2001.
TESTIMONY OF THE MARYLAND SOCIETY OF ANESTHESIOLOGISTS ("MSA")
AND THE AMERICAN SOCIETY OF ANESTHESIOLOGISTS ("ASA")
RE: H.B. 1356
BEFORE THE MARYLAND HOUSE COMMITTEE ON ENVIRONMENTAL MATTERS
MARCH 15, 2001

Summary

With due respect to the sponsors of H.B. 1356, The Maryland Society of Anesthesiologists and The American Society of Anesthesiologists (ASA) submits that this bill is without substantive meaning, is potentially misleading if enacted, and in any event presumes the effectiveness of a federal regulation not yet effective and the future of which is in doubt. If the intent of the bill is to create new Maryland law, it fails by its terms; if the intent is to foster independent practice by nurse anesthetists, it fails in its purpose for lack of specificity and is dangerous and unwise.

Interest in H.B. 1356

The American Society of Anesthesiologists is a national, nonprofit association of more than 36,000 physicians and other scientists engaged or especially interested in the medical specialty of anesthesiology. More than ninety percent of all practicing Anesthesiologists in the United States belong to the Society, making it the preeminent voice of the specialty. Approximately 750 of its members practice in the State of Maryland and are members of its Maryland component society, the Maryland-DC Society of Anesthesiologists.

Since its founding in 1905, ASA has functioned as a research, scientific, and educational resource for anesthesiologists, patients, the public, and policymakers alike and has continuously provided highly respected guidance and expertise. Through its many publications and professional programs, the Society advances its goals of raising and maintaining the standards of the medical practice of anesthesiology and improving patient care. In recent years, it has been recognized as a leader among medical specialty organizations for its aggressive program of developing practice parameters designed to enhance patient safety. Indeed, the Institute of Medicine recently labeled the ASA-driven patient safety effort the "gold standard" for medical specialties.

H.B. 1356 Is Unnecessary And Inappropriate

H.B. 1356 states as follows:

"The Board of Nursing shall adopt and enforce regulations that conform to the intent of Federal Health Care Financing Administration regulations governing the administration by nurse anesthetists of anesthesia in hospitals and ambulatory surgical centers. Section 2. And be it further enacted, That this Act shall take effect October 1, 2001."

On January 18, 2001, the federal Health Care Financing Administration (HCFA), an agency within the Department of Health and Human Services (DHHS), issued a final rule (Exhibit 1) eliminating its long-standing Medicare/Medicaid requirement that nurse anesthetists be supervised by a physician. The new stated requirement would be that anesthesia be provided to Medicare/Medicaid patients by a practitioner licensed by the State to do so, without any express reference to supervision.

The effective date of the rule is March 19, 2001, but on January 20, President George W. Bush extended the effective date of the rule to May 18. The newly appointed Secretary of DHHS, Tommy Thompson, is now considering whether to permit the rule to go into effect, to amend or rescind it, or to take some other course of action deferring its effectiveness.

ASA, supported by all of organized medicine, vigorously opposed the HCFA rule on patient safety grounds prior to its publication, and is currently advocating that the rule be rescinded, pending completion of a comprehensive comparative anesthesia outcomes study by DHHS. ASA believes that such a study will conclusively show that the anesthesia safety of Medicare/Medicaid patients will be impaired by the elimination of physician involvement in anesthesia care - as several prior outcome studies have already suggested - thus justifying a continued national Medicare/Medicaid minimum supervision standard.

It is vitally important that the Committee understand that finalization of the January 18 rule, should it in fact become effective in its present form, does not place a federal imprimatur on unsupervised nurse anesthesia practice. Instead, the rule merely shifts to the individual States the burden of determining the appropriate safety-related standards for and restrictions on nurse anesthesia practice to the individual States with respect to Medicare and Medicaid cases. In the Summary of the HCFA rule, HCFA states: "Under this final rule, State laws will determine which professionals are permitted to administer anesthetics and the level of supervision required, recognizing a State's traditional domain in establishing professional licensure and scope-of-practice laws. States and hospitals are free to establish additional standards for professional practice and oversight as they deem necessary." Federal Register, Vol. 66, No. 12, Thursday, January 18, 2001 at 4674.
It is a fact that in issuing the rule, HCFA made no determination that unsupervised nurse anesthesia was safe; to the contrary, it merely found that the opponents of the rule had not proven it was unsafe, thus leaving the ultimate question to the individual States. (HCFA's adoption of this test for safety-oriented federal regulatory standards stands in sharp contrast to DHHS's long-standing requirement that drugs and medical devices be proven safe and effective before they can be marketed - apparently HCFA thought that States are competent to decide this nurse anesthesia safety standard for themselves with respect to Medicare/Medicaid cases, but are not competent to evaluate the safety of drugs and medical devices.) In any event, the intent of the HCFA rule, upon which H.B. 1356 is expressly based, is merely to turn over the States the determination of an appropriate standard - not to tell them what that standard should be.

In Maryland, nurse anesthetists are classified by the Board of Nursing as registered nurses with special certification from the American Association of Nurse Anesthetists and the Board of Nursing. See MD. CODE. ANN. [Health Occupations] § 8-503(a)(2)(1999); MD. REGS. CODE tit. 10, Section 10.27.06.01(B) (1999). Exhibit 2 Nurse anesthetists are authorized to engage in the practice of nurse anesthesia, which means "performing acts in collaboration with an anesthesiologist, licensed physician or dentist which require substantial specialized knowledge, judgment, and skill related to the administration of anesthesia, including preoperative and postoperative assessment of patients; administering anesthetics; monitoring patients during anesthesia; management of fluid in intravenous therapy; and respiratory care." See Section 10.27.06.01(A) (defining practice of nurse anesthesia); Section 10.27.06.02(A) (general scope of practice).

Nurse anesthetists must collaborate with physicians or dentists possessing "knowledge and experience in resuscitation, anesthetic drugs, and their reactions." See Section 10.27.06.01 (G); Section 10.27.06.02(B) (expanding on collaboration requirement); Section 10.27.06.01(C) (collaboration requirement). The collaborating anesthesiologist or other qualified physician shall be "physically available to the nurse anesthetist for consultation at all times during the administration and recovery from anesthesia." Section 10.27.06.02(B)(1).

By its terms, H.B. 1356 would not change existing Maryland law as to the practice of nurse anesthesia, nor tell the Board of Nursing what it should do, because the HCFA "intent" upon which it is based does not compel a change in Maryland law or even suggest what Maryland law should be. As noted above, the HCFA rule if it ever takes effect - merely tells the individual States that they are free to set their own standards as to Medicare and Medicaid cases - a state of affairs that has always existed as to all non-Medicare/Medicaid cases.

As judicially interpreted, Maryland's law requires that nurse anesthetists be supervised by a physician. Maryland will be perfectly free to retain that requirement with respect to Medicare and Medicaid cases, and the federal rule upon which H.B. 1356 is based does not suggest that it should be changed. In the preamble to its rule, HCFA states "setting forth a final rule that allows States the ultimate determination regarding which licensed independent practitioners may administer anesthesia does not prohibit any State or hospital from requiring physician supervision." Federal Register, Vol. 66, No. 12, Thursday, January 18, 2001 at 4675. Since the state of Maryland has an established scope of practice for nurse anesthetists and since this scope of practice does not in any way conflict with the intent of the HCFA rule, MSA and ASA fail to understand why this legislation is necessary, or stated otherwise, is not simply superfluous.

**H.B. 1356 Should Not Be Read As Authorizing Unsupervised Nurse Anesthesia**

If by selective references in its recitals to the preamble to the HCFA rule, H.B. 1356 is intended to induce the Board of Nursing to overturn existing Maryland law and grant independent practice to nurse anesthetists, ASA objects on the ground that in light of clear patient safety considerations, a far more specific statement of that legislative intent is required than what now appears in the proposed legislative provision itself.

The determination of anesthesia remains one of the most dangerous of medical procedures to which a patient can be subjected. It involves an undertaking where the patient's physiologic functions are slowed or stopped, and where the margin between the routine and the disastrous is literally measured in seconds and in cubic centimeters of drugs. Under these circumstances, the capacity rapidly and correctly to apply medical judgment to changes in the patient's condition is indispensable, and can - and often does - spell the difference between life and death.

The education and training of anesthesiologists and nurse anesthetists are vastly different and prepare the two professionals for different roles. Nurse anesthetists successfully participate in the provision of many aspects of anesthesia care and are qualified to perform numerous anesthesia-related techniques. However, many aspects of anesthesia care - from the prescription of an anesthesia plan for each patient to the treatment of perioperative aberrations or emergencies - necessitate the comprehensive didactic and clinical medical training of an anesthesiologist or, when an anesthesiologist is unavailable, the medical training of a physician.

Anesthesiologists must complete twelve years of formal education - four years of a science-intensive pre-medical undergraduate education; four years of medical school in which the individual gains knowledge of the fundamental science of the human condition (biochemistry, biophysics, anatomy, pharmacology, physiology and pathology) and receives extensive clinical instruction and experience in medical diagnosis and therapy; and four years of residency training which includes one year of clinical medicine, two years of clinical anesthesiology and one year of concentrated study and experience in connection with the most serious complications.
Anesthesiologists receive extended training in pharmacokinetics -- the quantitative study of the action of drugs in the body over a period of time, including the processes of absorption, distribution, localization in tissues, biotransformation and excretion, and the factors that affect these processes. In addition, many anesthesiologists choose to receive training in subspecialties such as pediatric anesthesia, critical care medicine or pain management.

In contrast, one-third of all practicing nurse anesthetists have not earned an undergraduate degree; only since 1989 have nurse anesthesia training programs required a Bachelor of Science degree in nursing or equivalent undergraduate degree as a prerequisite. Undergraduate nursing programs do not include training in the sciences equivalent to that of a pre-medical program. Nurse anesthesia training programs consist of two to three years of didactic and clinical training in the techniques of administration of anesthetics; beginning in 1998, this training must lead to a master's degree to qualify the trainee for certification as a nurse anesthetist.

Nurse anesthetists are not trained to perform an anesthetic procedure independently. Most importantly, nurse anesthetists are not trained to make a medical assessment of the patient's condition. They are qualified to perform certain functions in connection with the patient's treatment, such as monitoring and technical delivery, provided that an anesthesiologist or other physician remains available to the patient. For example, once the basic parameters of the anesthesia plan are prescribed by the anesthesiologist, a nurse anesthetist is competent to take various steps to implement the plan (such as administering anesthetic agents and monitoring the patient's vital signs).

Licensure requirements for nurse anesthetists exist in every state. In addition, a variety of statutory and regulatory schemes affect nurse anesthesia practice, including the nurse practice act, medical practice act, pharmacy act, regulations and statutes regarding medical facility licensure, and perhaps others. At a minimum, all states require licensure as a registered nurse. In some states, no additional licensure requirements exist because nurse anesthesia practice, including the nurse practice act, medical practice act, pharmacy act, regulations and statutes regarding medical facility licensure, and perhaps others. At a minimum, all states require licensure as a registered nurse. In some states, no additional licensure requirements exist because nurse anesthesia practice, including the nurse practice act, medical practice act, pharmacy act, regulations and statutes regarding medical facility licensure, and perhaps others. At a minimum, all states require licensure as a registered nurse. In some states, no additional licensure requirements exist because

Almost all States today require either that a nurse anesthetist work under the medical direction or supervision of a physician or pursuant to a collaboration arrangement with a physician. MSA and ASA believes that in light of the radical differences in training and skills between anesthesiologists and nurse anesthetists, these laws should be strengthened, not diluted or dismantled.

MSA's and ASA's opposition to independent practice by nurse anesthetists is fundamentally grounded in our concern for patient anesthesia safety. A major single-State anesthesia outcome study was published by researchers at the University of Pennsylvania in July, 2000, showing that after adjustment for patient acuity and hospital characteristics, there were 25 excess deaths per 10,000 Medicare surgical patients when a physician anesthesiologist did not provide or direct the anesthesia care. (Exhibit 4) Most conservatively extrapolated, this result translates into more than 250 excess deaths per year among Medicare surgical patients nationwide.

In the preamble to its January 18 final rule, HCFA discounted the significance of this study because it compared only cases where a physician anesthesiologist, as distinct from some other type of physician (e.g. the surgeon), supervised the anesthesia care given by a nurse anesthetist. Since existing Medicare standards require anesthesiologist or other physician supervision, HCFA reasoned the study was "irrelevant" in that it did not cover cases where there was no physician involvement at all, that is, where nurse anesthetists worked unsupervised.

HCFA was unwilling to infer from the comparative Pennsylvania research data than an even more serious problem might arise when there was no physician supervision at all - a conclusion that the simplest logic would compel. HCFA ignored the testimony of the Pennsylvania study's principal author, given last June before a U.S. Senate committee, that the study "...raises important questions regarding the quality of care delivered to Medicare patients undergoing general surgical and orthopedic procedures who did not have an anesthesiologist personally perform or medically direct their anesthesia care." Instead, HCFA radically mischaracterized the statistical significance of the study in the preamble to the January 18 final rule. Attached is a letter dated January 14, 2001 from the principal author of the Pennsylvania study, detailing HCFA's lack of understanding of the study's meaning and results. (Exhibit 5)

ASA also knows that patients want physicians to be involved in the administration of anesthesia. In a national survey conducted by The Tarrance Group, February 11-14, 2001, 77 percent of seniors said they were opposed (over two-thirds strongly opposed) to HCFA's decision to eliminate the physician supervision requirement, and 92 percent of them favored (almost all strongly) Medicare maintaining uniform benefits and quality of care in all 50 states. Percentages for all voting age citizens on both these questions were just slightly lower. These results are consistent with three other national surveys, and a number of single-State surveys, conducted since late 1997. The results of the 2001 survey are attached (Exhibit 6).

Conclusion

For the foregoing reasons, MSA and ASA believe H.B. 1356 should not be reported out of Committee. We submit that its express terms are without substantive meaning and in any event, contemplate the effectiveness of a federal regulation that has not occurred and may never occur. We also submit that if its express terms are ignored and the bill represents an obscure attempt to induce the Board of Nursing to grant independent nurse anesthesia practice, H.B. 1356 is dangerous, contrary to the public interest, and at variance with the wishes of patients and prospective patients.
Refresher Courses

CSE & PCEA: Real World Experience
David R. Gambling, MBBS

3:45 - 4:25 pm

The learner will be able to incorporate the newer strategies and techniques for anesthetic management of labor and delivery and assess their applicability to a non-academic setting.

Latex Allergy
Barbara Zucker-Pinchoff, MD

4:30 - 5:10 pm

The learner will be able to describe the risk factors for and the diagnosis and treatment of latex allergy.
CSE and PCEA: “Real World” Experience

David R. Gambling, MB, BS; FRCPC
Sharp Mary Birch Hospital for Women, San Diego, California

Introduction:

Labor epidural analgesia has become more sophisticated over the past decade with the introduction of combined spinal-epidural (CSE) analgesia and patient-controlled epidural analgesia (PCEA). CSE is a technique that provides rapid onset, high quality analgesia and permits maternal ambulation if desired. PCEA enables self-administration of small incremental doses of local anesthetic solution. This gives a degree of control to the parturient previously unavailable and reduces the anxiety associated with anticipation of a return of pain. “Real World” experience is defined as a busy private practice in the USA. The term was designed to get your attention but not to insult those of you with a different pattern of practice. Much of what is outlined here is applicable anywhere that an epidural service is provided.

Combined Spinal-Epidural Analgesia

CSE has gained in popularity over the past ten years, in part, because of the development of small bore, pencil point needles long enough to pass beyond the tip of a standard epidural needle. This has allowed dural puncture without risking a high PDH rate (0.5-1%). In addition, anesthesiologists have learned much from studies involving the use of subarachnoid fentanyl and sufentanil during labor.

How is CSE performed?

In my practice, I use a single space, needle through needle technique. Under strict asepsis a 17G, 3 1/2 inch epidural needle is advanced in a standard fashion at the L3-4 interspace until loss of resistance is achieved to air. I then use a 26 or 27 gauge long (5 inch) pencil-point spinal needle that needs to protrude at least 13-15mm beyond the tip of the epidural needle. There are locking spinal needles and epidural needles with a back eye or a spinal needle guide. I have not found these devices to be useful. As soon as a click or crunch is felt I withdraw the stylet of the spinal needle and wait for CSF flow. I then attach a syringe containing bupivacaine 2.5mg and 15-20 μg fentanyl and inject slowly in order to avoid waste or disconnect between the syringe and the spinal needle. After removing the spinal needle I catheterize the epidural space in the usual manner. The risk of passing the catheter through the small hole in the dura made by the spinal needle is negligible. I then start a low dose epidural infusion of a local anesthetic-opioid mixture. Patients are usually comfortable within 3-5 minutes.

Advantages of CSE

- Rapid onset
- No motor block
- Allows more accurate placement of epidural catheter
- Allows patient mobility if desired
- Provides sacral analgesia for advanced labor

**When to use CSE**
- To gain rapid analgesia in cases of severe distress
- Multiparous woman in advanced labor
- To regain patient confidence after a failed epidural
- To promote ambulation in very early labor

**Disadvantages of CSE**
- Pruritus
- Transient fetal bradycardia
- Hypotension, nausea, dysphagia, respiratory arrest
- Urinary retention
- Expense
- Epidural catheter not tested for 90 minutes
- Dural membrane is penetrated

**Potential Complications of CSE**
- Technical failure
- Headache
- Meningitis
- Epidural catheter migration
- Drug passage across dural hole
- High subarachnoid block

**Treatment of Side-Effects**

**Pruritus**
1. Nalbuphine 5mg IV q5-15 min x 2 doses
2. Benadryl 25mg IV x 1 dose
3. Narcan 0.1mg IV x 4 doses prn for intractable itching

**Hypotension**
1. IV fluid bolus
2. Ephedrine 10mg IV increments
3. Place patient in full lateral position
4. Assess anesthetic sensory level

**Fetal Bradycardia**
This may be abrupt in onset and profound, sometimes occurring with a tetanic uterine contraction and/or maternal hypotension.
1. Full lateral position
2. Oxygen by face mask 10L/min
3. Ephedrine 5-10mg IV even in the absence of hypotension
4. Fetal scalp stimulation
5. Sublingual nitroglycerine or s/c terbutaline for tetanic contraction
6. Stop oxytocin infusion, if one is running
7. May require emergency cesarean delivery if conservative measures fail

Patient-Controlled Epidural Analgesia
PCEA is a technique that has gained in popularity because it accommodates inter-patient differences in analgesic requirements during labor. PCEA also solves the problem of increasing pain during the later stages of labor and delivery and with oxytocin infusion. Patients receive an epidural catheter in a standard manner, or as part of a CSE technique, and a PCA pump containing a local anesthetic/opioid mixture of your choice is connected to the catheter.

What I tell the patient about PCEA
- You alone are in control of the pump
- You do not need permission to press the button
- Keep on top of the pain by not allowing it to return to a severe level
- You should feel normal at all times
- Report nausea, shortness of breath, lightheadedness, leg weakness
- Call if not comfortable after multiple PCA demands within a 20-30 minute period
- Expect pain relief within 5-10 minutes of making a demand
- For severe pain in perineal area during second stage use PCA in sitting position

Advantages of PCEA during labor
- Flexibility in dosing
- High patient satisfaction
- Sense of control
- Placebo effect
- Analgesia at least equal to continuous infusion
- Fewer top-up requests than continuous infusion
- Reduces demands on professional time
- Avoids delays in patient receiving extra analgesia

Disadvantages of PCEA during labor
- Cost of PCA pump
- Need to educate patient and nurse
- Not suitable for all parturients
  - Lack of motivation
  - Exhaustion
  - Unable to understand concept

PCEA dosing schedules
We use 0.125% bupivacaine with 2 µg/ml fentanyl. Initial dose 15-20 ml. PCEA dose = 5ml Lockout interval = 5minutes
Background infusion 6ml/hr
Hourly maximum = 26ml

There are many other recipes described. The use of a background infusion is probably unnecessary, but for some groups it is like a “baby security blanket” - very hard to let go of!

It is uncertain what the optimum lockout period is and our group will be reporting the results of a prospective study at this meeting, which compares a 5 minute lockout interval (LI) and one that is 15 minutes. A potential benefit of the 5 minute LI is that the patient can double her dose in 5 minute period if the initial relief is poor. A possible downside of grouping doses in this manner is the increased potential for side-effects, such as high sensory levels, hypotension and increased motor weakness.

Side-effects with PCEA
As with any form of drug delivery into the epidural space there is a potential for inadvertent intravascular and intrathecal injection with PCEA. Even so, I am unaware of any reported problems in the literature and have seen no serious problems in my own practice. Paech has experience with over 11,000 patients who have used PCEA, either in labor, or for post-operative analgesia. He has not seen problems related to either intrathecal or intravascular migration of the catheter. However, patients and nursing staff need to be instructed to look for signs of impending problems, and management protocols should be in place.

In summary:
• Educate the patient – this takes less than 5 minutes
• Educate the nursing staff – they are a huge resource and can make or break a PCEA program. Our nurses are very supportive of PCEA in labor.
• Have protocols in place that allow for rapid and appropriate management of side-effects
• Visit the patients routinely in order to confirm appropriate utilization and lack of adverse sequelae

Conclusion
Both PCEA and CSE have improved the options that anesthesiologists can offer their patients for high quality analgesia during labor. Rapid onset analgesia without significant weakness is now a reality, and patients can participate in their own pain management through PCEA. As consumers, our patients are delighted to have these choices and both techniques have been well accepted by our obstetricians. We have recently had an article written about PCEA in the “San Diego” magazine, which improves the profile of our department within the community and gets the attention of hospital administration. Not always a bad thing!!
References


3 Gambling DR, Sharma SK, Ramin SM et al. A randomized study of combined spinal-epidural analgesia versus intravenous meperidine during labor. Anesthesiology 1998; 89: 1336-44.


More and more patients are now presenting with a diagnosis of latex allergy. It is vital to know how to safely manage these patients, and how to prevent ourselves from joining their ranks. In addition, there are a number of case reports of latex allergy presenting during labor and delivery (1,2,3,4), so that we must be able to diagnose the condition as well.

It appears that less than 1% of the general population has IgE specific to latex (5), but this rises to about 12.5% (6) among highly exposed healthcare workers, and up to 30-60% of patients with myelodysplasia have latex allergy (7). The best way to prevent the development of latex allergy is to minimize exposure, and the only treatment is complete latex avoidance. By far the major source of bioavailable latex allergens in the medical environment is latex gloves. Any institution with a commitment to safe care of patients with latex allergy, and minimizing latex allergy among employees, must either use exclusively non-latex gloves, or low protein, non-powdered latex gloves.

The following topics will be covered:

- CARE OF PATIENTS WITH KNOWN LATEX ALLERGY
- RECOGNITION AND CARE OF PATIENTS WITHOUT PRIOR DIAGNOSIS OF LATEX ALLERGY
- PREVENTION OF LATEX ALLERGY IN HEALTHCARE WORKERS
- MANAGEMENT OF PERSONNEL WITH LATEX ALLERGY

There are many excellent resources available on the internet regarding latex allergy. Several are listed below (8,9,10,11,12)

REFERENCES:

8. ELASTIC: http://ELASTIC@latex-allergy.org
9. Latex Allergy Links: http://latexallergylinks.tripod.com
### Scientific Program

**Thursday, April 26, 2001**

<table>
<thead>
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<th>Time</th>
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<td>Registration</td>
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<td>7:00 - 8:00 am</td>
<td>Continental Breakfast with Exhibitors &amp; Posters</td>
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<tr>
<td>8:00 - 9:30 am</td>
<td>Gertie Marx Symposium - Alan Santos, MD (Moderator)</td>
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<td>Judges: Gertie Marx, MD; GM Bassell, MD; James R. Farina; MD; Anne May, MBBS, FRCA</td>
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<tr>
<td>9:30 - 10:00 am</td>
<td>Coffee Break with Exhibitors &amp; Posters</td>
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<tr>
<td>10:00 - 11:00 am</td>
<td>Poster Review #1 - David R. Gambling, MBBS</td>
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<tr>
<td>11:00 am - 12:00 pm</td>
<td>Oral Presentations - Gary M.S. Vasdev, MD</td>
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<td>12:00 pm - 1:00 pm</td>
<td>Lunch with Exhibitors and Posters</td>
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<tr>
<td>1:00 - 2:00 pm</td>
<td>Debate No. 1 - An Anesthesia Provider Should be Present for Vaginal Delivery in All Patients Receiving Neuraxial Analgesia</td>
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<td>CON: William R. Camann, MD</td>
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<td>2:00 - 3:00 pm</td>
<td>What's New in In Vitro Fertilization - Christo Zouves, MD</td>
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<td>3:00 - 3:30 pm</td>
<td>Break with Exhibitors and Posters</td>
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<td>3:30 - 4:30 pm</td>
<td>Poster Review #2 - Lawrence C. Tsen, MD</td>
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<td>4:30 - 5:15 pm</td>
<td>Refresher Course Lecture - Hemodynamic Control in Obstetrics - Chris C. Rout, FFARCS</td>
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<td>Research Works in Progress - Moderators: Robert D'Angelo, MD, Richard M. Smiley, MD, PhD</td>
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<tr>
<td>6:30 pm</td>
<td>SOAP Dine Around (See Social Activities)</td>
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Gertie Marx Symposium

Moderator: Alan Santos, MD
Judges: Gertie Marx, MD; GM Bassell, MD;
- James R. Farina; MD; Anne May, MBBS, FRCA

8:00 - 9:30 am

8:00 am  PLATELET FUNCTION IN PREECLAMPSIA: PLATELET FUNCTION ANALYZER (PFA-100) VS TEG
         J. Davies, R. Fernando, S. Hallworth

8:15 am  LOW DOSE LIDOCAINE CAUSES TOXIC CHANGES IN NEURONAL MORPHOLOGY
         P. Dadarkar, M. Johnson, C. Uhl

8:30 am  LATENT PHASE CERVICAL DILATION IS FASTER DURING EPIDURAL MEPERIDINE THAN DURING EPIDURAL BUPIVACAINE LABOR ANALGESIA IN NULLIPAROUS, INDUCED-LABOR PATIENTS

8:45 am  THE ED95 OF INTRATHECAL BUPIVACAINE WITH OPIOIDS FOR CESAREAN SECTION
         E. Mirikitani, Y. Ginosar, D. Drover, S. Cohen, E. Riley

9:00 am  THE EFFECT OF INJECTION RATE ON HYPOTENSION DURING SPINAL ANESTHESIA FOR ELECTIVE CESAREAN SECTION
         M. Seltenrich, A. Kamani, V. Gunka, J. Douglas

9:15 am  OBESITY AND INCREASED RISK FOR CESAREAN DELIVERY
         C. Leicht, I. Velickovic, M. Velickovic, E. Nystrom

All Abstracts listed on this page are in the Anesthesiology Supplement.
Poster Review #1

Moderator: David R. Gambling, MBBS

10:00 - 11:00 am

1. **THE EFFECT OF SITTING AND AMBULATING ON LABOR DURATION AND MATERNAL OUTCOME**
   M. Vallejo, L. Firestone, G. Mandell, F. Jaime, S. Makishima, S. Ramanarhan

2. **HYDROMORPHONE WITH EPIDURAL FENTANYL IN AMBULATORY PATIENTS IN EARLY LABOR**
   R. Parker, N. Connolly, T. Lucas, U. Faheem, S. Dunn, A. Rizvi, M. El-Mansouri, N. Thakkar, R. Kamasumadram

3. **EPIDURAL ANALGESIA AND FUNDIC ACID-BASE BALANCE: A META-ANALYSIS**
   F. Reynolds, S. Sharma, P. Seed

4. **THE OPTIMAL EPIDURAL INFUSION FOLLOWING THE COMBINED SPINAL EPIDURAL TECHNIQUE FOR LABOR.**
   A. Nair, I. Arnold, H. Bernstein, J. Zahn, C. Telfeyan, Y. Bellin

5. **DO BUPIVACAINE OR THE STAGE OF LABOR ALTER THE INCIDENCE OF FETAL BRADYCARDIA ASSOCIATED WITH INTRATHecal Sufentanil?**

6. **BODY TEMPERATURE CHANGES WITH EPIDURAL ANALGESIA AND THE PATIENT’S BODY HABITUS**
   S. Ramanarhan

7. **AN IONTOPHORETIC EPIDURAL CATHETER: THEORETICAL POSSIBILITIES**
   R. Glassenberg

8. **DOES A COMBINED SPINAL-EPIDURAL TECHNIQUE IMPROVE THE QUALITY OF SUBSEQUENT EPIDURAL LABOR ANALGESIA?**
   J. Thomas, L. Harris, P. Reiker, R. D’Angelo

9. **LABOR PCEA: 5 MIN VS 15 MIN LOCKOUT INTERVAL.**
   G. Stratmann, D. Gambling, J. Stackpole, A. Pue

10. **EPIDURAL BUPIVACAINE VS. BUPIVACAINE: OBSTETRIC OUTCOMES**
    T. Breen, D. Campbell, R. Nunn, J. Kronberg, A. Santos, S. Kelly-Francis, D. Thys

11. **ANALGESIC MANAGEMENT OF INTRUTERINE FETAL DEMISE (REVISITED)**
    A. Com, I. Groeneveld, R. Sashidharan

12. **COMPARISON OF ESPOCAN® AND TUOHY NEEDLES FOR COMBINED SPINAL-EPIDURAL (CSE) ANALGESIA**
    I. Browne, D. Berlinbach, D. Stein, D. O’Gorman, A. Santos, S. Kelly-Francis, D. Thys

13. **CAUSES OF LABOR EPIDURAL CATHETER REPLACEMENT**
    A. Vasudevan, P. Hess, A. Soni, S. Sarna, S. Pratt

14. **DOES ETHNICITY INFLUENCE LABOUR ANALGESIA**
    S. Brayshaw, C. Duke, R. Sashidharan

15. **DOES ULTRA-LOW DOSE LABOR EPIDURAL ANALGESIA INFLUENCE EARLY BREASTFEEDING?**
    S. Reid, D. Ly

16. **DOES EPIDURAL NALOXONE ALLEVIATE ITCHING FROM INTRATHecal FENTANYL IN THE LABORING PARTURIENT?**
    K. Choi, J. Tong, F. Gadalla, E. Alnigenis

17. **THROMBOCTOPENIA IN PREGNANCY: PLATELET FUNCTION ANALYZER (PFA-100) VS THROMBOELASTOGRAPH (TEG)**
    J. Davies, R. Fernando, S. Hallworth

18. **THE EFFECTS OF PATIENT-CONTROLLED EPIDURAL ANALGESIA VS CONTINUOUS INFUSION EPIDURAL ANALGESIA ON THE COURSE OF LABOR AND DELIVERY.**
    S. Sharma, J. Alexander, J. Wiley, K. Leveno

19. **COMPARISON OF PCEA TO CEI ON A LABOR WARD: UTILIZATION AND TOP-UP REQUIREMENTS**
    J. Schultz MD, E. Bell MD, F. Dexter MD/PhD, H. Muir MD, J. Reynolds PhD

20. **EFFICACY AND COMPLICATIONS OF TWO TYPES OF EPIDURAL CATHETERS FOR OBSTETRIC ANESTHESIA**
    R. Hayashi, J. Cross, B. Jones

21. **SPINAL SufenTANIL, FETAL BRADYCARDIA (FB), AND MATERNAL CATECHOLAMINES IN PARTURIENTS**
    F. Lenkovsky, M. Garahah, E. Kristensen, I. Bernstein, J. Rathmell, A. Kaye, K. Flaherty

22. **THE EFFECTS OF INTRATHecal EPINEPHRINE ON CSE LABOR ANALGESIA**
    R. D’Angelo, M. Poss, L. Harris

23. **IS A CSE TECHNIQUE BETTER THAN A STANDARD EPIDURAL TECHNIQUE FOR PARTURIENTS WITH SCOLIOSIS?**
    R. Farragher, L. Tsen

24. **ANALGESIC EFFICACY OF BUTORPHANOL IN FEMALE VERSUS MALE RATS.**
    K. Kuczkowski, B. Tsang

25. **PUBLISHED ABSTRACTS IN OBSTETRICAL ANESTHESIA: FULL PUBLICATION RATES AND DATA RELIABILITY**
    S. Halpern, S. Palmer, P. Angle, J. Tarsis (Listed in Anesthesiology Supplement under Best Papers of the Meeting)

All Abstracts listed on this page are in the Anesthesiology Supplement.
Oral Presentations
Moderator: Gary M.S. Vasdev, MD

11:00 am - 12:00 n

11:00 am  GENERAL ANESTHESIA FOR CESAREAN DELIVERY. THE STATUS OF CURRENT RESIDENT TRAINING AND EXPERIENCE.
K. Bhavani-Shankar, W. Camann

11:15 am  VALIDATION AND APPLICATION OF NIRS TO MEASURE IN UTEROFETAL SHEEP CEREBRAL OXYGENATION DURING MATERNAL GENERAL ANESTHESIA
J. Reynolds, J. Schultz, D. Amory, S. Punnahitananda, P. Benni, W. Eubanks, J. Booth

11:30 am  DOES ETHNIC ORIGIN AFFECT RELATIONSHIP OF BMI AND INCIDENCE OF CS?
E. Bell, A. Olufolabi, A. Hartle

11:45 am  SPINAL IS SAFER THAN GA FOR LSCS IN ECLAMPTICS
M. Razzaque, K. Rahman, R. Sashidharan

All Abstracts listed on this page are in the Anesthesiology Supplement.
Debate No. 1

An Anesthesia Provider Should be Present for Vaginal Delivery in All Patients Receiving Neuraxial Analgesia

Moderator: David J. Birnbach, MD
PRO: Brett B. Gutsche, MD
CON: William R. Camann, MD

1:00 - 2:00 pm

Following this debate, the participants will be able to list the medical, patient care, manpower, and reimbursement issues relevant to the anesthesiologist’s physical presence at the vaginal delivery of all patients receiving labor analgesia.
What's New in In Vitro Fertilization

Christo Zouves, MD

2:00 - 3:00 pm

Following this lecture, the participants will be able to describe current treatment strategies for patients undergoing in vitro fertilization and the possible ramifications for the anesthetic management they receive. They will also understand some of the philosophical and ethical issues related to this field.
WHAT’S NEW IN IVF

Christo Zouves, MD
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Objective

Following this lecture, the participants will be able to describe current treatment strategies for patients undergoing in vitro fertilization and the possible ramifications for the anesthetic management they received. They will also understand some of the philosophical and ethical issues related to this field.

Introduction

At first blush, the connection between in vitro fertilization and obstetric anesthesia and perinatology may not be obvious. In fact, there is a clear interdependence as well as a cause and effect relationship. In order to fertilize eggs in vitro, we require to retrieve these eggs transvaginally with a needle puncture and this requires at the very least analgesia while the gold standard is appropriately managed unconscious intravenous sedation.

The in vitro process makes babies which need to be delivered either traditionally with or without analgesia, as well as by cesarean section. In addition, IVF more often makes multiple babies and these multiple pregnancies may provoke premature labor, pregnancy induced hypertension and many of the known complications of pregnancy including cesarean section. In addition, patients identified with autoimmune phenomena especially abnormal phospholipid antibodies may be treated either through the first trimester or occasionally throughout pregnancy with aspirin, with or without the addition of heparin. This obviously has ramifications for the safety of the placement of epidural catheters for analgesia and anesthesia.

The ability to use donated eggs from younger women also enables older women even up to the age of mid to late 50’s to conceive and carry a baby thereby adding a less compliant cardiovascular and musculoskeletal system to the delivery equation.
What is in vitro fertilization? IVF consists of stimulating the ovaries of a patient known as the egg provider with injectable menotropins, culminating in the transvaginal retrieval of oocytes with ultrasound guidance and the fertilization of these oocytes in the laboratory with sperm usually provided by the partner or else by a known or unknown donor. These embryos are then cultured anywhere from three to five days and are then transferred into the uterus of the recipient who may be the same or a different person from the one who provided the eggs.

**Relationship Between IVF & SOAP**

I. Transvaginal egg retrieval

II. Obstetrical anesthesia/perinatology
   - Multiple pregnancy
   - Pregnancy induced hypertension (PIH)
   - Heparin/Aspirin therapy
   - Advanced maternal age

III. ICU Management of Ovarian hyperstimulation syndrome (OHSS)

   I. Transvaginal Egg Retrieval

   Embryologically, the testicle and the ovary originate in the same place and carry the same nerve supply and given the inability to apply regional anesthesia to the ovary as one would to the spermatic cord, it behooves us to supply adequate analgesia while passing a seventeen gauge needle sometimes multiple times into the stimulated ovary.

   There are centers that continue to retrieve oocytes with local infiltration of the vaginal fornix with little or no additional analgesia. I believe that it is unduly cruel especially when young women are undergoing oocyte retrieval as egg donors and I also believe that without anesthesiologist supervision, there are safety issues around infrequent but significant complications relating to the airway and also to vasovagal episodes with the puncture and stretching of pelvic peritoneum. Our patients often remark upon the ease & satisfaction when they sleep during the procedure in contrast to awake sedation used in other centers.

   Typically the procedure takes 15 minutes but flexibility is needed for longer duration procedures. I believe that patients undergoing egg retrieval are entitled to adequate analgesia as well as competent management of the airway and provoked syncope. Egg retrieval is after all a completely elective procedure which should carry no significant morbidity and certainly no mortality. Given that we are working in the peri-implantation period, all medications should be safe for gametes, embryos, and should also not adversely affect the hatching and the implantation of embryos into the endometrial lining.

   Drugs of choice for unconscious intravenous sedation (UIS) during transvaginal egg retrieval, should include the following: narcotics (fentanyl or alfentanil) and propofol. Versed is sometimes used, but is a benzodiazepine and is slow to reverse and should probably be avoided. Versed, when used probably adds little to the total anesthetic, but
when given in greater than minimal doses delays awakening and return to street fitness. Intravenous antibiotics, like a cephalosporin should be administered. Drugs to avoid would be antiprostaglandins (Ibuprofen, Ketolorac, and indomethacin).

II. Obstetrical Anesthesia/Perinatology

a. Multiple Pregnancy
All the complications of pregnancy are exacerbated by multiple pregnancy and IVF is responsible for approximately 1/3 of the increasing multiple pregnancy seen over the last ten years. The other 1/3 comes from the use of injectable fertility medications without IVF and the remaining 1/3 is due to the higher risk of spontaneous multiple pregnancy when women postpone childbearing into their late 30’s and early 40’s. Multiple pregnancies often require prolonged bedrest as well as the addition of potent medications to suppress premature uterine activity and these may include calcium channel blockers, sympathomimetic medications, and magnesium sulfate. All of these add to the challenge of obstetrical anesthesia when analgesia is required in labor or an anesthetic for an emergency cesarean section.

b. Pregnancy Induced Hypertension (PIH)
In addition, pregnancy induced hypertension is more common in multiple pregnancy and also it is more common at the extremes of reproductive age with IVF being responsible for pregnancy in an ever increasing population of 40 and even early 50 year old patients.

c. Heparin/Aspirin Therapy
Patients with acquired thrombophilia with positive phospholipid antibodies or inherited thrombophilia with MTHFR/Leiden V or Protein C deficiencies, will require heparin or Lovenox with aspirin. This may complicate epidural anesthesia and potentially cesarean section.

d. Advanced Maternal Age
Advanced maternal age and obstetrical anesthesia combine the problems already mentioned with pregnancy-induced hypertension with a less compliant cardiovascular system and sometimes patients with pre-existing hypertension or glucose intolerance.

III. Management of OHSS

Ovarian hyperstimulation syndrome still occurs in 2-6% of young women stimulated with injectable menotropins and while 1-2% of these patients require intensive care because of pre renal failure and the tendency to a hypercoagulable state. Severe OHSS may also precipitate the adult respiratory distress syndrome and disseminated intravascular coagulation.

OHSS is preventable and will be discussed separately below.
What’s New in IVF?

1. Prediction and prevention of severe ovarian hyperstimulation syndrome (OHSS)
2. Intracytoplasmic sperm injection (ICSI)
3. Blastocyst embryo transfer
4. Pre-implantation genetic diagnosis (PGD)
5. Somatic cell nuclear transfer (SCNT)

1. Prediction and Prevention of Severe Ovarian Hyperstimulation Syndrome (OHSS)

Moderate ovarian hyperstimulation syndrome occurs in approximately 6% of stimulated cycles, while severe OHSS occurs in 1-2%. There is an 80% chance of developing severe OHSS if there are more than 20 follicles or the estradiol level is greater than 6,000 pg/ml at the time of hCG administration.

Severe OHSS consists of an increase in ovarian size to greater than 8 cm, hemoconcentration, ascites, electrolyte imbalance, hypercoagulability and oliguria with or without renal failure. The hemodynamic changes seen with severe OHSS are very similar to those changes which you are very familiar with in patients who develop severe PIH and specifically the HELLP syndrome. These consist of increased capillary permeability with the leakage of fluid and colloid into the third space leading to significant contraction of the intravascular volume in the presence of peripheral intracellular and extracellular edema. This process is accompanied in OHSS as well as in PIH by varying degrees of end organ failure based on enhanced coagulation and microscopic deposition of fibrin and other products.

The trigger for the increase in capillary permeability and the whole process of OHSS appears to be the administration of hCG for the purposes of maturation of oocytes and retrieval and is further exacerbated when this patient becomes pregnant after embryo transfer again driven by the rising hCG of pregnancy. In the past the only method of avoiding this syndrome in patients who present with more than 20 follicles, was to cancel the cycle and omit the dose of hCG. Another strategy was to cancel the transfer of embryos freezing all for future use, but still incurring the risk associated with the administration of hCG for egg retrieval. Other strategies administrating colloid in the form of human serum albumin, have been tried without significant success.

I have been fortunate along with my colleagues, Geoffrey Sher, MD and Frank Barnes, PhD, to have developed a method called prolonged coasting which eliminates the occurrence of severe ovarian hyperstimulation syndrome. This procedure consists of discontinuing the fertility medications in individuals who are at risk and waiting for the estradiol level to drop below 3,000 before administrating hCG and preceding with egg retrieval. This process causes the death of significant numbers of granulosa cells within each follicle which decreases the production of estradiol which in turn decreases the capillary permeability and the third space problem. Given that all patients undergoing stimulation and egg retrieval who are at risk of OHSS are young and are in good health, it is also important to limit fluid intake after the egg retrieval to no more than a liter of an isotonic sports drink daily, thereby
limiting the outflow of fluid into the third space and also forcing the kidneys to access the fluid in the third space leading to a more rapid resolution.

Rarely patients may require transvaginal paracentesis to relieve pressure in the abdomen and this is usually accompanied by a light intravenous analgesic in the form of Fentanyl. These patients should be taking a baby aspirin on a daily basis and should they develop severe OHSS should also receive prophylactic heparin 5000 units bid.

Using this method of prolonged coasting we have been able to all but eliminate severe OHSS in our practice to the point that OHSS is now preventable and there should be no need to cancel an IVF cycle and it is still possible to achieve very high pregnancy rates in these patients.

2. **Intracytoplasmic Sperm Injection (ICSI)**

Intracytoplasmic sperm injection (ICSI) gives us the ability to all but eliminate male factor as a negative variable in IVF. A single sperm can be isolated either from the ejaculate or directly from the testicle and injected under 400x magnification directly into the cytoplasm of the egg. This achieves normal fertilization of approximately 70% of mature eggs and has decreased the use of frozen donor sperm to men with absolutely no sperm even on testicular biopsy and to patients without a male partner or a male partner with a major genetic abnormality.

3. **Blastocyst Transfer**

Given that multiple pregnancy is one of the single most important complications of fertility therapy in general, and also given that this increase in multiple pregnancy contributes significantly to the workload of obstetric anesthesiologists and perinatologists, everything should be done to decrease IVF births to a single baby if at all possible.

There are a number of ways to try and balance the intense desire of couples to have a family when they are up against the biological clock and self-paying for most of these expensive therapies in the absence of insurance help and the risk of multiples. One strategy is to transfer fewer embryos especially when the egg provider is young, while another is to discuss and offer the option of selective reduction should a multiple pregnancy greater than twins result. A third option which offers significant advantages, is the ability to grow the embryos for two additional days from the third to the fifth day and to then transfer embryos at a more advanced stage called the blastocyst stage, transferring no more than two embryos in young patients as opposed to three or four embryos in the same patient on day three.

Allowing embryos to grow longer in the laboratory does allow for a more accurate selection of the most rapidly dividing embryos, but also exposes the embryos to an additional two days in an environment which may not be as nurturing as the uterus itself.

4. **Pre-implantation Genetic Diagnosis (PGD)**

As medicine moves to the molecular level with the mapping of the human genome and the cloning of Dolly and others we are now able to test more accurately the normalcy of the
number of chromosomes in embryos prior to transfer enabling us to transfer only embryos with the normal number of chromosomes in selected patients.

Probes exist to exclude aneuploidy for the following chromosomes 13, 16, 18, 21, 22, x and y and also for the sexing of embryos and this can be performed by using fluorescent in situ hybridization (FISH). More sophisticated prolimerase chain reaction probes are becoming available to be able to test for individual gene defects and as the technology advances, we should be able to perform a full DNA fingerprint on an embryo prior to transfer by removing only one or two cells of an eight-cell embryo on day three.

At the present stage of our technology, we can clearly do the FISH technique for the commonest aneuploidies which are generally age related while the more advanced testing for translocations and individual genes and the whole DNA fingerprint are still experimental and not readily clinically available.

PGD still raises ethical issues of clinical, scientific, societal and political concern because it introduces into clinical practice, along with human genome mapping and rapid biotechnological development, the possibility of choosing children based on medical and nonmedical preferences.

5. Somatic Cell Nuclear Transfer (SCNT)
Somatic cell nuclear transfer (SCNT) is the scientific euphemism for cloning which as you know has already been performed in most of our common domestic and farm animals. The process of extracting the nucleus from a somatic cell or nongamete, removing the nucleus from a donor egg and fusing the somatic nucleus to the cytoplasmic membrane of the egg with an electric current is technically possible but still an inefficient process. More than 200 eggs were treated in this way in order to achieve the conception and birth of Dolly the sheep. In addition, approximately 1/3 of those embryos that do implant after SCNT may have major congenital abnormalities making cloning in humans even from a technical point of view fraught with danger.

The moral and ethical debate around SCNT is fought on the one hand by advocates for patients who require both a sperm and an egg for reproduction for whom the choice of using the complete genetic complement of one or other of the partners is preferable to adoption and between those opposing SCNT on the basis that it removes the uniqueness of each individual and places unacceptable burdens on a child born with a genetic complement of a parent or adult and the pressures to achieve and also the downside of having the full knowledge of genetic or health related problems which may develop 20, 30 or 40 years later, long before they may happen.

These philosophical debates are raging at the present time even with the knowledge of the inefficiency of the cloning process and the very high risk of major congenital abnormalities.
References


EC80-EC95 OF BUPIV AND ROPIV PLUS FENT FOR LABOR EPIDURAL ANALGESIA
D. Campbell, R. Zwack, T. Breen, R. Yip

RIGHT AND LEFT SHIFTS OF HEMOGLOBIN DISSOCIATION CURVES: WHY PLACENTAL OXYGEN TRANSPORT IS NOT HOKEY POKEY
R. Glassenberg, S. Glassenberg

DESFLURANE VERSUS ISOFLURANE FOR FETAL SURGERY
J. Galinkin, L. Myers, R. Gaiser

DO PROPHYLACTIC EPIDURAL BLOOD PATCHES DECREASE THE RATE OF THERAPEUTIC EPIDURAL BLOOD PATCHES?
A. Pue

PSYCHIATRIC SIDE EFFECTS OF INDOMETHACIN IN PARTURIENTS
M. Clunie, L. Crone, L. Klassen, R. Yip

DID TUOHY DESIGN THE EPIDURAL NEEDLE OR WAS IT HUBER?
J. Martini, D. Martin, G. Kamath, G. Vasdev

EPIDURAL ANALGESIA AND OXYTOCIN USE: AUGMENTATION VS INDUCTION
S. Ramanathan

DEVELOPMENT AND VALIDATION OF A RISK SCORE FOR BREAKTHROUGH PAIN DURING LABOR EPIDURAL ANALGESIA
A. Vasudevan, S. Pratt, A. Soni, M. Sarna, P. Hess

LABOR EPIDURAL ANALGESIA GUIDELINES: FRIEND OR FOE?
D. Ray, B. Harrison, C. Burke, G. Vasdev

NALBUPHINE GIVEN DURING LABOR CAN CAUSE A TRANSIENT DECREASE IN THE BASELINE FETAL HEART RATE
E. Goodman, S. Thomas, R. Stupi, K. Jaffe

HOW DOES AMNIOTIC FLUID EFFECT COAGULATION?
M. Harrett, S. Dutta, K. Bhavani-Shankar

WHIRLPOOL BATHS IN LABOR. ANALGESIC ADJUNCT OR MICROBIOLOGIC HAZARD?
I. Browne, D. Birnbauch, D. Stein, A. Santos, S. Kelly-Francis, D. Thys, O. Murray, E. Sordillo

SENSORY CHANGES AFTER COMBINED SPINAL-EPIDURAL ANALGESIA AND EPIDURAL ANALGESIA IN LABOR
M. Duncan, P. Prasad, K. McKeating

BEGINNING LABOUR EPIDURAL ANALGESIA, USING PAIN AS THE MAIN CRITERIA
C. Lobo, M. Ramon, C. Machado, T. Cardoso, F. Pedro, C. Correia

ASSOCIATION OF THE G-PROTEIN b-3 SUBUNIT 825C/T POLYMORPHISM AND WEIGHT GAIN IN PREGNANCY
R. Smiley, R. Landau, V. Dishy, H. Xie, A. Wood, R. Kim, C. Stein

PHOSPHODIESTERASE (PDE5) RECEPTOR INHIBITION MODERATES THE VASOPRESSOR EFFECT OF 5-HYDROXYTRYPTAMINE (5-HT) ON THE FETOPLACENTAL VASCULATURE.
J. Downing, B. Minzter, R. Ramasubramanian, R. Paschall, J. York, R. Johnson

PHOSPHODIESTERASE (PDE5) PLACENTAL RECEPTOR INHIBITION OBTUNDS HYPOXIC FETOPLACENTAL VASOCONSTRICTION (HPV) IN THE HUMAN PLACENTA.
J. Downing, B. Minzter, R. Ramasubramanian, R. Paschall, J. York, R. Johnson

PRIMARY PULMONARY HYPERTENSION: SUCCESSFUL C/S USING TIVA, NO AND TEE
P. DeBalli, A. Habib, H. Grocott, A. Olufolabi

THE USE OF NATIONAL CQI DATA TO IMPROVE HOSPITAL ANESTHESIA OUTCOMES
B. Kaul, M. Vallejo, S. Ramanathar, G. Mandell

WHAT DO PREGNANT WOMEN KNOW ABOUT PAIN RELIEF AND EPIDURAL ANALGESIA?
A. Celesia, H. Scavuzzo, C. Fernández

DELAYED ADRIAMycin-INDUCED PERIPARTUM CARDIOMYOPATHY
P. Pan, C. Moore, V. Ross, G. Justis

POSTDURAL PUNCTURE HEADACHE: USING THE DATABASE AS A QI TOOL TO CHANGE PRACTICE
A. Olufolabi, E. Bell, H. Muir

QUALITY IMPROVEMENT USING AN OBSERVATIONAL DATABASE: TREATMENT OF PDPH
A. Olufolabi, E. Bell, H. Muir

PRIMARY PULMONARY HYPERTENSION: SUCCESSFUL C/S USING TIVA, NITROUS OXIDE AND TEE
P. DeBalli, A. Habib, H. Grocott, A. Olufolabi
The learner will be able to categorize the changes in both normal and preeclamptic pregnancy that impact hemodynamic function. The learner will be able to predict how hemodynamic function is affected by various anesthetics and employ appropriate pharmacologic management.
CARDIOVASCULAR CONTROL IN PREGNANCY

Chris Rout

"It is incident to physicians, I am afraid, above all other men, to mistake subsequence for consequence"

Samuel Johnson

Normal pregnancy is associated with an increase in blood volume and cardiac output, with contributions from both increased heart rate and stroke volume. Highest antenatal cardiac outputs are demonstrated in the early third trimester and persist until term, when a small decrease might occur. Blood pressure decreases initially, reaching a nadir in the early second trimester and then increases towards non-pregnant values at term.

These facts are so often repeated that they have become almost axiomatic. Yet when one attempts to examine how or why these changes occur, or even tries to examine the individual components or derivatives of cardiac output, the picture becomes blurred and there are as yet many unanswered questions. Also it would be impossible to gain a clear understanding of cardiovascular physiological changes without also considering the physiological changes occurring in other systems, the most important being endocrine and renal.

Recent studies have demonstrated that the cardiovascular remodelling associated with pregnancy persists into the postpartum period, perhaps longer (1). It is possible that some of the changes never return completely to their pre-pregnancy values and may contribute to the comparatively better cardiovascular health experienced by women in general, compared to men. If this is indeed the case then there are obvious implications to the interpretation of studies that use values obtained in the postpartum period as a baseline for the changes during pregnancy, or include multigravid patients. This is particularly relevant to interpretation of data describing the changes associated with pregnancy-induced hypertension, where the cardiovascular remodelling is different to that of normal pregnancy. Ideally, data should be used only from first pregnancies and control values obtained pre-pregnancy during the follicular phase of the menstrual cycle. Unfortunately, few such studies exist and the data from other studies should be interpreted with caution.

BLOOD VOLUME, CARDIAC OUTPUT AND BLOOD PRESSURE

Most texts depict a smooth, upward trend in cardiac output from the beginning of pregnancy. However, the increase in blood volume and cardiac output may be more of a "stepwise" increase in the first trimester. Clappe performed serial studies of 20 women, commencing preconception and repeating recordings in the seventh and 15th post conceptual weeks. Plasma volume was already increased by 11% in week 7. Indeed, many of the changes of pregnancy already may have commenced with conception and represent a continuation of changes normally seen during the luteal phase of the menstrual cycle.
Although plasma volume increases early, there is a transient decrease in red cell mass during the first few weeks of pregnancy. So the effects of increased plasma volume on total blood volume are not seen until later in the first trimester, when red cell mass has started to recover (Figure 1). By the end of the first trimester, blood volume has increased by more than 15%. Blood volume increases more rapidly in the second trimester, by the end of which it is 40% greater than pre-pregnancy values. A further small increase occurs in the third trimester. At term plasma volume is increased by about 55%, red cell volume by about 30%, and total blood volume by 45%.

The decrease in diastolic blood pressure (due to increased run-off through dilated resistance vessels) precedes the decrease in systolic pressure, so pulse pressure widens. Also the proportional change in diastolic pressure is greater than that of systolic pressure so the wide pulse pressure persists. Both systolic and diastolic pressures remain low during the second trimester but then begin to increase towards their pre-pregnancy values at term.

Cardiac output has increased by about 20% by the end of the first trimester (Figure 2). This is principally caused by an increase in heart rate, although the increase in blood volume is reflected by an increase in left ventricular end diastolic volume and small increase in stroke volume. Left ventricular end systolic volume decreases very little (if at all) despite decrease in arterial blood pressure.
Heart rate reaches a maximum (± 20%) during the middle of the second trimester, but stroke volume continues to increase until the early third trimester, when it is making an equal contribution to the increase cardiac output. In total, cardiac output increases by about 45% above pre-pregnancy values. Early studies of cardiac output measured in the supine position demonstrated a marked decrease in the third trimester, due to the vena caval obstruction. While cardiac output may decrease slightly towards term (possibly due to decreased flow through the aging placenta) cardiac output varies little during the third trimester, until the onset of uterine contraction.

PRELOAD, AFTERLOAD AND CONTRACTILITY

Left ventricular pump function improves during pregnancy. Preload increases consequent to the increased blood volume and is demonstrated by the increase in left ventricular and diastolic volume. This occurs without any increase in end diastolic or left atrial pressure, so left ventricular compliance must increase. This improved diastolic function is reflected by increased early diastolic atrio-ventricular flow rates, increasing the ratio of rapid phase passive filling to active filling due to atrial contraction.4

Systemic vascular resistance decreases during pregnancy, but it is not always a reliable indicator of left ventricular afterload. Although diastolic blood pressure has decreased significantly at 6 weeks gestation, left ventricular afterload, as reflected by ventricular wall stress, is increased in the first trimester. This is due to the increase in wall tension due to volume induced left ventricular dilatation. A process of muscle hypertrophy ensues, increasing wall thickness and reducing stress, which normalizes by the mid second trimester. By this stage remodelling of the major vessels has occurred, with increased aortic compliance and reduced systolic pressure. The combination of increased left ventricular wall mass, increased aortic compliance and decreased peripheral resistance due to the increased size of the placental bed results in decreased afterload.

The only currently acceptable index of contractility is velocity of circumferential fibre shortening, adjusted for heart rate and afterload. Only two studies have specifically examined this and both of them have shortcomings. Both studies recruited patients when already pregnant. Mone5 documented the changes occurring in several echocardiographic studies, four during pregnancy and two post partum, in 33 women. No details of the parity of the women were given. The rate corrected velocity of circumferential fibre shortening decreased progressively throughout pregnancy, consistent with a decrease in contractility. The lowest value was observed at the first post-partum examination (2 - 4 weeks postpartum) but this had increased towards the "baseline" value (at 9 - 12 weeks gestational age) by the second postpartum examination at 8 – 10 weeks. Lang6 only studied the peripartum period in a comparison of normotensives with preeclamptic subjects. Patients were already in early labour at the time of entry to the study. No significant differences in afterload adjusted VCFc were observed.

The decrease in contractility makes sense from theoretical consideration of the ventricular end systolic pressure-volume relationship. Despite the decrease in mean
arterial pressure echocardiographic studies have consistently documented either a very small or no decrease in end systolic volume. This suggests a decrease in slope (clockwise rotation) of the end systolic pressure-volume relationship, reflecting decreased contractility.

PERIPHERAL CIRCULATION

Several texts ascribe the principal cardiovascular changes of pregnancy (increased cardiac output and decreased vascular resistance) to the introduction and development of the placenta as an additional parallel low resistance circuit. While this may be true of changes beyond the first trimester, it cannot explain the early changes of the first trimester. Plasma volume starts to increase before conception, and recent evidence suggests that an increase in glomerular filtration rate occurs before the increase in cardiac output. Mean arterial pressure is already decreased by six weeks of gestation in association with an increase in cardiac output, increased plasma volume and increased renal plasma flow. Renal vasodilatation within the first few weeks of pregnancy makes a significant contribution to reduced vascular resistance before placentation has occurred.

It is likely that pregnancy induced remodelling occurs in many vascular beds. An important alteration occurs in the relationship between vascular endothelium and smooth muscle. In a comparison of brachial artery diameter in the three trimesters of pregnancy with that of age-matched controls, Dorup demonstrated significantly increased brachial artery diameter in the second and third trimester. Flow mediated dilatation (assessed by reactive hyperaemia) was increased in all pregnant groups, whereas nitro-glycerine-induced dilation was similar to non-pregnant controls. This suggests an increase in endothelial production of nitric oxide (NO) in response to shear stress. Other studies have demonstrated increased nitric oxide synthase activity in the vessels of placenta and other tissues.

There have been few studies examining the behaviour of peripheral veins during pregnancy. Studies of nitric oxide synthase suggest similar changes to those seen in arteries. Venodilatation tends to occur, but one study demonstrated an increase in venous tone in the legs (with little change in the arms) from the first trimester and the suggestion was that this contributes to the maintenance of cardiac preload augmentation.

Studies of capillary bed dynamics demonstrate increased capillary blood flow velocity in pregnancy, consistent with increased cardiac output and haemodilution. Vasomotion (rhythmic variation in capillary blood flow) is unchanged in both frequency and amplitude. The generally vasodilated state of pregnancy reduces vasodilator reserve in response to tissue hypoxia. There is no evidence of altered capillary permeability or reflectance, but tissue fluid tends to accumulate due to altered Starling's forces associated with reduced plasma colloid osmotic pressure and (later in pregnancy) increased capillary hydrostatic pressures. There is thus a reduced "safety margin" against oedema formation, which is particularly important in the lungs.
CONTROL (REGULATORY) MECHANISMS

The concept of control is elusive (if not inappropriate) from a physiological standpoint. Even the term "regulation" is misleading as it conveys the idea that physiological systems are deliberately attempting to maintain individual biochemical or physiological variables at a set-point of "normality", based upon some kind of biological blueprint. In reality, what we measure reflects an infinitesimal portion of the complex interaction of many oscillating systems, and what we regard as "normal" represents the harmony they produce with minimal energy cost. Thus extreme caution must be exercised in ascribing cause and effect. Nevertheless, there are several physiological systems in which servo-control mechanisms have been identified.

An important point to remember is that biological systems seem to have as much difficulty in "sensing" flow as we have in measuring it. Centrally regulated circulatory adjustments are based upon input from mechanoreceptors (and chemoreceptors) that respond to changes in pressure and volume (stretch). Output signals adjust heart rate and vascular resistance in the short term via the sympathetic and parasympathetic systems. Long-term adjustments occur via the neuroendocrine response. Neither global flow (cardiac output) nor vascular resistance are directly regulated by central systems. The mechanism that comes closest to a flow-based servomechanism is the endothelial nitric oxide synthase (NOS) response to shear stress. Metabolic responses (again, not fully elucidated) demanding increases in oxygen and nutrient supply and waste clearance, combined with endothelial NOS, adjust flow at a local level and cardiac output is redistributed according to metabolic need. Increased cardiac output is achieved by central systems maintaining perfusion pressure in the face of decreased vascular resistance. Under certain conditions (for example in response to sudden environmental threat), these automatic processes of adjustment are overridden by higher centres within the brain. Cardiovascular variables are altered outside their "normal" range and redistribution of cardiac output occurs preparatory to violent physical activity.

Under normal circumstances, cardiac output changes with metabolic needs and correlates with oxygen consumption. Although this relationship holds in later pregnancy and increased cardiac output reflects the increased metabolic requirements of the developing fetus and placenta, the increase in cardiac output in the first trimester is out of proportion to the body's metabolic needs. It is an abnormal situation and, to a certain extent, attempting to elucidate cause and effect in terms of "control" mechanisms is as fruitless as trying to ascertain the normal relationship between pressure, heart rate and vascular resistance from data recorded during a “flight or fight” reaction.

AUTONOMIC RESPONSES

The baroreceptor responses are altered during pregnancy, but it is not entirely clear how. Decreased arterial pressure represents an adjustment of the "set point", to maintain the variability of carotid sinus pressure about a lower mean. Also, there is evidence that the "gain" of the response may be altered, with a decreased slope of the relationship between pressure change and both heart rate and vasomotor
Using power spectral analysis of pulse interval and systolic blood pressure in pregnant and non-pregnant women, Blake (15) demonstrated an increase (by 80%) in systolic blood pressure variability in the supine position between early and late pregnancy. Supine high-frequency pulse interval variability decreased by 75% and baroreceptor sensitivity for heart rate (change in heart rate in relation to change in pressure) decreased by 50%. Values obtained upon standing showed no change in variability compared to non-pregnant controls. There was a general decrease in power in the supine position, the ratio of low to high frequency pulse interval variability increased in the supine but not the standing position, suggesting decreased vagal activity was more likely than increased sympathetic activity. On the other hand, Speranze (16) demonstrated a decrease in the low to high frequency power response in pregnant women in the lateral recumbent position. Changing to the supine position reversed this effect with an increase in the LF/HF ratio in the third trimester, but had no effect in non-pregnant controls. Ekholm (17) used a combination of tests (valsalva, deep breathing, orthostasis, hand grip) and demonstrated changes consistent with deceased parasympathetic responsiveness.

Studies in rats have demonstrated reduced renal sympathetic nerve activity in response to sodium nitroprusside in pregnancy and during infusion of progesterone metabolites (18,19). Progesterone infusion in (non-pregnant) ewes produces a significant decrease in blood pressure, and in higher (supraphysiological) doses can flatten the slope of the heart rate response to hypotension (20). This might be comparable with the pattern of response in human pregnancy, when a decrease in blood pressure occurs in early pregnancy (or even the luteal phase of the normal cycle (21)), at a time of relatively low plasma progesterone concentrations. Alteration of sympathetic responses may occur later in pregnancy (22), coincident with higher plasma progesterone concentrations. Pregnant patients at term appear to show a decreased response to isoproterenol (23). However, Ramsay (24) demonstrated decreased bradycardic responses to pressor challenge in the first and early second trimester, although the pressor responses were similar.

One of the confounding factors in interpretation of baroreceptor responses during pregnancy in the human or intact animal preparation is blunting of peripheral adrenergic responses. This can be due to altered adrenergic receptor responses or competing physiological mechanisms, possibly both. There is down-regulation of alpha₁ adrenergic receptors during pregnancy. Other pressor responses are blunted in pregnancy; notably, the pressor response to angiotensin II is characteristically diminished, more so than responses to norepinephrine. Also, the baroreceptor response is not necessarily linear, and it may be influenced by preexisting haemodynamic conditions. There is less of a response at lower mean arterial pressures, such as those associated with hypocapnia.

Decreased sympathetic responsiveness has important implications for patient management. It is generally held that the increase in blood volume in pregnancy increases the patient’s ability to withstand haemorrhage. Certainly, this seems to be the case at Caesarean delivery, when blood loss is usually between 500 and 1000mL. However, it is very important to keep up with intravenous fluid replacement in situations of ongoing obstetric haemorrhage. While the increased blood volume initially provides a “buffer” against blood loss, the point is rapidly reached when the blunted autonomic responses impair the patient’s ability to compensate for loss of
blood volume and profound hypotension can occur. This is why the general clinical impression that bleeding at Caesarean section is either trivial or catastrophic, with few cases in-between. The hazards of regional anaesthesia in the bleeding patient are emphasised in obstetric anesthesia texts, but the effects of general anesthesia may be neglected. General anesthesia is associated with central depression of baroreceptor responses and many of the agents that we use are either vasodilators, myocardial depressants or both. It is not unusual for the seemingly well resuscitated patient to become profoundly hypotensive following induction of anesthesia.

HORMONAL INFLUENCES

Dramatic changes in circulating concentrations of hormones occur during pregnancy. All of the gestational hormones can be shown to have effects upon the cardiovascular system, either directly or by alteration of secretion of or receptor responses to other agents. Attempts to relate cardiovascular events during pregnancy to the different hormones either singly or in combination, however, can lead to the classic error of ascribing a cause to an effect where no direct relationship may exist. In vitro studies may have little relevance to the intact animal, and there can be interspecies differences that limit the application of observations to human pregnancy. The effects of a hormone are influenced not only by the background concentrations of other hormones, but also the hormone’s function may be to condition the cellular responses to another agent. One example is that of oestrogen, which has beneficial cardiovascular effects in postmenopausal women, including increased arterial compliance, but no apparent effect upon arterial compliance in biological male transsexuals(25). Acetyl-choline infusion has no obvious effect on coronary blood flow in men presenting for coronary angiography, until it is administered 15 minutes after intravenous administration of conjugated oestrogen, when it increases coronary flow by 32% (26).
The cardiovascular changes of pregnancy are often ascribed to the influence of oestrogen and progesterone. However, figures 3 and 4 demonstrate that plasma concentrations of both hormones alter little from their concentrations during the luteal phase of the normal menstrual cycle until the end of the first trimester.

Although physiological changes similar to those that occur in the luteal phase the normal menstrual cycle, and they are likely to be due to the influence of oestrogen and progesterone, further changes occur in the first trimester of pregnancy. If we are to ascribe the cardiovascular changes of the first trimester to hormonal influence we should first examine the cardiovascular effects of hormones that reach an early peak plasma concentration.

**CHORIONIC GONADOTROPHIN**

Human Chorionic Gonadotrophin concentration increases in plasma dramatically following conception, reaching a peak at about 10 weeks of gestation. (figure 5) The beta subunit is detectable in plasma as early as 6 days post conception and in urine at 14 days, which forms the basis of pregnancy tests. It has a similar function to luteinising hormone (LH) in stimulating oestrogen and progesterone production from the corpus luteum, until the placenta takes over their production (after about 6 weeks). The timing of the peak concentration after the placenta has replaced the corpus luteum suggests additional roles for hCG. One role may be in the development of normal male sexual differentiation. It inhibits LH production, probably via an action suppressing pulsatile release of gonadotrophin releasing hormone (GnRH) from the hypothalamus. The effect at LH receptors is via
adenyl cyclase. Increased concentrations of βHCG are associated with increased plasma renin activity (PRA). This may be a direct effect effect while plasma levels are high, but subsequently the action is via increased synthesis and release of progesterone. Chorionic gonadotrophin is possibly implicated, together with oestrogen, in the aetiology of the ovarian hyperstimulation syndrome which is characterised by hypotension, low peripheral resistance and increased PRA and aldosterone. HCG has been demonstrated to increase vascular permeability in OHSS via either the kinin/kallikrein systems or vascular endothelial growth factor. (29)

βHCG appears to inhibit vascular smooth muscle contraction to a number of agents, both via an endothelium dependent and independent (30) effect via inhibition of calcium entry. It may play a part in maintaining utero-placental blood flow (31), but its chief role appears to be related to placental development and growth.

RELAXIN

This is an insulin-like hormone in structure and its plasma concentration peaks at about the same time as βhCG. It is produced in the corpus luteum, possibly in other tissues including heart atria. Receptors have been identified in uterus, cervix, vagina, breast and nipple, atria and adrenal cortex. In myometrium it produces a dose dependent activation of adenyl cyclase via receptor-tyrosine kinase and stimulatory G protein (32). It stimulates endothelial growth factor in normal human endometrial cells. It also has effect on proteins within the interstitial matrix and may possibly be involved in remodelling of the walls of major arteries. It has complex interactions with oestrogen and probably contributes to uteroplacental flow. Its main vascular effects are an increase in heart rate and vasodilatation; it also stimulates NO synthesis. It has impressive dilatory effects on renal arteries (via NO), increasing glomerular filtration rate and renal plasma flow. This effect is independent of oestrogen and progesterone. It also contributes to the regulation of fluid balance by decreasing plasma osmolality either via its direct effect in the kidney or central stimulation of ADH release. It has an inhibitory effect on platelet aggregation.

PLASMA RENIN ACTIVITY, ANGIOTENSIN, AND ALDOSTERONE

Plasma renin activity increases in the luteal phase of the menstrual cycle, and further increases occur following conception, under the influence of oestrogen, progesterone, hCS and possibly βhCG. Angiotensin II concentrations increase. The vascular effects of this very potent pressor agent are obtunded by two principal mechanisms: firstly the competing effects of pregnancy hormones upon NOS in endothelial cells and directly upon vascular smooth muscle, and secondly by down-regulation of vascular angiotensin II 1A receptors. Angiotensin II receptor regulation is interesting from the point of view of pregnancy "requirements". Sustained increases in angiotensin II concentration down-regulate the AT 1A receptor, but up-regulate the AT 1B receptor in the adrenal cortex, which is responsible for stimulation of aldosterone secretion. Sustained increases of angiotensin are maintained by the stimulatory effects of oestrogens upon angiotensinogen synthesis in the liver. The effects of aldosterone dominate sodium and water regulation and are principally responsible for the increased extracellular fluid volume of pregnancy.
ESTROGENS AND PROGESTERONE

Estrogens are produced firstly in response to LH and then to \( \beta \)hCG. They have an anabolic action and increase myometrial growth. They also increase sensitivity to oxytocin. They increase salt and water retention both indirectly via angiotensinogen and directly via a weak independent effect. Endothelial nitric oxide production is increased. It thus has vasodilator effects and increases forearm blood flow in postmenopausal women. However, high levels of estradiol are associated with reduced uterine blood flow in early pregnancy\(^{(33)}\), whereas progesterone is associated with increased flow. Oestrogens have an anabolic action, and their effects on cardiovascular remodelling in postmenopausal women suggest a possible role in the remodelling of pregnancy.

Progesterone also increases towards term. It is a vasodilator and thermogenic, and is probably responsible for the temperature rise following ovulation. It has an anti-oestrogenic effect on myometrium, decreasing excitability and sensitivity to oxytocin. It may have an indirect effect upon cardiovascular regulation via its stimulatory effect upon respiration, reducing PaCO\(_2\) and contributing to the respiratory alkalosis of pregnancy.

ATRIAL NATRIURETIC PEPTIDE

Concentrations are increased during pregnancy. It has a potent natriuretic effect and weak vasodilator action. It is produced in response to volume expansion and atrial stretch. In sheep, the ANP response to left atrial distension is considerably greater than that due to right atrial distension, and this effect is enhanced by pregnancy\(^{(34)}\). If a similar effect occurs in humans, it would explain both the increased circulating ANP concentrations and the correlation between ANP concentration and arterial pressure observed in preeclampsia. In normal pregnancy, the renal effects are dominated by aldosterone. Brain natriuretic peptide also increases in pregnancy.

PROSTAGLANDINS

There is a general increase in concentrations of vasodilator prostaglandins in pregnancy, due to the effects of pregnancy hormones on lipid metabolism substrates. Prostacyclin production increases, increasing the ratio of concentrations of prostacyclin to thromboxane.

OTHER HORMONES

Human chorionic somatomammotrophin (hCS), previously known as human placental lactogen, (HPL), has similarities to growth hormone and affects lipolysis and glucose balance, the effect being to ensure adequate supplies of glucose to the fetus. Its concentration rises steadily throughout pregnancy (figure 5). \( \beta \) Endorphin synthesis increases towards the end of pregnancy. It might have a possible role in baroreceptor modification. Another possible candidate is Neuropeptide Y.
CONCLUSION

Recognition of the extensive endocrine changes and cardiovascular remodelling of early pregnancy, and understanding of the interaction between the various factors involved (that we know about) provides some insight into the effects of complications of pregnancy, particularly the hypertensive disorders. The most important message is that the changes associated with preeclampsia are not occurring against a background of normal physiology. Attempts to interpret changes associated with the disease, such as cardiac output and intravascular blood volume, in terms of normal "regulatory" mechanisms will be misleading. The altered cardiovascular remodelling of preeclampsia has implications for future pregnancies, and possibly for continued cardiovascular health.

REFERENCES


Research Works in Progress
Moderators: Robert D'Angelo, MD, Richard M. Smiley, MD, PhD

4:30 - 5:15 pm
Scientific Program

Friday, April 27, 2001

6:30 - 8:00 am  Breakfast with Exhibitors
7:00 am  Registration
7:00 - 7:45 am  Refresher Course
    Neurologic Complications of Regional Anesthesia in Obstetrics
    Mark I. Zakowski, MD
7:00 - 11:30 am  Golf Tournament (See Social Activities)
8:00 - 11:30 am  Fun Run/Walk, Tennis Tournament and Tours (See Social Activities)
12:00 noon - 1:00 pm  Business Meeting
1:00 - 2:30 pm  Oral Presentations
    Moderator: H. Jane Huffnagle, DO
2:30 - 3:00 pm  Break with Exhibitors & Posters
3:00 - 4:00 pm  Zuspan Papers
    Moderator/Judge: Anne May, MBBS, FRCA
    Judges: Robert Resnik, MD; Frederick P. Zuspan, MD; Laurence S. Reisner, MD;
    Robert D'Angelo, MD
4:00 - 5:00 pm  What's New in Obstetrics?
    Robert Resnik, MD
5:00 - 5:15 pm  Presentation of Zuspan Award
    Frederick P. Zuspan, MD; Anne May, MBBS, FRCA
6:30 pm  Banquet — Sea World

7:30 pm  Banquet
Neurologic Complications of Regional Anesthesia in Obstetrics

Mark I. Zakowski, MD

7:00 - 7:45am

The learner will be able to list the common maternal neurologic diseases and be able to recognize the common neurologic complications of pregnancy, parturition and obstetrical anesthesia.
Neurologic Complications of Regional Anesthesia in Obstetrics
By
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Introduction
For both parturients and anesthesiologists the most feared complication of regional anesthesia is a neurologic deficit. Fortunately, neurologic deficits are very rare, especially in obstetric patients. Most neurological injuries are due to obstetrical, not anesthetic causes. A focused history, physical examination, and laboratory tests are needed to ensure proper diagnosis and treatment. The obstetric and anesthetic causes of neurological deficits will be reviewed.

History/physical examination/laboratory tests
A proper history should focus on the exact onset, location, and radiation of symptoms. Was there pain during needle insertion or injection of local anesthetic? Was there a period of full recovery or was the anesthetic block prolonged? Do the symptoms follow a dermatomal or peripheral nerve pattern? Items to inquire about specifically related to OB include: leg position (especially during second stage of labor), duration and degree of hyperflexion of the hips, length of second stage and the use of forceps.

On physical exam, a detailed neurologic assessment must be performed. Careful mapping of symptoms and findings may reveal a pattern consistent with nerve injury involving a single dermatome or peripheral nerve. Areas to check include: sensory and motor tone of the paraspinal muscles (innervated by posterior rami of the nerve root), tenderness to deep palpation of the spinous processes (transmits pressure to epidural space, suggestive of intrapinal mass), sacroiliac joint tenderness or localized areas of erythema or purulence. Detailed documentation in the chart is very important for good patient care and may serve in your future defense.1

Peripheral nerve injuries may occur. The common peroneal nerve is prone to compression at the fibular head during positioning in stirrups. Symptoms include lateral calf paresthesia, dorsal sensory loss between the 1st and 2nd toes, along with foot drop and inversion. Pressure on the lateral femoral cutaneous nerve as it passes under the inguinal ligament produces numbness along the lateral aspect of the thigh. This usually recovers spontaneously within 6 weeks. The femoral nerve may be compressed by the inguinal ligament during flexion of the hip. Symptoms include quadriceps weakness and hyperesthesia in the thigh and calf. The lumbosacral trunk may be injured within the pelvis by the fetal head (especially with forceps or occiput postero-lateral position). Symptoms may be unilateral (75%) or bilateral (25%) and may affect the quadriceps, hip adduction and cause foot drop.23

The preliminary differential diagnosis will suggest which tests are needed. If fever accompanies back pain or headache, a white blood cell count and CSF evaluation (septic meningitis) are needed. If symptoms are isolated to a single nerve root, CT or MRI will be helpful. History of a recent regional anesthetic does not prove causation.
An occult herniated disc may become symptomatic after positioning and pushing during delivery. Any bilateral symptoms or deficits warrant a CT or MRI scan to determine compression by an intraspinal mass (e.g. blood or abscess). CT scan is superior to MRI for detection of intracranial blood, especially subarachnoid hemorrhage, and for defining cortical bone structure. MRI is superior for intracranial and intraspinal soft tissue lesions. Gadolinium enhanced MRI increases detection of neoplastic and inflammatory lesions (e.g. abscess). An occult herniated disc may become symptomatic after positioning and pushing during delivery. Any bilateral symptoms or deficits warrant a CT or MRI scan to determine compression by an intraspinal mass (e.g. blood or abscess). CT scan is superior to MRI for detection of intracranial blood, especially subarachnoid hemorrhage, and for defining cortical bone structure. MRI is superior for intracranial and intraspinal soft tissue lesions. Gadolinium enhanced MRI increases detection of neoplastic and inflammatory lesions (e.g. abscess).

Electrophysiologic testing may also be helpful. EMG can help document the time and location of injury. After denervation, muscle fibers begin to discharge spontaneously, but changes are not seen until 2-3 weeks after injury. Thus, an abnormal EMG obtained within the first week following a regional anesthetic is useful for determining preexisting disease. If an interval change occurs 4-6 weeks later, then the injury occurred around the time of delivery. Injury at the level of the nerve root should affect both the anterior and the posterior rami. If the paraspinous area (supplied by the posterior ramus) is not affected, then the level of nerve injury is distal to the nerve root and not caused by central neuraxial anesthesia. Nerve conduction-velocity studies can provide immediate information about both motor and sensory nerves. Lesions proximal to the dorsal root ganglia do not affect the sensory potential and thus help to distinguish radicular from peripheral nerve disease. Somatosensory evoked potentials (SSEPs) monitor the dorsal column of the spinal cord and are a key, objective test of sensory function. SSEPs are sensitive to spinal cord damage produced by compression, mechanical distraction and ischemia. Motor evoked potentials (MEPs) measure the descending motor pathways in the anterior spinal cord. A magnetic field is used to stimulate the motor cortex with responses measured in the peripheral muscles. Although not widely available, MEPs are a superb, objective test to assess motor pathways.

Obstetric related neurological deficits

Neurologic injury related to labor and delivery occurs more commonly than anesthetic related deficits. Parturients who do not receive regional or general anesthesia may experience compression nerve injury, or rarely, an ischemic spinal cord injury. The incidence of permanent neurological deficits is as high as 1/2,100 (1.6-4.8/10,000). Past obstetric practice allowed protracted labor and the frequent use of forceps, which contributed to lumbosacral plexus injury. The fetal head may also compress and injure the lumbosacral plexus as it crosses the ala of the sacrum or the posterior brim of the pelvis. This injury is more common in nulliparous women with platypelloid pelvises, large babies, cephalopelvic disproportion, vertex presentation and forceps delivery. Compressive nerve injuries of this type may involve multiple root levels and appear as injuries to the femoral or obturator nerves with sensory impairment in the 4th and 5th lumbar dermatomes.

Femoral nerve injury decreases sensation over the anterior thigh and medial calf and impairs quadriceps strength, hip flexion and patellar reflex. Proximal lesions at the level of the lumbosacral plexus also may decrease hip flexion due to iliopsoas weakness. The obturator nerve can be compressed against the lateral pelvic wall or during its course in the obturator canal. This results in decreased sensation over the medial thigh, weakness of the hip adductors and decreased ability to internally rotate.
Ischemic injury may also produce neurologic deficits. The spinal cord may become ischemic during periods of hypotension or by compression of its blood supply. The anterior part of the lower spinal cord is supplied by either the artery of Adamkiewicz (85%) or a branch of the iliac artery (15%). The feeder vessels from the iliac artery may be compressed as they cross the lumbosacral trunk. The artery of Adamkiewicz supplies the anterior 2/3rds of the spinal cord and injury results in the loss of motor function (anterior horn), as well as pain and temperature (spinothalamic tract). This is known as anterior spinal artery syndrome. The dorsal column, which carries vibration and joint sensation, is supplied by the vertebral arteries and are therefore spared. Arteriovenous malformation within the spinal cord may also rarely cause paraplegia. The mechanism of injury is increased spinal venous pressure, which predisposes to arterial stasis during periods of moderate hypotension or compression.

**Anesthesia related neurologic deficits**

Serious neurological complications related to regional anesthesia are fortunately very rare. Neurological complications may be due to direct nerve trauma, severe hypotension, cardiac arrest, equipment problems, adverse drug effect, administration of the wrong drug and wrong site of administration.

Direct trauma to nervous tissue may occur at the level of the spinal cord, nerve root, or peripheral nerve. Two thirds of anesthesia related neurological complications are associated with either paresthesia (direct nerve trauma) or pain during injection (intraneuronal location). Epidural needle insertion is most likely to contact a nerve root. Spinal needles may touch nerve roots, or directly injure the spinal cord. If the patient reports localized pain with insertion of an epidural or spinal needle or catheter, stop immediately! Transient paresthesia with threading an epidural catheter is common. Anatomic variation may alter landmarks and place nervous tissue at risk for injury. The spinal cord usually terminates at the 1st lumbar vertebrae (60%) but may go as low as the L2-3 space (10%). In addition, the superior iliac crest is usually at the L4 spinous process or L4-5 interspace (79%), however, it may be as high as the L3-4 interspace (4%).

Auroy et al. prospectively monitored neurologic complications in more than 103,000 regional anesthetics. All deficits were present within 48 hours after anesthesia. Most (29/34) were transient, with recovery occurring between 2 days and 3 months. Spinal anesthesia was significantly more likely to result in both neurologic injury (5.9 vs. 2/10,000) and radiculopathy (4.7 vs. 1.7/10,000), compared to epidural anesthesia. All radiculopathies resolved except one (spinal). Of the patients who developed deficits without paresthesia, 12/13 occurred following spinal anesthesia, most with lidocaine 5%. In this series only one patient (who was elderly and experienced prolonged hypotension) became paraplegic.

Scott et al monitored 505,000 epidural blocks in parturients, finding only 38 single root neuropathies (0.75/10,000). All deficits resolved by 3 months except for one. In a similar study involving 123,000 regional anesthetics in parturients, 46 cases of single nerve root neuropathy were reported (3.7/10,000), with complete recovery in all patients by 3 months.

Cardiac arrest occurred significantly more commonly following spinal anesthesia compared to epidural (6.4 vs. 1/10,000). While fatal cardiac arrest occurred in elderly
patients undergoing hip arthroplasty (5/6), most recovered without sequelae (25). In obstetric patients, there were 3 cardiac arrests in 505,000 epidurals (0.06/10,000). Two patients recovered without sequelae and one had brain damage after severe hypotension following a ‘top-up’. Intravascular administration of bupivacaine will result in cardiac arrest. Bupivacaine binds avidly to the sodium channel in a ‘fast in - slow out’ manner. Thus, cardiac resuscitation is extremely difficult and often requires cardio-pulmonary bypass until the bupivacaine dissociates from the sodium channel and is metabolized. Bretylium has been suggested for resuscitation during bupivacaine-induced cardiac arrest.

Epidural catheters may rarely break or shear. Catheters are never to be withdrawn through the needle. If part of a catheter is left in a patient, the patient should be informed. However, no surgery or attempts to retrieve the catheter are warranted unless there are persistent neurologic symptoms.

The epidural space is remarkably tolerant to chemical contamination. However, the subarachnoid space is not. Drugs that have been accidentally injected into the epidural space without sequelae include thiopental, magnesium and TPN. Only undiluted KCL produced permanent paraplegia following epidural administration.

Epidural hematoma is another feared, but rarely seen complication of regional anesthesia (1/150,000-250,000) in healthy patients. Most epidural hematomas following regional anesthesia occurred in patients with hemostatic abnormalities, particularly those on anticoagulants. Low molecular weight heparins have been responsible for over 35 epidural hematomas following regional anesthesia and should be considered a strong relative contraindication. The symptoms of epidural hematoma are bilateral leg weakness, urinary incontinence and loss of rectal sphincter tone. These severe neurologic deficits may be preceded by sharp pain in the back or legs with progression over a few hours. Prolonged motor paralysis without regression of block should raise suspicion. Stat CT or MRI is indicated. Symptomatic epidural hematoma must be decompressed surgically within 6 hours for the best chance of full recovery.

Epidural abscess is rare, accounting for 0.2-1.2/10,000 tertiary hospital admissions. Epidural abscess is usually due to infection in the body seeding the epidural space. In one review, epidural anesthesia was associated with only in 1 in 39 epidural abscesses. while epidural anesthesia was unrelated to 35 abscesses in another review. Symptoms of epidural abscess usually develop a few days to a few weeks after delivery. In a series of over 500,000 epidurals, only one patient (diabetic) developed an abscess, albeit 11 months after delivery. Symptoms include fever, malaise, and headache and back pain at the level of the infection. Pain will be found on deep palpation over the site. White blood cell count will be elevated. Progression of symptoms to nerve root pain usually takes 1-3 days. Neurologic deficits will progress as the spinal cord is compressed including: lower extremity pain, weakness, bowel and bladder dysfunction and paraplegia. Surgical treatment is necessary.

Conclusion

In summary, neurologic complications due to regional anesthesia are very rare in obstetric patients. Although it is more likely that neurologic complaints are due to factors associated with labor and delivery (1.6-4.8/10,000), it is imperative to explore the possible deficits related to regional anesthetic techniques (0-1.2/10,000). A careful
history, physical exam, laboratory testing and use of imaging techniques will help to ensure an accurate diagnosis and good outcome.

Dr. Mark Zakowski will present more details of this topic at the SOAP annual meeting in a refresher course lecture. For more details on this topic including tables and figures, refer to Obstetric Anesthesia, Norris ed, Chapter 39 “Postoperative Complications Associated with Regional Anesthesia in the Parturient” by Dr. Zakowski.

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### Oral Presentations

Moderator: H. Jane Huffnagle, DO

1:00 - 2:30 pm

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<th>Time</th>
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<td>1:00 pm</td>
<td>IS NORMAL LABOR NORMAL?</td>
<td>M. Vidovich, C. Wong, T. Krejcie</td>
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<td>1:15 pm</td>
<td>COMPARISON OF MINIMUM LOCAL ANALGESIC VOLUMES OF TWO CONCENTRATIONS OF EPIDURAL BUPIVACAINE.</td>
<td>G. Lyons, H. Gorton, A. Robinson, M. Columb</td>
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<td>1:30 pm</td>
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<td>S. Maloney, J. Johnson, S. Hughes, M. Rosen</td>
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<td>1:45 pm</td>
<td>ROPIVACAINE COMPARED WITH BUPIVACAINE FOR LABOR ANALGESIA AND ABILITY TO AMBULATE</td>
<td>C. Swide, N. Neupane, J. Horn</td>
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<td>2:00 pm</td>
<td>HAEMODYNAMIC CHANGES WITH ’MOBILE’ EPIDURALS IN LABOUR: IS IT SAFE FOR WOMEN TO AMBULATE?</td>
<td>W. Hussain for the COMET Study Group UK.</td>
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<td>2:15 pm</td>
<td>ROPIVACAINE IS UNRELIABLE FOR USE AS A SPINAL TEST DOSE</td>
<td>M. Owen, P. Gautier, D. Hood</td>
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All Abstracts listed on this page are in the *Anesthesiology* Supplement.
Zuspan Papers / Awards

Moderator/Judge: Anne May, MBBS, FRCA
Judges: Robert Resnik, MD; Frederick P. Zuspan, MD; Laurence S. Reisner, MD; Robert D’Angelo, MD

3:00 - 4:00 pm

3:00 pm
TEMPORAL TRENDS IN OPERATIVE OBSTETRIC DELIVERY: 1992-1999
C. DiMarco, P. Ramsey, L. Williams, G. Vasdev, K. Ramin

3:15 pm
FACTORS ASSOCIATED WITH POST-PARTUM URINARY RETENTION AFTER VAGINAL DELIVERY
M. Carley, J. Carley, K. Ramin, G. Vasdev, M. Webb, R. Lee

3:30 pm
CARDIOTOCOGRAPHIC ABNORMALITIES ASSOCIATED WITH LABOR INDUCTION.
J. Balintona, L. Meyer, K. Ramin, G. Vasdev, P. Ramsey

3:45 pm
PERIPARTUM ANESTHETIC AND OBSTETRICAL MANAGEMENT OF PARTURIENTS AFFLICTED WITH CHIARI I MALFORMATION
A. Meath, R. Chantigian, M. Beran-Koehn, M. Warner, K. Ramin

All Abstracts listed on this page are in the Anesthesiology Supplement.
What's New in Obstetrics?

Robert Resnik, MD

4:00 - 5:00 pm

Following this lecture, the participants will be able to categorize current patient care concerns in obstetrics and their possible ramifications for anesthetic care.
Although there are numerous advances in obstetrics during the past year, worthy of attention, this discussion will focus on 9 generally unrelated areas in which significant new information has or will change the management of the obstetrical patient; or, is a controversial and hotly debated issue.

- The current role of electronic fetal heart-rate monitoring in obstetrics: Numerous epidemiologic as well as randomized control trials during the last 15 years have led investigators to conclude that the positive predictive value of electronic fetal heart-rate monitoring in preventing hypoxic encephalopathy and subsequent cerebral palsy is extraordinarily low. A recent task force convened by the Perinatal Society of Australia and New Zealand (MacLennan, A. Brit. Med. Journ. 1999; 319:1054) entitled “A Template for Defining a Causal Relationship Between Acute Intrapartum Events in Cerebral Palsy” recently agreed with the observation that multiple late decelerations and decreased beat to beat variability have a false positive rate of 99.8% (Nelson, KB et al. New Eng. J. Med. 1996; 334:613). The task force further concluded, in agreement with the findings of a group convened by the NICHD (Am. J. Obstet. Gynecol. 1997; 177:1385) that “a fetus demonstrating absent fetal heart rate variability in the presence of persistent late for variable decelerations, or a bradycardia, had evidence of potentially damaging acidaemia.” A recent task force convened by ACOG is likely to draw similar conclusions based on current evidence.
Preterm labor screening—genetics and the environment: Recent evidence suggests that one may more accurately predict which pregnant women will deliver preterm by measurement of cervical length by transvaginal ultrasound, or by the use of measurement of cervical-vaginal fetal fibronectin. Specifically, at the extremes, a cervical length of 2.5 cm or less in a woman at approximately 24 weeks gestation, the risk of preterm birth is approximately 30%. The risk of preterm birth with a cervical length of 4.5 cm is less than 5% and with a cervical length of 1.0 cm approximately 50%. The fibronectins are a family of ubiquitous proteins found in the plasma and extracellular matrix. When found to be present in either asymptomatic or symptomatic (contracting) women prior to 28 weeks gestation, the positive predictive value for preterm birth varies from 30—40%. The main value of this test appears to be the specificity—that is, when FFN is absent, the risk of preterm delivery is extremely low (Harron, Am. J. Obstet. Gynecol. 2000; 182:1458, Iams, N. Eng. J. Med. 1996; 334:567; Iams Am. J. Obstet. Gynecol. 1998; 178:1035).

There is new evidence that environmental and genetic factors combined may help to more plausibly explain preterm labor issues. This is well illustrated by the bacterial vaginosis (BV) story. Briefly, it has been reported that women with bacterial vaginosis have an increased risk of preterm delivery, and further that treatment with metronidazole and erythromycin reduces the incidence of preterm delivery (Hillier et al. N. Eng. J. Med. 1995; 333:1737; Hauth JC et al. N. Eng. J. Med. 1995; 333:1732). These findings generated a great deal of interest in the role of cervico/vaginal infections which may induce prostaglandin synthesis in the lower uterine segment and consequently preterm labor. However, more recent studies have failed to reproduce the original findings. In a multi-institutional trial
recently reported by the maternal-fetal medicine unit network, metronidazole did not prevent preterm delivery in women with asymptomatic BV (Carey et al. N. Eng. J. Med. 2000;342:534). Although the findings are preliminary, it has also been demonstrated in a smaller cohort of women that the relative risk for preterm delivery was 12 times higher among women who had BV as well as the allelic variant in the promoter region of the maternal tumor necrosis factor alpha (TNFA) gene. In comparison, women with TNFA who were BV negative had a relative risk only twice that of those without the susceptible maternal genotype (Macones et al Am. J. Obstet. Gynecol. 2001; 184, Abstract 0005, p. S3).

• Management of Placenta Accreta: A significant fallout of the increasing cesarean section rate over the last 20 years has been a marked increase in the incidence of placenta accreta. This has resulted in significant anesthetic and surgical challenges intrapartum. Specific ultrasound and MRI findings have now been shown to provide excellent predictive reliability, allowing for more controlled surgery. In addition, blood loss may be kept to a minimum by presurgical placement of balloon tip catheters in the internal iliac arteries, which may be inflated prior to dissection of surgical planes and removal of the uterus.

• The role of thrombophilic disorders in pregnancy pathophysiology: It has recently been demonstrated that a number of identifiable thrombophilic disorders result in significant complications of pregnancy, including an increased risk of venous thromboembolism, late fetal demise, preeclampsia, and intrauterine growth restriction. The complications resulting from acquired thrombophilia induced by the

**Treatment of gestational diabetes:** The hallmark of all clinical management of diabetes in pregnancy has been to establish a relatively euglycemic state, recognizing that the fasting blood sugar decreases in pregnancy. “Tight” metabolic control markedly decreases the risks of congenital malformations, fetal demise, macrosomia, delayed fetal lung maturation and neonatal hypoglycemia. The traditional management in the gestational diabetic has been to measure glucose frequently during the day and attempt to control blood glucose by nutritional means; if unsuccessful, insulin has been utilized to obtain the same goal. However, pregnancy produces a state of insulin resistance due to the presence of human placental lactogen (HPL), and in fact, the gestational diabetic is already producing excessive quantities of insulin in an attempt to maintain glucose homeostasis. Oral hypoglycemic agents, which would clearly be more satisfactory to patients, has been avoided because of the risks of teratogenicity. Recently, it has been shown that the use of glyburide, which does not cross the placental in significant
amounts, is as effective as insulin in producing glucose homeostasis in most gestational diabetics and, without fetal risks (Langer et al. *N. Eng. J. Med.* 2000; 343:1134).

- **Current role of fetal pulse oximetry:** There has been recent interest in a new and apparently accurate technology which provides continuous monitoring of oxygen saturation of the fetus, involving a transcervical device (sensor) which is lodged against the fetal cheek. The surface of the device contains three gold electrodes to determine adequate electrical contact, a photoemitter and a photodetector. The sensor is then connected to an oximeter which processes the signal, calculates and displays the oxygen saturation. The saturation is then averaged over approximately 45 seconds.

A recent multicenter RCT included 10,010 patients has been concluded, the goal of which was to determine if the addition of pulse oximetry monitoring improved the accuracy of electronic fetal monitoring in deciding which mothers need cesarean section for non reassuring fetal status. The study demonstrated a 50% reduction in the cesarean section rate for non reassuring fetal status (10 to 5%), but no overall reduction in the cesarean section rate because of a higher rate of c-section for dystocia in the study group. No adverse maternal or neonatal outcomes were noted. It has yet to be determined how or whether this device will be used and how widely. (Garrite et al. *Am. J. Obstet. Gynecol.* To be published).

- **New concepts in the use of corticosteroids to induce lung maturation:**

Corticosteroids have been used to induce lung and accelerate lung maturation in the...
preterm fetus for 20 years. There has been recent extensive debate regarding whether repeated (weekly) dosing is required in the undelivered patient, if it has any benefit, or if there are any risks. There is a great deal of recent evidence suggesting that repeated dosing is of no additional benefit in inducing lung maturation, and may be of some risk with respect to fetal growth (Am. J. Obstet. Gynecol. 2001; 184: Abstracts 10, 15, 17).

The management of Rh isoimmunization utilizing the measurement of middle cerebral artery blood flow velocity by Doppler: The traditional management of the Rh isoimmunized fetus has been to perform amniocentesis, or direct fetal umbilical blood sampling in order to determine the severity of disease. In order to avoid these invasive procedures, recent attention has been directed toward the study of blood flow velocity in the middle cerebral artery of the fetus, which increases in response to hypoxemia in a compensatory fashion. Recently, a group of 111 fetuses at risk of anemia from maternal red cell isoimmunization have had their peak flow velocity measured in the MCA, and then compared to the severity of anemia utilizing a cutoff value of 1.5 times the median. All fetuses with moderate and severe anemia have been correctly identified, with a sensitivity of 100% and a false positive value of 12%. This technique is likely to further decrease the number of fetuses exposed to cordocentesis, thus reducing fetal losses directly related to the procedure (N. Eng. J. Med. 2000;342:9).
Scientific Program

Saturday, April 28, 2001

6:30 am  Registration
7:00 - 8:15 am  Continental Breakfast in Plenary Session Room
7:00 - 8:15 am  Clinical Forum: Coagulopathies & Transfusion Medicine
Moderator: Shiv Kumar Sharma, MD, FRCA
LMWH & Neuronal Anesthesia - Terese T. Horlocker, MD
Bleeding Disorders, Transfusion & Cell Saver in OB - Penny Ballem, MD
8:15 - 9:15 am  Fred Hehre Lecture
M. Joanne Douglas, MD
9:15 - 10:00 am  Debate No. 2
Most OB Patients with a "Wet Tap" Should Get a Prophylactic Epidural Blood Patch
Moderator: Geraldine O'Sullivan, MD
PRO: Theodore G. Cheek, MD  CON: Gary M.S. Vasdev, MD
10:00 - 10:30 am  Coffee Break with Exhibitors & Posters
10:30 am - 12:00 n  Oral Presentations — Best Paper of the Meeting Award
Moderator/Judge: Donald H. Penning, MD, MSc, FRCPCH
Judges: Edward R. Molina-Lamas, MD, FACA; Mark C. Norris, MD;
David C. Campbell, MD, MSc, FRCPCH; Hisayo O. Morishima, MD, PhD
12:00 n - 1:00 pm  Lunch on own
1:00 - 2:00 pm  Gerard W. Ostheimer: What's New in Obstetric Anesthesia Lecture
B. Scott Segal, MD
2:00 - 3:00 pm  Oral Presentations
Moderator: Cheryl A. DeSimone, MD
3:00 - 4:15 pm  Poster Review #3
Moderator: Laurence S. Reisner, MD
4:15 pm  Best Paper of the Meeting Award / Adjournment
Moderators: Valerie A. Arkoosh, MD; Donald H. Penning, MD, MSc, FRCPCH
Clinical Forum: Coagulopathies & Transfusion Medicine

- Moderator: Shiv Kumar Sharma, MD, FRCA

LMWH & Neuraxial Anesthesia - Terese T. Horlocker, MD
Bleeding Disorders, Transfusion & Cell Saver in OB - Penny Ballem, MD

7:00 - 8:15 am

Following this panel, the participants will be able to describe the impact of new anticoagulants on the ability to perform regional anesthesia, list the common bleeding disorders in parturients, and explain the role of transfusion and the cell saver in obstetrics.
Venous Thromboembolism and Pregnancy

Venous thromboembolic disease remains the most common cause of maternal death. The overall risk of thromboembolism in pregnancy is six times greater than in the non-pregnant state. Factors increasing the risk are obstruction of venous return by the enlarging uterus and prothrombotic hemostatic changes. The incidence of venous thromboembolism is higher in pregnant women who have had previous thrombotic events. Women at a high risk of pregnancy-related thrombosis include those with an inherited thrombophilia such as activated protein C resistance, antithrombin III, protein C and S deficiency and acquired thrombophilia such the antiphospholipid antibody syndrome. Pregnant women with the antiphospholipid antibody syndrome have a predisposition not only to both venous and arterial thromboembolism but also to spontaneous abortion, classically mid-trimester.

In the past, pregnant women at risk of thromboembolism have been treated with oral anticoagulants or standard unfractionated heparin (SH). Oral anticoagulants are not ideal because they cross the placenta and confer a risk of fetal abnormality in the first trimester and intra-cranial hemorrhage at any time during gestation. Standard heparin does not cross the placental barrier, but it is associated with maternal side-effects such as bleeding, thrombocytopenia and osteoporosis. Therapy with SH requires 2 to 3 times daily injection and is difficult to monitor accurately during pregnancy using the activated partial thromboplastin time (aPTT) (Robin, 1998).

The low molecular weight heparin (LMWH) also does not cross the placental barrier but offers several advantages compared to SH. LMWH may be monitored with great sensitivity using a specific anti-Xa assay. The systemic absorption from subcutaneous injection is better and anti-Xa activity is longer than UF heparin. As a consequence of these features, lower dosage and less frequent injections are required which is a considerable practical advantage when therapy is contemplated for nine months. Osteoporosis, which may be a dose-dependent complication of heparin use, may be less frequent with LMWH because lower doses are required to prevent thromboembolism. Thus, LMWH appears theoretically superior to SH in the management of the pregnant patient with a high risk of thromboembolism (Ellison, 2000). However, there is little data assessing the potential use of LMWH in pregnancy although they are widely used. For example, there is a lack of prospective, randomized controlled trials comparing LMWH and SH. In addition, the benefits of LMWH and rate of adverse events remain inconclusive (Ensom, 1999).

Anesthesia management of the anticoagulated parturient presents a challenge to the anesthesiologist. The parturient may present in active labor and request neuraxial anesthesia or analgesia. Timing of needle and catheter placement (relative to administration of the anticoagulant) remains controversial. Likewise, re-establishment of anticoagulation postpartum will also affect regional technique. A review of the pharmacology of the anticoagulant medications, the large series of patients who have safely received anticoagulants in combination with neuraxial anesthesia, as well as the case reports of spinal hematoma will assist the clinician with these difficult decisions.

Incidence of Spinal Hematoma

The actual incidence of neurologic dysfunction resulting from hemorrhagic complications associated with neuraxial blockade is unknown; however, the incidence cited in the literature is estimated to be less than 1 in 150,000 epidural and less than 1 in 220,000 spinal anesthetics (Tryba, 1993). Vandermeulen et al (Vandermeulen, 1994) reported 61 cases of spinal hematoma associated with epidural or spinal anesthesia. Five of the 61 patients were parturients. The spinal hematomas associated with central neural blockade occurred in patients with evidence of hemostatic abnormality in 42 of 61 (68%) patients. Twenty-five of the patients had received intravenous or subcutaneous heparin, while an additional five patients were presumably administered heparin, as they were undergoing a vascular surgical procedure. In addition, 12 patients had evidence of coagulopathy or were
treated with antiplatelet medications, oral anticoagulants, thrombolitics, or dextran 70 immediately before or after the spinal or epidural anesthetic. Regional technique was also noted. A spinal anesthetic was performed in 15 patients. The remaining 46 patients received an epidural anesthetic, including 32 patients with an indwelling catheter. In 15 of these 32 patients, the spinal hematoma occurred immediately after the removal of the epidural catheter. (Nine of these catheters were removed during therapeutic levels of heparinization). These results suggest that catheter removal is not entirelyatraumatic, and the patient's coagulation status at the time of catheter removal is perhaps as critical as that at the time of catheter placement. Neurologic outcome was partial or good in only 38% of patients, and tended to occur in patients who underwent laminectomy within eight hours of diagnosis of spinal hematoma.

Intravenous and Subcutaneous Standard Heparin

Complete systemic heparinization is typically reserved for the most high-risk patients, typically patients with an acute thromboembolism. However, intraoperative administration of a modest intravenous dose is occasionally performed during vascular or orthopaedic procedures. In a study involving over 4000 patients, Rao and El-Etr (Rao, 1981) demonstrated the safety of indwelling spinal and epidural catheters during systemic heparinization. However, the heparin activity was closely monitored, the indwelling catheters were removed at a time when circulating heparin levels were relatively low, and patients with a preexisting coagulation disorder were excluded. A subsequent study in the neurologic literature by Ruff and Dougherty (Ruff, 1981) reported spinal hematomas in 7 of 342 patients (2%) who underwent a diagnostic lumbar puncture and subsequent heparinization. Traumatic needle placement, initiation of anticoagulation within 1 hour of lumbar puncture or concomitant aspirin therapy were identified as risk factors in the development of spinal hematoma in anticoagulated patients.

Low-dose subcutaneous standard (unfractionated) heparin is administered for thromboprophylaxis in patients undergoing major thoracoabdominal surgery and in patients at increased risk of hemorrhage with oral anticoagulant or LMWH therapy. As previously mentioned, subcutaneous heparin does not provide adequate prophylaxis following major orthopedic surgery, and is seldom utilized in this patient population. A review of the literature by Schwander and Bachmann (Schwander, 1991) noted no spinal hematomas in over 5000 patients who received subcutaneous heparin in combination with spinal or epidural anesthesia. There are only three cases of spinal hematoma associated with neuraxial blockade in the presence of low-dose heparin, two of which involved a continuous epidural anesthetic technique (Darnat, 1986; Dupeyrat, 1990; Metzger, 1998).

Regional Anesthetic Management of the Patient Receiving Standard Heparin

The safety of neuraxial techniques in combination with intraoperative heparinization is well documented, providing no other coagulopathies is present. The concurrent use of medications that affect other components of the clotting mechanisms may increase the risk of bleeding complications for patients receiving standard heparin. These medications include antiplatelet medications, LMWH, and oral anticoagulants (Liu, 1998).

Intravenous heparin administration should be delayed for 1 hour after needle placement. Indwelling catheters should be removed 1 hour before a subsequent heparin administration or 2-4 hours after the last heparin dose. Evaluation of the coagulation status may be appropriate prior to catheter removal in patients who have demonstrated enhanced response or are on higher doses of heparin. Although the occurrence of a bloody or difficult needle placement may increase risk, there are no data to support mandatory cancellation of a case should this occur. If the decision is made to proceed, full discussion with the surgeon and careful postoperative monitoring are warranted. Prolonged therapeutic anticoagulation appears to increase risk of spinal hematoma formation, especially if combined with other anticoagulants or thrombolitics. Therefore, neuraxial blocks should be avoided in this clinical setting. If systematic anticoagulation therapy is begun with an epidural catheter in place, it is recommended to delay catheter removal for 2-4 hours following heparin discontinuation and after evaluation of coagulation status (Liu, 1998).

There is no contradiction to use of neuraxial techniques during subcutaneous standard heparin. The risk of neuraxial bleeding may be reduced by delay of the heparin injection until after the block, and may be increased in debilitated patients or after prolonged therapy (Liu, 1998).
Low Molecular Weight Heparin

Low molecular weight heparin (LMWH) has recently been introduced for thromboprophylaxis following knee or hip arthroplasty. Extensive clinical testing and utilization of LMWH in Europe over the last ten years suggested that there was not an increased risk of spinal hematoma in patients undergoing neuraxial anesthesia while receiving LMWH thromboprophylaxis perioperatively (2,14). However, in the five years since the release of LMWH for general use in the United States in May 1993, over forty cases of spinal hematoma associated with neuraxial anesthesia administered in the presence of perioperative LMWH prophylaxis have been reported to the manufacturer (Horlocker, 1998). Many of these events occurred when LMWH was administered in a dose of 40 mg once daily, rather than 30 mg every twelve hours. Concomitant antiplatelet therapy was present in several cases. The apparent difference in incidence in Europe compared to the United States may be a result of a difference in dose and dosage schedule. For example, in Europe the recommended dose of enoxaparin is 40 mg once daily, rather than 30 mg every twelve hours. However, timing of catheter removal may also have an impact. Although the actual frequency of spinal hematoma in patients receiving enoxaparin while undergoing spinal or epidural anesthesia is difficult to determine, the incidence has been estimated to be 1 in 3,100 continuous epidural anesthetics and 1 in 41,000 spinal anesthetics. Continued evaluation of the safety of spinal or epidural anesthesia in a patient receiving LMWH prophylaxis is required. Indeed, it appears that the clinician should proceed cautiously with regional anesthesia in the patient receiving LMWH (Horlocker, 1998).

Regional Anesthetic Management of the Patient Receiving Low Molecular Weight Heparin

Anesthesiologists in the United States can draw upon the European experience to develop their own practice guidelines for the management of patients undergoing spinal and epidural blocks while receiving perioperative LMWH. Monitoring of the anti-Xa level is not recommended. The anti-Xa level is not predictive of the risk of bleeding, and is therefore not helpful in the management of patients undergoing neuraxial blocks (15). Antiplatelet or oral anticoagulant medications administered in combination with LMWH may increase the risk of spinal hematoma. Concomitant administration of medications affecting hemostasis, such as antiplatelet drugs, standard heparin, or dextran represents an additional risk of hemorrhagic complications perioperatively, including spinal hematoma. Education of the entire patient care team is necessary to avoid potentiation of the anticoagulant effects (Horlocker, 1998).

Patients on preoperative LMWH can be assumed to have altered coagulation at the time of needle placement. A single-dose spinal anesthetic may be the safest neuraxial technique in patients receiving preoperative LMWH. In these patients, needle placement should occur at least 10 to 12 hours after the LMWH dose. This is consistent with European regimens, where the first dose is administered 12 hours preoperatively. Patients receiving higher "treatment" doses of LMWH (e.g. enoxaparin 1 mg/kg twice daily) will require longer delays (24 hours). Neuraxial techniques should be avoided in patients administered a dose of LMWH two hours preoperatively (general surgery patients), since needle placement occurs during peak anticoagulant activity (Horlocker, 1998).

Patients with postoperative initiation of LMWH thromboprophylaxis may safely undergo single-dose and continuous catheter techniques. The first dose of LMWH should be administered no earlier than 24 hours postoperatively. In addition, it is recommended that indwelling catheters be removed prior to initiation of LMWH thromboprophylaxis. If a continuous technique is selected, the epidural catheter may be left indwelling overnight and removed the following day, with the first dose of LMWH administered two hours after catheter removal (Horlocker, 1998).

The decision to implement LMWH therapy in the presence of an indwelling catheter must be made with care. Extreme vigilance of the patient's neurologic status is warranted. An opioid or dilute local anesthetic solution is recommended in these patients in order to allow frequent monitoring of neurologic function. If epidural analgesia is anticipated to continue for more than 24 hours, LMWH administration may be delayed, or an alternate method of thromboprophylaxis may be selected (e.g. external pneumatic compression), based on the risk profile for the individual patient. These decisions should be made preoperatively to allow optimal management of both postoperative analgesia and thromboprophylaxis (Horlocker, 1998).
For any LMWH prophylaxis regimen, timing of catheter removal is of paramount importance. Catheter removal should be delayed for at least 10 to 12 hours after a dose of LMWH. A true normalization of the patient’s coagulation status could be achieved if the evening dose of LMWH was not given, and the catheter was removed the following morning (24 hours after the last dose). Again, subsequent dosing should not occur for at least two hours after catheter removal (Horlocker, 1998).

Oral Anticoagulants

Few data exist regarding the risk of spinal hematoma in patients with indwelling epidural catheters who are anticoagulated with warfarin. The optimal duration of an indwelling catheter and the timing of its removal also remain controversial. To date, only three studies have evaluated the risk of spinal hematoma in patients with indwelling spinal or epidural catheters who receive oral anticoagulants perioperatively. Odoom and Sih (Odoom, 1983) performed 1000 continuous lumbar epidural anesthetics in vascular surgical patients who were receiving oral anticoagulants preoperatively. The thrombotest (a test measuring factor IX activity) was decreased in all patients prior to needle placement. Heparin was also administered intraoperatively. Epidural catheters remained in place for 48 hours postoperatively. There were no neurologic complications. While these results are reassuring, the obsolescence of the thrombotest as a measure of anticoagulation combined with the unknown coagulation status of the patients at the time of catheter removal limit the usefulness of these results. Therefore, except in extraordinary circumstances, spinal or epidural needle/catheter placement and removal should not be performed in fully anticoagulated patients.

There were also no symptomatic spinal hematomas in 192 patients receiving postoperative epidural analgesia in conjunction with low-dose warfarin after total knee arthroplasty. Patients received warfarin, starting on the postoperative day, to prolong the PT to 15.0-17.3 s (normal 10.9-12.8 s), corresponding to an INR of 2.0-3.0. Epidural catheters were left indwelling 37±15 h (range 13-96 h). Mean PT at the time of epidural catheter removal was 13.4±2 s (range 10.6-25.8 s). The mean PT did not increase beyond the normal range until 48 hours postoperatively, and therapeutic values were not achieved on average until the seventh postoperative day. This study documents the relative safety of low-dose warfarin anticoagulation in patients with an indwelling epidural catheter. It also demonstrates the large variability in patient response to warfarin. For example, the mean PT did not increase beyond the normal range until 48 hours postoperatively, and therapeutic values were not achieved on average until the seventh postoperative day. However, 36 patients had a documented PT greater than 12.8 s after a single dose of warfarin, including 2 patients with therapeutic values. The authors recommended close monitoring of coagulation status to avoid excessive prolongation of the PT during epidural catheterization (Horlocker, 1994).

Wu and Perkins (Wu, 1996) retrospectively reviewed the medical records of 459 patients who underwent orthopedic surgical procedures under spinal or epidural anesthesia, including 412 patients who received postoperative epidural analgesia. Preoperatively, antiplatelet medications were reported in 270 patients, warfarin (mean dose 4.9 ± 1.4 mg) in 181 patients, subcutaneous (unfractionated) heparin in 5 patients, and LMWH in 6 patients. All patients were anticoagulated with warfarin postoperatively, although the dose of warfarin administered was not recorded. The time of catheter removal and corresponding PT were noted. Mean duration of epidural analgesia was 43.6 ± 12.5 hours (range 5-118 hours). Prothrombin time at the time of epidural catheter removal was 14.1 ± 3.2 s (normal 9.6-11.1 s), corresponding to an INR of 1.4. Patients who had warfarin thromboprophylaxis initiated preoperatively had significantly higher PTs at the time of catheter removal than patients who had received postoperative warfarin only. There was no evidence of spinal hematoma. These results suggest that patients receiving oral anticoagulants may safely undergo regional techniques, even when thromboprophylaxis is initiated preoperatively. Unfortunately, this study reports only the PT at the time of catheter removal, and does not describe the prolongation of the PT with respect to progressive warfarin administration, making it impossible to determine how many doses of warfarin and what cumulative dose will result in thromboprophylactic effect.
Anesthetic management of patients anticoagulated perioperatively with warfarin is dependent on dosage and timing of initiation of therapy. The PT and INR of patients on chronic oral anticoagulation will require three to five days to normalize after discontinuation of the anticoagulant therapy. Theoretically, since the PT and INR reflect predominantly factor VII activity, (and factor VII has only a six to eight hour half-life), there may be an interval during which the PT and INR approach normal values, yet factors II and X levels may not be adequate for normal hemostasis. Therefore, it is recommended that documentation of the patient's normal coagulation status be achieved prior to implementation of neuraxial block (Enneking, 1998).

Many orthopedic surgeons administer the first dose of warfarin the night before surgery. For these patients, the PT and INR should be checked prior to neuraxial block if the first dose was given more than 24 hours earlier, or a second dose of oral anticoagulant has been administered. Patients receiving low dose warfarin therapy during epidural analgesia should have their prothrombin time and INR monitored on a daily basis, and checked before catheter removal, if initial dose of warfarin was more than 36 hours beforehand. Initial studies evaluating the safety of epidural analgesia in association with oral anticoagulation utilized low dose warfarin, with the mean daily doses of approximately 5mg. Higher dose warfarin may require more intensive monitoring of the coagulation status. Reduced doses of warfarin should be given to patients who are likely to have an enhanced response to the drug. In general, it is recommended that indwelling neuraxial catheters be removed when the INR < 1.5 in order to assure adequate levels of all vitamin-K dependent factors. An INR > 3 should prompt the physician to withhold or reduce the warfarin dose in patients with indwelling neuraxial catheters. There is no definitive recommendation for removal of neuraxial catheters in patients with therapeutic levels of anticoagulation during a neuraxial catheter infusion. Caution must be exercised in making decisions about removing or maintaining these catheters (Enneking, 1998).

Antiplatelet Medications

Antiplatelet medications are seldom used as primary agents of thromboprophylaxis. However, many orthopedic patients report chronic use of one or more antiplatelet drugs (Horlocker, 1996). Although Vandermeulen et al (Vandermeulen, 1994) implicated antiplatelet therapy in 3 of the 61 cases of spinal hematoma occurring after spinal or epidural anesthesia, several large studies have demonstrated the relative safety of neuraxial blockade in both obstetric and surgical patients receiving these medications (Horlocker, 1996; CLASP, 1994, Horlocker, 1990).

In a prospective study involving 1000 patients, Horlocker et al (Horlocker, 1995) reported that preoperative antiplatelet therapy did not increase the incidence of blood present at the time of needle/catheter placement or removal, suggesting that trauma incurred during needle or catheter placement is neither increased nor sustained by these medications. The clinician should be aware of the possible increased risk of spinal hematoma in patients receiving antiplatelet medications who undergo subsequent heparinization (Ruff, 1981).

Ticlopidine and clopidogrel are also platelet aggregation inhibitors. These agents interfere with platelet-fibrinogen binding and subsequent platelet-platelet interactions. The effect is irreversible for the life of the platelet. Ticlopidine and clopidogrel have no effect on platelet cyclooxygenase, acting independently of aspirin. However, these medications have not been tested in combination. The risk of spinal hematoma in patients receiving ticlopidine and clopidogel is unknown.

Regional Anesthetic Management of the Patient Receiving Antiplatelet Medications

Antiplatelet drugs, by themselves, appear to represent no added significant risk for the development of spinal hematoma in patients having epidural or spinal anesthesia. However, the concurrent use of medications that affect other components of the clotting mechanisms, such as oral anticoagulants, standard heparin, and LMWH, may increase the risk of bleeding complications for patients receiving antiplatelet agents. Assessment of platelet function prior to performance of neuraxial block is not recommended. However, careful preoperative assessment of the patient to identify alterations of health that might contribute to bleeding is crucial (Urmey, 1998).

In summary, the decision to perform spinal or epidural anesthesia/analgesia and the timing of catheter removal in a patient receiving anticoagulants perioperatively should be made on an individual basis, weighing the small, though definite risk of spinal hematoma with the benefits of regional anesthesia for a specific patient. Alternative anesthetic and analgesic techniques exist for patients considered to be at an unacceptable risk. The patient's
Coagulation status should be optimized at the time of spinal or epidural needle/catheter placement, and the level of anticoagulation must be carefully monitored during the period of epidural catheterization. It is important to note that patients respond with variable sensitivities to anticoagulant medications. Indwelling catheters should be not removed in the presence of therapeutic anticoagulation, as this appears to significantly increase the risk of spinal hematoma. In addition, communication between clinicians involved in the perioperative management of patients receiving anticoagulants is essential in order to decrease the risk of serious hemorrhagic complications. Patients should be closely monitored in the perioperative period for early signs of cord compression such as severe back pain, progression of numbness or weakness, and bowel and bladder dysfunction. If spinal hematoma is suspected, radiographic confirmation must be sought immediately because delay may lead to irreversible cord ischemia. The treatment of choice is decompressive laminectomy.
References

Bleeding Disorders, Transfusion & Cell Saver in OB
Penny Ballem, MD

NOTES:
Fred Hebre Lecture

M. Joanne Douglas, MD

8:15 - 9:15 am

Following this lecture, the participants will be able to describe some of the historic advances made in regional anesthesia for obstetrics over the past several decades.
Fred Hehre Lecture  
Joanne Douglas, MD, FRCPC, Vancouver, B.C.

Objectives
1. To describe some of the historic advances made in regional anesthesia for obstetrics over the past decades
2. To consider how these may point to new directions for the future.

Dr. Fred Hehre, whose work is honored by this lecture added much to our knowledge through his research in obstetric anesthesia. Of particular note are his studies on the effects of vena caval obstruction on the spread of local anesthetic in the epidural space, effects of local anesthetic on the fetal heart rate and measurement of local anesthetic concentrations in the newborn and mother at delivery and his concerns about the need for adequate numbers of obstetric anesthesiologists.

Looking to the Past to find a Vision for the Future

Regional anesthesia for obstetrics was first described in the early part of the 20th Century with the report from Kreiss of spinal anesthesia in six laboring women. In 1909 Stoeckel reported on the injection of procaine mixed with adrenaline into the caudal space and the possibility of pain-free labor was realized. The rest of the 20th Century saw refinements of the techniques, development of better equipment, drugs and a realization as to the possible uses of these techniques. Of equal import was the development of anesthesia as a specialty and obstetric anesthesia as a subspecialty.

Refinements of Technique:
From its inception regional anesthesia for obstetrics has been fraught with controversy. Hailed at the onset with its ability to relieve the pain of labor and glowing reports of its successes, nevertheless, there was always the possibility of “spinal” headache. Post dural puncture headache continues to be the complication identified with spinal anesthesia to this date. Early writers noted a difference in headache incidence with the use of smaller gauge spinal needles and as early as 1927 Greene pointed out the advantage of a “pencil-point” needle. However, until Sprotte described his series of over 34,000 cases using his variation of the pencil-point needle the anesthetic community was slow to widely adopt the use of these needles. In fact, spinal anesthesia in obstetrics has seen a re-birth in the last 20 years with the reintroduction of the pencil-point needle.

Various loss of resistance techniques have been used throughout the 20th Century with different authorities recommending the use of air, saline and hanging drop. All have depended on the differential pressure ("negative") in the epidural space. Initially, identification of the epidural space depended on the tactile sense of the operator but later the use of a fluid-filled syringe was described. Although many anesthesiologists prefer air the latter part of the Century saw reports and summaries of reports that seem to indicate that loss of resistance to saline is the better technique. In his classic text Bromage pointed out that “a rigid fluid-filled system is theoretically ideal for a crisp and
unequivocal end-point to the loss of resistance technique. Fluid is incompressible and consequently the transition from complete resistance to loss of resistance is immediate and convincing." This does not mean that those who use air should switch. However, there is ample anecdotal evidence that loss of resistance to saline is a better technique for new trainees as it is associated with a lower incidence of inadvertent dural puncture.

The inability of spinal or epidural analgesia/anesthesia to provide analgesia for a long labor led anesthesiologists to develop continuous techniques. Continuous spinal anesthesia initially used a malleable needle inserted into the subarachnoid space, a split mattress which allowed the patient to be supine and a length of tubing which connected the malleable needle to a syringe containing local anesthetic. Needless to say, there were difficulties with this technique. Tuohy was the first to describe the insertion of a ureteral catheter into the subarachnoid space and this technique was later also used for the epidural space. Refinements to these “catheters” continued through the Century with development of better materials. Disagreements over catheter design, multi-port or uniport, have occupied researchers. From a personal perspective the development of the new flexible catheters has been a major advance. In my hands the incidence of paresthesiae during insertion and venipuncture with these new catheters is markedly less.

Another catheter development was the introduction of the “micro” catheter for continuous spinal anesthesia. These catheters were withdrawn from the market after reports of an unacceptably high incidence of permanent neurological complications. With the recognition that the catheter design was not the complete reason for these complications, these catheters may be reintroduced.

Probably one of the more interesting developments of the 20th Century was the widespread adoption of the combined spinal-epidural (CSE) technique. Originally described in 1937 it was reintroduced to clinical practice as a practical means of providing long lasting, effective anesthesia for surgery. Reports of its use for labor analgesia have led to enthusiasm for this technique. Of greater importance was the realization that women who had CSE could walk. The term “walking epidural” also applies to the more traditional, low dose epidural technique. Interestingly, in a 1948 text by Lull and Hingson the authors commented that “several of the patients have been able to sit in a chair or to walk painlessly about the room under this form of block" so the concept of ambulation with regional block is not new.

In 1933, Cleland reported the use of paravertebral block but this technique did not gain wide spread popularity as it failed to produce analgesia/anesthesia for the second stage of labor. In 1999 Leighton et al re-examined sympathetic blockade using the lumbar approach. Their research suggests that his technique may have some advantages.

Refinements of the Drugs Used for Regional Block in Obstetrics.
Kreiss injected cocaine into the subarachnoid space to provide analgesia while Stoeckel used a mixture of procaine and epinephrine. Early papers described the use of various local anesthetics and combinations of drugs many of which are no longer in general use.
Of interest Barker first reported on the addition of glucose to stovaine in 1907, utilizing baricity to achieve the desired level of anesthesia.

Lidocaine and bupivacaine are the local anesthetics in common use today. Concerns about the cardiac toxicity of bupivacaine led to the development of ropivacaine and levobupivacaine. While holding out considerable promise it is unlikely that these will replace bupivacaine for labor analgesia, if only for cost considerations.

Complications
Much interest has focused on the complications associated with regional analgesia/anesthesia. Efforts to reduce the incidence of hypotension and its possible effects on the fetal heart have had a prominent place in the anesthetic literature. Unfortunately, although some progress has been made in this area there still is much that is unknown. Postulated reasons for fetal heart rate changes which may accompany regional anesthesia include effects of the local anesthetic on the fetal heart, relative decrease in uterine blood flow secondary to maternal hypotension (either globally or at the level of the uterus), increased uterine tone or some as yet unidentified process. Although prophylactic administration of fluid and/or a vasopressor are methods commonly used to avoid hypotension, studies have not shown consistent results.

Interestingly, Pitkin in 1928 recommended using an ephedrine-novocain solution for skin infiltration prior to spinal anesthesia. He commented that if ephedrine is used “the patient may be carried through without the slightest drop in blood pressure”. The amount he recommended ranged from 30-65 mg depending on the desired height of the block.

Throughout the Century there has been a justifiable concern about possible neurological complications associated with regional anesthesia. There is little information about these complications in the early part of the century. Certainly, spinal anesthesia suffered a severe set back in the United Kingdom following the notorious Woolley and Roe cases. In the United States Kennedy et al drew attention to “the grave spinal cord paralyses caused by spinal anesthesia”. Some of the cases described included women who had received spinal anesthesia for Cesarean section.

Some of the neurological complications associated with regional anesthesia have been related to problems with technique from the introduction of phenol through cracks in the ampoules, combination of spinal microcatheters with hyperbaric lidocaine and introduction of 2-chloroprocaine (low pH, metabisulphite) inadvertently into the subarachnoid space. A recent paper and accompanying editorial suggest another concern relating to the administration of spinal anesthesia, namely correct identification of the level of introduction of the spinal needle. Early users of spinal anesthesia performed intrathecal injections at all levels, from cervical to low lumbar. Although some caution was urged with relation to certain levels there was little mention of permanent neurological injury. This may have been relative as alternatives, such as general anesthesia, had a higher risk of death. However, in the current era it is necessary that the lowest possible space is used for insertion of the spinal needle to avoid possible trauma to the spinal cord/conus.
Infection is an ongoing concern with regional anesthesia. There has always been a small risk of meningitis/abscess associated with performing regional blockade. However, the overall incidence has been low. I believe the epidural space is very forgiving of small breaks in technique but the same cannot be said for the subarachnoid space. The reintroduction of CSE to obstetrics has led to an increase in the number of reports of meningitis. This may simply relate to the fact that less care is taken when these blocks are performed in the labor room, in contrast to the operating room. Because of the potential, not only for breaks in sterile technique, but also for introduction of “wrong” substances into the intrathecal space I believe the use of CSE for labor analgesia has to be approached with the utmost care and attention to detail.

Looking Forward - Research:
Although the 20th Century might rightly be called one of “Discovery and Rediscovery” in obstetric anesthesia there still is much that needs to be refined and learned. Further research needs to be done in the area of prevention of hypotension and fetal heart rate changes associated with regional anesthesia. Although various studies have failed to demonstrate a consistent relationship, all practicing anesthesiologists have been aware of the “20 minute syndrome”. Many suggest that it is unimportant as it responds (usually) to changes in position, bolus of fluid or ephedrine and oxygen. However, the question has still not been adequately addressed.

The same might be said for hypotension accompanying regional blockade for Cesarean section. With a reported incidence over 60% with spinal anesthesia it is essential that research continue as we search for better methods to prevent and treat hypotension. In their studies on the pregnant ewe, James and colleagues found that ephedrine improved uterine blood flow during spinal-induced hypotension but that it was not restored to baseline values. Our obstetrics colleagues still have concerns about the use of ephedrine and its possible effects on the fetus. Although the best agent of those currently available is ephedrine the final answer may rest with an, as yet, undiscovered vasopressor.

Epidural and intrathecal opioids have been a real boon for postoperative analgesia and for improving analgesia during labor and Cesarean section. Newer opioids that combine local anesthetic activity with opioid activity may ultimately prove the ideal agents for labor pain. Use of a single drug would decrease the risk of drug errors that accompany the use of multiple agents.

Is there anything left to learn with respect to technique? I believe that there are still new areas to explore. Our obstetrics colleagues are using ultrasound to more accurately diagnose problems in the developing fetus. Might we make use of their technology to assist us with identification of the epidural and subarachnoid spaces? Although described by Wallace the technique has yet to prove practical in the labor unit. In the future some variation may prove practical and will also enable us identify the level for spinal blockade. A combination of a reliable method of identifying the appropriate space for injection and injection of a new long-acting agent (providing effective analgesia without motor block and without interfering in the progress of labor) using a needle-less system would be ideal.
Conclusion
There is much that we can learn from the past but we must not content ourselves with what we have accomplished. It is important to celebrate and affirm our history but we must continue to learn and to build on the knowledge provided by our colleagues.

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Collins KM, Bevan DR, Beard RW. Fluid loading to reduce abnormalities of fetal heart rate and maternal hypotension during epidural analgesia in labour. BMJ 1978;2:1460-1
Greene HM. Lumbar puncture and the prevention of postpuncture headache. JAMA 1926;86:391-2
Hopkins SR. Case of Cesarean section under spinal anesthesia. JAMA 1902;38:1355
Reynolds F. Damage to the conus medullaris following spinal anaesthesia. Anaesthesia 2001;56:235-47
Sicard JA, Forestier J. Radiographic method for exploration of the extradural space using Lipiodol. Rev Neurol 1921;28:1264
Tuohy EB. Continuous spinal anesthesia: its usefulness and technic involved. Anesthesiology 1944;5:142-8
Wollman SB, Marx GF. Acute hydration for prevention of hypotension of spinal anesthesia in parturients. Anesthesiology 1968;29:374-80
Debate No. 2

Most OB Patients with a “Wet Tap” Should Get a
- Prophylactic Epidural Blood Patch

Moderator: Geraldine O’Sullivan, MD
Pro: Theodore G. Cheek, MD
Con: Gary M.S. Vasdev, MD

9:15 - 10:00 am

Following this debate, the participants will be able to list the indications and contraindications for prophylactic epidural blood patch and access the efficacy of prophylactic epidural blood patch.
Oral Presentations / Best Paper of the Meeting Award

Moderator/Judge: Donald H. Penning, MD, MSc, FRCPC
Judges: Edward R. Molina-Lamas, MD, FACA; Mark C. Norris, MD;
David C. Campbell, MD, MSc, FRCPC; Hisayo O. Morishima, MD, PhD

10:30am - 12:00 n

10:30 am  POSTURAL STABILITY FOLLOWING REGIONAL ANALGESIA FOR LABOR
J. Davies, R. Fernando, S. Verma, P. Found, A. McLeod

10:45 am  ALLOPREGNANOLONE PROTECTS AGAINST NMDA-INDUCED CELLULAR INJURY
IN HUMAN NT2-N NEURONS
E. Lockhart, R. Boustany, R. Pearlstein, D. Warner, D. Penning

11:00 am  PATIENT-CONTROLLED EPIDURAL ANALGESIA VS. CONTINUOUS INFUSION FOR
LABOR PAIN. A META-ANALYSIS
M. Van der Vyver, S. Halpern, G. Joseph

11:15 am  MAGNESIUM SULFATE AND HYPOXIA: EFFECTS ON PREGNANCY OUTCOME AND
FETAL NEUROCHEMISTRY OF NEARTERM GUINEA PIGS
S. Punnahitananda, E. Grubbs, E. Flanagan, Y. Wang, J. Reynolds

11:30 am  USE OF IUPC TO EVALUATE THE EFFECT OF CSE ON UTERINE CONTRACTION
PATTERNS
J. Sullivan, B. Scavone, C. Wong, M. Avram

11:45 am  ETHNIC ORIGIN, MALLAMPATI CLASSIFICATION AND LARYNGOSCOPIC VIEW AT
CS
E. Bell, A. Olufolabi, A. Hartle

All Abstracts on this page are located in the Anesthesiology Supplement.
Gerard W. Ostheimer: What’s New in Obstetric Anesthesia Lecture

- B. Scott Segal, MD

1:00 - 2:00 pm

Following this lecture, the participants will be able to restate predominant trends in the current obstetric anesthesia literature and their impact on anesthetic management of the pregnant patient.
Alternative medicine
Amputation
Amniotic fluid embolism
Airway, Aspiration
Breech presentation, multiple gestation
Cesarean section
  - Anesthetic techniques: comparisons
  - Anesthetic techniques: general anesthesia
  - Anesthetic techniques: side effects
  - Anesthetic techniques: spinal
  - Antibiotics/infection
  - Complications
  - Other risks of C/S
  - Rates and risk factors for
Coagulation
Coexisting disease
  - Advanced maternal age
  - Cardiovascular
  - Diabetes
  - Hematologic
  - Hepatic
  - HIV
  - Malignant hyperthermia
  - Neurological
  - Oncologic
  - Obesity
  - Orthopedic/rheumatologic
  - Pulmonary
  - Psychiatric
Complications of regional anesthesia
  - Equipment problems
  - Fever and Infection
  - Neurologic injury
What's New in Obstetric Anesthesiology Lecture

- Post-dural puncture headache
- Other complications

Combined spinal-epidural anesthesia
- Reviews and commentary
- Drugs and additives
- Technique and equipment
- Comparison and interaction with epidural analgesia
- Side effects and complications

Debates

Epidural analgesia for labor
- Drugs and additives
- Informed consent, patient expectations
- Reviews
- Techniques

Epidural anatomy, equipment and technique

Fetal surgery

Fetus and newborn

Hemodynamics and vasoactive drugs

IVF

Midwifery

Monitoring

Non-epidural labor analgesia
- Remifentanil
- Other

Other obstetric procedures (VBAC, cerclage, etc.)

Pharmacology

Postoperative analgesia

PPS

Preeclampsia
- Anesthetic management
- Diagnosis
- Hemodynamics and monitoring
- Outcomes
- Pathophysiology and causes
Preterm labor
Progress of Labor
Workload, resources, training
Alternative medicine


Growing popularity of alternative labor and birth management techniques in a Swiss hospital led to a dramatic reduction in episiotomy rate but no change in the rate of induction, amniotomy, oxytocin use, cesarean section rate or an already very low epidural rate (13%).


This small randomized but unblinded trial showed a significant increase in onset of labor in women consuming castor oil vs. those who did not.


Review article claims reduction of epidural use among parturients attended by doulas as a benefit of such support.


Randomized trial of perineal massage from 34 weeks until delivery. There was a slight increase in the chance of delivering with an intact perineum (24.5% vs. 15.1% in controls) but no differences in dyspareunia, or urinary or fecal incontinence at 3 months postpartum.


Except for a slightly lower birth weight, no adverse effects were noted in a mouse study of antenatal and gestational St. John's wort use.
What's New in Obstetric Anesthesiology Lecture


Ambulation


*Patients were randomized to 20 ml bupivacaine or ropivacaine, both 0.08%, with fentanyl 2 mcg/ml. Analgesia was equivalent, but there was a greater incidence of spontaneous micturition (65% vs. 100%) and ability to ambulate (75% vs. 100%) in the ropivacaine group.*


*This was a randomized comparison of epidural bupivacaine 0.0625% and 0.125%, both with or without a test dose of 1.5% lidocaine with epinephrine, all with 10 mcg sufentanil. Both 0.0625% groups provided inadequate analgesia. The 0.125% group without a test dose had the highest incidence of ambulation in the first hour following epidural initiation.*


Amniotic fluid embolism


*Comment on: Davies S. Amniotic fluid embolism and isolated disseminated intravascular coagulation. Can J Anaesth 1999 May;46(5 Pt 1):456-9*


A register of amniotic fluid embolism cases has been established in the UK to look at possible therapies.

See coagulation.


### Airway, Aspiration


The overall incidence was 1/249.

A parturient's airway changed from Samsoon/Mallampati class 2 to 4 during the course of a cesarean hysterectomy for placenta accreta performed under regional anesthesia.

In 1870 obstetric patients given general anesthesia without cricoid pressure or intubation (but not for cesarean section), there was only one case of mild aspiration (0.053%).


33. Comment on: *Br J Anaesth* 1999 Sep;83(3):453-60

Despite nearly universal agreement that awake fiberoptic intubation was the technique of choice in the known difficult airway for C/S with failed or contraindicated regional anesthesia, only 8% of obstetric anesthesiology consultants had actually performed one in an obstetric patient.


**Breech presentation, multiple gestation**


**Cesarean section**

- **Anesthetic techniques: comparisons**


45. Both 3 mg epidurally and 0.3 mg intrathecally were equally effective, but intrathecal administration caused more pruritus.

In a randomized trial of 64 term parturients, CSE with 7.5 mg hyperbaric spinal bupivacaine plus 10 ml 0.25% epidural bupivacaine was superior to 20-25 ml bicarbonated epidural 2% lidocaine with fentanyl and epinephrine with respect to comfort, motor block, shivering, nausea, time to surgical anesthesia, and recovery room discharge time.


Satisfaction scores at 2 and 24 hours were higher in patients receiving epidural than spinal anesthesia; the authors attributed the difference to side effects from subarachnoid morphine.


In a survey of 60,455 cesarean sections, 78% were done under regional, with hospitals ranging from 41-95%. For elective C/S, the rate was slightly higher (87%). 11% of the general anesthetics were due to conversion from regional anesthesia, but the rate was much higher in some centers. The figures are slightly lower than those reported by Hawkins for the U.S. in 1992 (Anesthesiology 1997 Jul;87(1):135-43) but considerably higher than those from Germany.

- Anesthetic techniques: general anesthesia


Alfentanil 10 mcg/kg was compared to placebo in a randomized trial of 40 elective C/S under GA. Patients receiving alfentanil had smaller increases in blood pressure and plasma norepinephrine. Neonates in the alfentanil group had slightly greater UA PO2 and lower Apgar scores, but similar NACS scores.


The BIS monitor was used during elective cesarean section under light general anesthesia with nitrous oxide and isoflurane (mean BIS during word presentation=76.3). Using a sophisticated word-completion test postoperatively, there was evidence of explicit memory without conscious recall. The study has greater implications for the understanding of memory and learning under anesthesia than it does for the practical performance of C/S under general anesthesia.


Comment on: Anaesthesia 1999 Oct;54(10):994-8


- Anesthetic techniques: side effects

Stimulation of the P6 accupressure point (on the anterior forearm just above the wrist) reduced the incidence of nausea by approximately 50% both during and in the first 14 hours postoperatively, when compared to a placebo wristband.


- Anesthetic techniques: spinal

In a small randomized trial (N=16 per group), 5 mg of plain bupivacaine with 25 mcg fentanyl provided essentially equivalent sensory analgesia, less motor block, less hypotension and lower ephedrine requirement, and less nausea than 10 mg of plain bupivacaine.


In two randomized trials of 60 patients each, women received subarachnoid hyperbaric bupivacaine 8, 10 or 12 mg. In the second trial, fentanyl 10 mcg was added to each bupivacaine dose. Patients were not, however, specifically randomized to opioid or no-opioid groups (the trials were sequential); this mars the statistical validity of comparison between such groups. Patients in the 8 and 10 mg bupivacaine-only groups had more intraoperative pain, but other side effects did not differ between the groups. The lowest dose of bupivacaine, when combined with fentanyl, was effective for cesarean section.


What's New in Obstetric Anesthesiology Lecture


- **Antibiotics/infection**


69. Hopkins L, Smaill F. Antibiotic prophylaxis regimens and drugs for cesarean section. *Cochrane Database Syst Rev*. 2000;2. *Meta-analysis of 51 randomized trials. First generation cephalosporins and ampicillin were equivalent in efficacy; no additional benefit was gained by using later generation cephalosporins or multiple drug regimens. Lavage and systemic routes were equivalent. Insufficient data exists to assess differences in timing (pre-operative vs. post-cord clamping).*

70. Lydon-Rochelle M, Holt VL, Martin DP, Easterling TR. Association between method of delivery and maternal rehospitalization. *Jama*. 2000;283:2411-6. *Large cohort study of 256,000 deliveries. Rehospitalization after delivery occurred in 1.2%, and was 1.8 times more likely after C/S and 1.3 times more likely after assisted vaginal delivery vs. after spontaneous vaginal delivery. Risk was especially greater for infections.*


- **Complications**


75. Garrett WR. Emergency drugs [letter]. *Anaesthesia*. 2000;55:402. 30 ml acetone was given instead of sodium citrate!


• **Other risks of C/S**

82. Bost BW. Should elective cesarean birth be offered at term as an alternative to labor and delivery for prevention of complications, including symptomatic pelvic prolapse, as well as stress urinary and fecal incontinence? *Obstet Gynecol*. 2000;95:S46.


Performing elective repeat C/S instead of trial of labor was estimated to result in more maternal morbidity and total health care cost with minimal neonatal benefit ($2.4 million and 1591 cesareans per major neonatal morbid event prevented).

- Rates and risk factors for
   *This ACOG consensus document implicates many factors in the failure of the U.S. to achieve the 15% national rate of C/S suggested by Healthy People 2000. It especially recommended the adoption of a case-mix adjusted cesarean rate for comparisons between institutions. The section attributing some of the failure to the use of epidural analgesia clearly shows Dr. Lieberman’s influence on the committee, as it stresses some of the worst work in the field, including Thorp’s nonrandomized work from the 1980’s, Lieberman’s own work, and the randomized trial of Ramin et al., which was analyzed incorrectly (see Sharma and Leveno, 2000, under Progress of Labor).*


   *Increased rates of cesarean section were primarily responsible for an increase in preterm delivery.*

   *Even after correction for multiple confounders (prepregnancy BMI, age, length of labor, induction, delivery hospital, and epidural analgesia [1]), sedentary women had a cesarean section risk 4.5 times greater than active women.*

   *Decision-incision time (DIT) was 30.5 ± 21 minutes in 84 cases of C/S for suspected fetal distress at <37 weeks. Longer DIT was associated with fetal tachycardia plus decreased variability, and with spinal anesthesia (OR=6.2). However, neonatal pH < 7.10 was not associated with these or any other patient variable.*

   *Cesarean section rates continued to rise in 1999.*

   *Over 2/3 of 733 unplanned vertex cesareans in a multicenter cohort were for lack of progress in labor; many did not meet ACOG definitions of prolonged 2nd stage or were done in latent labor.*

94. Lau TK, Lo KW, Leung TY, Fok WY, Rogers MS. Outcome of labour after successful external cephalic version at term complicated by isolated transient fetal bradycardia. Bjom. 2000;107:401-5. Bradycardia occurred in 8.4% of attempted versions, resulting in a cesarean section rate for "fetal distress" of 16.7% in these pregnancies (vs. 8.4% in cases without bradycardia).


96. Lucas DN, Yentis SM, Kinsella SM, Holdcroft A, May AE, Wee M, Robinson PN. Urgency of caesarean section: a new classification. JR Soc Med. 2000;93:346-50. Obstetricians and anesthesiologists agreed 90% of the time on assignment of 407 C/S to a four-grade classification system—(i) immediate threat to life of woman or fetus; (ii) maternal or fetal compromise which is not immediately life-threatening; (iii) needing early delivery but no maternal or fetal compromise; (iv) at a time to suit the patient and maternity team.

97. Maslow AS, Sweeny AL. Elective induction of labor as a risk factor for cesarean delivery among low-risk women at term. Obstet Gynecol. 2000;95:917-22. After adjusting for known confounders including birth weight, maternal age, and gestational age, induction was associated with 4 hours longer labor, $273 greater cost, and a 2.4 fold increase in the risk of cesarean section.


100. Shipp TD, Zelop CM, Repke JT, Cohen A, Caughey AB, Lieberman E. Labor after previous cesarean: influence of prior indication and parity. Obstet Gynecol. 2000;95:913-6. Retrospective analysis of all attempted VBAC's from 1984-1996. Overall rates of cesareans were higher for women with one prior cesarean than for nulliparas. Rates of cesareans after trials of labor were related to the prior cesarean indications. Rates were highest for women whose prior cesareans were for failure to progress and lowest for women whose prior cesareans were for breech. The latter group had a rate that was essentially identical to that of nulliparas.


Coagulation


*A single dose of an intravenous non-steroidal anti-inflammatory drug minimally affected bleeding time and had no clinically detectable effects on coagulation.*

*Colloid fluid loading prior to cesarean section created similar decreases in r and k values in the TEG to control patients not receiving fluid, suggesting that environmental factors cause modest hypercoagulability in preoperative patients.*


*The investigators compared unwashed blood from the surgical field to samples post-wash in the cell saver and samples which had been washed and then passed through a leukocyte depletion filter to a control sample drawn from a maternal femoral catheter. The postfiltration samples contained essentially no squamous cells, bacteria, or lamellar bodies when compared to prewash samples. There was more fetal hemoglobin and less potassium in the post-filtration sample vs. maternal blood.*

*Comment on: Waters, Anesthesiology 2000 Jun;92(6):1531-6.*

*One of the most common factor abnormalities, factor V Leiden causes a hypercoagulable state associated with recurrent pregnancy loss. Enoxaparin is becoming a standard treatment for this condition, so obstetric anesthesiologists must be aware of the implications of this therapy.*
Coexisting disease

- **Advanced maternal age**
  
  Case-control study demonstrated higher incidence of preeclampsia, diabetes, placental abruption, placenta previa, and cesarean section, but neonatal outcome was not different from controls.

  
  Comment on: *Anaesthesia* 1999 Sep;54(9):887-91

- **Cardiovascular**


  
  Comment on: *Br J Anaesth* 1999 Dec;83(6):956-9


- **Diabetes**


128. Langer O, Conway DL, Berkus MD, Xenakis EM, Gonzales O. A comparison of glyburide and insulin in women with gestational diabetes mellitus. *N Engl J Med*. 2000;343:1134-8. Prospective, randomized trial of glyburide vs. insulin demonstrated equivalent glycemic control and neonatal outcomes, including no difference in fetal anomalies. Cord blood insulin concentrations were similar between the groups, and no glyburide was detected in cord blood. This study may dispel historical fear of teratogenic effects when using sulfonylurea drugs in pregnancy.

- **Hematologic**


- **Hepatic**

HIV

Malignant hyperthermia

Neurological

Oncologic

Obesity

- Orthopedic/rheumatologic


- Pulmonary


- Psychiatric


Complications of regional anesthesia

- Equipment problems


### Fever and Infection


Maternal fever > 100.4 °F developed in 10.1% of a retrospective sample of 1218 nulliparous women with spontaneous labor and vertex presentation. Approximately 5% had T > 100.5 and 5% had T > 101. Temperature greater than 100.4 was associated with lower 1-minute Apgar score and neonatal hypotonia. T > 101 was associated for need for bag and mask ventilation of the neonate, oxygen therapy in the NICU, and a nonsignificantly increased incidence of seizure (3.3% vs. 2.0% in infants of febrile mothers). Lieberman’s group continues to attribute these findings to epidural analgesia, but this study like the others from this group suffers from an inability to control for the risk factors for selecting epidural analgesia which may confound the results.


Case control study of all unexplained neonatal seizures in term infants from 1989-1996 at Brigham and Women’s Hospital. Maternal fever in labor (> 100.4 °F) was a strong predictor of risk of seizure (fever occurred in 31.6% of cases, 9.2% of controls).


Another retrospective look by the Lieberman group. Obstetric provider, prolonged second stage, fetal macrosomia, and epidural analgesia were risk factors for episiotomy.

### Neurologic injury


Procaine (100 mg hyperbaric) was associated with less TNS than lidocaine (50 mg hyperbaric) in outpatient knee arthroscopy: 6% vs. 31%. However, procaine produced inferior quality anesthesia and longer discharge time.


5% hyperbaric lidocaine given for inpatient surgery in the supine position led to TNS in 26% vs. 3% in patients randomized to 0.5% hyperbaric bupivacaine.


In a study of 12 volunteers, the investigators measured baseline EMG, nerve conduction velocities, and somatosensory-evoked potentials followed by spinal anesthesia in the lithotomy position with 50 mg of 5% hyperbaric lidocaine. Repeat testing at 24 hours in all volunteers revealed no abnormalities in any patient. 5/12 patients developed TNS symptoms; these patients were tested
again 4-6 weeks later and again demonstrated no abnormalities. The authors concluded that
careful neurologic testing does not reveal abnormalities in cases of TNS.

Tonino P. The anesthetic and recovery profile of two doses (60 and 80 mg) of plain
Both 60 mg of 1.5% and 80 mg of 2% mepivacaine provided good anesthesia for ambulatory ACL
repair with minimal side effects and no TNS.

180. Rowlingson JC. To avoid "transient neurologic symptoms"--the search continues. Reg

• Post-dural puncture headache

181. Anand A. Post-dural puncture headache associated with cerebral venous thrombosis

182. Ansaloni L, Balzani C, Falaschi F, Paze E. Post-spinal headache after dural puncture with
perpendicular or horizontal needle bevel direction: a randomized controlled trial in an

183. Carter BL, Pasupuleti R. Use of intravenous cosyntropin in the treatment of postdural

184. Chiu C, Chan Y. Which and what headache were we treating? Epidural blood patch for
atypical headache following obstetric epidural anaesthesia. Intern J Obst Anesth.

185. Cyna A. Inadvertent dural puncture. Avoiding unintentional puncture is a primary goal of

186. Flaatten H, Felthaus J, Kuwelker M, Wisborg T. Postural post-dural puncture headache. A
prospective randomised study and a meta-analysis comparing two different 0.40 mm O.D.
Not surprisingly, both the prospective trial of 27G Quincke vs. 27G pencil point as well as a meta-
analysis of previous such comparisons found a strong benefit of pencil point over cutting needles of
equal diameter.

187. Seifert C. Inadvertent dural puncture. Further study is needed of possible long term

188. Stocks GM, Wooller DJ, Young JM, Fernando R. Postpartum headache after epidural
A case of cortical vein thrombosis masquerading as a PDPH and treated by two unsuccessful
blood patches.

Pencil point needles did not differ from one another, but all were better than 25-gauge Quincke or 26-gauge Atraucan. Despite randomizing 1200 women, this study is underpowered, given the low PDPH rates. The pencil point PDPH rates (2.8-4%) were higher than those previously reported by others.


*It wasn't a PDPH, even though there was a dural puncture!*

- Other complications


*Comment on: Br J Anaesth 2000 Jan;84(1): 118-20*


*Comment in: Anaesthesia 2000 Jul;55(7): 709-10*

**Combined spinal-epidural anesthesia**

- Reviews and commentary


*Comment in: Anaesthesia 2000 Jul;55(7):722-3*


- **Drugs and additives**

  In contrast to past studies, dextrose did not affect the sensory analgesia of intrathecal analgesia, but reduced the incidence of pruritus and limited its cephalad extent.


  In a randomized trial, patients receiving CSE with bupivacaine 2.5 mg, fentanyl 25 mcg, clonidine 30 mcg, and neostigmine 10 mcg had longer duration of analgesia (165 ± 32 minutes) than B/F (90 ± 21) or B/F/C (123 ± 21) alone, but at the expense of more nausea.


  This randomized, blinded trial was a dose-finding study of sufentanil 0-10 mcg combined with 2.5 mg bupivacaine in a CSE, followed by a lidocaine epidural test dose. Groups were comparable with regards to demographics and labor pattern. Any dose of sufentanil (2.5, 5, 7.5, or 10 mcg) was superior to placebo with regard to duration of analgesia but all were equivalent to each other. There was more pruritus with the two highest doses. FHR changes did not differ between any group.

- **Technique and equipment**

  Postoperative PCEA ropivacaine 0.1% with or without fentanyl 2 mcg/ml were compared in a randomized, double-blind study of 47 patients after C/S under spinal bupivacaine. The ropivacaine-fentanyl group had less motor block, lower VAS pain scores with movement and rest, and consumed less overall anesthetic. Satisfaction was also higher.

  Patients receiving spinal bupivacaine 2.5 mg and fentanyl 25 mcg were randomized to receive epidural ropivacaine 0.1% with 1:400,000 epinephrine and fentanyl 2 mcg/ml at 10 ml/hr or saline
placebo. The duration of analgesia (to first request for supplementation) was 158 ± 60 minutes in the ropivacaine group vs. 104 ± 26 minutes in the saline group. 20% of patients required no further analgesia in the ropivacaine group, vs. 0% with saline. Side effects were essentially equivalent between the groups, except for a slight increase in hypotension in the ropivacaine group.


• Comparison and interaction with epidural analgesia


40 patients undergoing abdominal general surgery were randomized to postoperative PCEA with or without dural puncture with a 25G Quincke needle. The groups did not differ with regard to epidural solution requirements, pain scores, spread of sensory blockade, or intensity of motor block.


CSE (2.5 mg bupivacaine + 25 mcg fentanyl) was equivalent to dilute bupivacaine (10 ml of 0.0625% bupivacaine with fentanyl 2 mcg/ml, epinephrine 1:200,000 and bicarbonate) in all respects except faster onset in the CSE group.


• Side effects and complications


217. Dunn SM, Connelly NR, Parker RK. Postdural puncture headache (PDPH) and combined spinal-epidural (CSE) [letter; comment]. *Anesth Analg*. 2000;90:1249-50. 
*Comment on: Anesth Analg* 1999 Oct;89(4):969-78


**Debates**


228. Porter J. Systemic narcotics still have a significant and useful role in the management of labour pain (Con). *Intern J Obst Anesth*. 2000;9:45-47.

229. Walsh D. Systemic narcotics still have a significant and useful role in the management of labour pain (Pro). *Intern J Obst Anesth*. 2000;9:45-47.

**Epidural analgesia for labor**

- **Drugs and additives**

230. Chen LK, Hsu HW, Lin CJ, Huang CH, Tsai SK, Lee CN, Hsieh FJ. Effects of epidural fentanyl on labor pain during the early period of the first stage of induced labor in nulliparous women. *J Formos Med Assoc*. 2000;99:549-53. *Randomized trial of different strategies for management of early labor pain. Subjects received epidural fentanyl or no analgesic prior to 4 cm dilation, followed by epidural bupivacaine 0.05% with fentanyl at 4 cm until delivery. A third comparison group received no analgesia during labor. Both analgesia groups had lower cesarean rates than the no analgesia group. The fentanyl group had significantly lower VAS pain scores than the group that did not receive any analgesia prior to 4 cm.*


233. Fischer C, Blanie P, Jaouen E, Vayssiere C, Kaloul I, Cottat JC. Ropivacaine, 0.1%, plus sufentanil, 0.5 microg/ml, versus bupivacaine, 0.1%, plus sufentanil, 0.5 microg/ml, using patient-controlled epidural analgesia for labor: a double-blind comparison. *Anesthesiology*. 2000;92:1588-93. *This randomized trial (N=200) compared equal concentrations of ropivacaine and bupivacaine both with 0.5 mcg/ml sufentanil by PCEA for labor analgesia. VAS scores, volume of local anesthetic injected, mode of delivery and side effects were equivalent between groups. Motor block was more frequent with bupivacaine (12% vs. 2%). Maternal satisfaction (VAS) was slightly higher in the bupivacaine group. More supplemental boluses were required in the ropivacaine group during the second stage (30% vs. 20%). This investigation adds evidence to the claim that ropivacaine is less potent than bupivacaine in the clinically meaningful concentrations for labor analgesia.*

234. Meister GC, D'Angelo R, Owen M, Nelson KE, Gaver R. A comparison of epidural analgesia with 0.125% ropivacaine with fentanyl versus 0.125% bupivacaine with fentanyl during labor. *Anesth Analg*. 2000;90:632-7. *This was a small randomized trial (N=50) of PCEA ropivacaine or bupivacaine 0.125% with fentanyl 2 mcg/ml. The groups did not differ with regard to drug used, analgesia (VAS), satisfaction, or side effects. There was less motor block in the ropivacaine group. It remains to be
demonstrated whether the still controversial difference in ropivacaine/bupivacaine potency explains this result or whether ropivacaine genuinely produces less motor block at equianalgesic concentrations, since the 0.125% concentration used in this study probably significantly exceeds the minimum needed to produce adequate pain relief for either drug.


Randomized trial of PCEA bupivacaine 0.625% and fentanyl 2 mcg/ml, with or without clonidine 4.5 mcg/ml. Overall pain scores were similar between the groups, though there was a somewhat higher percentage of patients with "excellent" 1st stage analgesia in the clonidine group. There was lower local anesthetic use and reduced supplementation in the clonidine group. Blood pressure did not differ, but shivering was less common and sedation more common in the clonidine group.


This randomized trial compared 20 ml boluses of epidural ropivacaine 0.1% and bupivacaine 0.0625%, both with sufentanil 10 mcg. The difference in concentrations used was based on the "Polley-Capogna-Columb" potency ratio of 0.6. Analgesia, onset time, maternal hemodynamics, and ability to ambulate did not differ; duration was longer in the ropivacaine group (89 vs. 119 minutes).


Comment on: Gautier P, De Kock M, Van Steenberge A, Miclot D, Fanard L, Hody JL. A double-blind comparison of 0.125% ropivacaine with sufentanil and 0.125% bupivacaine with sufentanil for epidural labor analgesia. *Anesthesiology* 1999 Mar;90(3):772-8


84 parturients were randomized to epidural bupivacaine followed by intravenous fentanyl, 60mcg or bupivacaine with epidural fentanyl 60 mcg in 20 ml volumes and bupivacaine concentrations determined by the up/down sequential allocation method to determine the MLAC for the local anesthetic. The MLAC in the intravenous group was 0.064% and in the epidural fentanyl group it was 0.034%, a significant difference in potency of 1.88 fold. There was also greater dermatomal spread and pruritus in the epidural fentanyl group.

Informed consent, patient expectations


Reviews


Techniques


248. Nickells JS, Vaughan DJ, Lillywhite NK, Loughnan B, Hasan M, Robinson PN. Speed of onset of regional analgesia in labour: a comparison of the epidural and spinal routes. *Anaesthesia*. 2000;55:17-20. Randomized trial comparing CSE (bupivacaine 2.5 mg with fentanyl 25 mcg) to epidural analgesia (bupivacaine 12.5 mg with fentanyl 50 mcg) and found only a small, statistically marginal difference in time to first painless contraction (10.0 ± 5.7 vs. 12.1 ± 6.5 minutes).

Epidural anatomy, equipment and technique


*This one was pretty scary. We were right only 29% of the time, and we usually thought a given space was much lower than it really was. To make it worse, the cord ended below L1 19% of the time!*


*Comment in: Anaesthesia 2000 Aug;55(8):831*


What's New in Obstetric Anesthesiology Lecture


**Fetal surgery**


**Fetus and newborn**


*C/S affected dopaminergic function in some strains of rats but not others, suggesting that genetic factors play a role; the investigators postulate a connection to development of schizophrenia.*


*Editorial: Camann, Anesthesiology 2000 Jan;92(1):3-5*


*An artificial sweetener (cyclamate/saccharin) reduced pain reaction to a heel prick in term neonates. In contrast, glycine tends to increase pain reaction whereas breast milk has no effect.*


**Hemodynamics and vasoactive drugs**

283. Hofmeyr GJ. Prophylactic intravenous preloading for regional analgesia in labour. *Cochrane Database Syst Rev.* 2000;2. Review of literature revealed only one trial that could be meta-analyzed, and concluded it was subject to "considerable bias".


285. Kee WD, Khaw KS, Lee BB, Lau TK, Gin T. A dose-response study of prophylactic intravenous ephedrine for the prevention of hypotension during spinal anesthesia for cesarean delivery. *Anesth Analg.* 2000;90:1390-5. The authors investigated doses of IV ephedrine from 10-30 mg vs. placebo, as prophylaxis for hypotension during spinal anesthesia for cesarean delivery. The smallest effective dose was 30 mg. However, this dose did not completely eliminate hypotension, caused reactive hypertension in some patients, and did not improve neonatal outcome.


289. Langevin PB, Katovich MJ, Wood CE, James CF, Langevin SO. The effect of nitroglycerin on the gravid uterus in sheep and rabbits. *Anesth Analg.* 2000;90:337-43. TNG did not appear to have an effect on active tension development in laboring ewes, postpartum rabbits, or isolated uterine strips from term pregnant rabbits. However, TNG did increase the compliance to passive stretch of uterine tissue in vitro. These results are in contrast to clinical experience of many obstetrical anesthesiologists and the ability of TNG to treat some cases of preterm labor, as well as some other laboratory evidence of an effect of TNG and other nitric oxide donors on uterine activity.


Injection of a standardized spinal anesthetic for cesarean section over 2 minutes was associated with a modest reduction in hypotension and ephedrine requirements vs. injection over 15 seconds.


Randomized trial of prophylactic ephedrine (10 mg) vs. placebo on maternal hemodynamics measured by thoracic bioimpedence. No difference was seen in the changes in MAP, SVRI, HR, or CI; fluid and ephedrine requirements were also similar between groups.


*Comment in: Anesth Analg 2000 Feb;90(2):241-2*


Glycopyrrolate did not attenuate hypotension but increased HR and caused dry mouth.

**IVF**


Midwifery


Monitoring


312. Garite TJ, Dildy GA, McNamara H, Nageotte MP, Boehm FH, Dellinger EH, Knuppel RA, Porreco RP, Miller HS, Sunderji S, Varner MW, Swedlow DB. A multicenter controlled trial of fetal pulse oximetry in the intrapartum management of nonreassuring fetal heart rate patterns. *Am J Obstet Gynecol.* 2000;183:1049-58. Large randomized trial of electronic monitoring alone or in combination with fetal pulse oximetry of 1010 patients in 9 centers. The oximetry group had fewer cesarean sections for nonreassuring fetal status (4.3% vs. 10.2% in the control group) but the overall cesarean rates were not different (29% oximetry vs. 26% control). There was an increase in cesarean for dystocia in the oximetry
group that did not appear to be attributable to misdiagnosis of dystocia, as judged by blinded analysis of labor curves.

313. Kaita TM, Nikkola EM, Rantala MI, Ekblad UU, Salonen MA. Fetal oxygen saturation during epidural and paracervical analgesia. *Acta Obstet Gynecol Scand.* 2000;79:336-40. *After initially increasing fetal oxygen saturation in both analgesic groups, epidural analgesia was associated with a slight decrease or no change in fetal oxygenation at equilibrium, whereas paracervical block was associated with a very small but sustained rise in saturation. The authors questioned the clinical significance of the difference.*


316. Schmidt S, Koslowski S, Sierra F, Meyer-Wittkopf M, Heller G. Clinical usefulness of pulse oximetry in the fetus with non-reassuring heart rate pattern? *J Perinat Med.* 2000;28:298-305. *Using a criterion of SpO2 < 30% in the fetus as a cutoff and umbilical artery pH at delivery as a "gold standard", the authors calculated sensitivity of fetal oximetry to be 0.18, specificity to be 0.83, positive predictive value of 0.17 and negative predictive value of 0.83. The area under the ROC curve indicated fetal pulse oximetry was no better than chance in discriminating healthy from acidotic fetuses.*


Non-epidural labor analgesia

- Remifentanil

  *The investigators studied the effect of remifentanil boluses administered by an anesthesiologist at the beginning of each contraction. The study was terminated after just 4 patients because analgesia was poor and maternal side effects were significant (sedation, pruritus, nausea, respiratory depression with desaturation).*

  *Comment in: Br J Anaesth 2000 Jul;85(1):176-7*

- Other
  *Meta-analysis of trials comparing various opioids (especially those used in the U.K.) concluded insufficient data existed to compare their efficacy or safety.*


  *Comment on: Ross JA, Tunstall ME, Campbell DM, Lemon JS. The use of 0.25% isoflurane premixed in 50% nitrous oxide and oxygen for pain relief in labour. Anaesthesia 1999 Dec;54(12):1166-72*


  *Fentanyl was slightly better than alfentanil, but neither provided good analgesia during late labor.*

  *Opioids or barbiturates at birth increased the likelihood of becoming a drug abuser later in life.*

2001 Gerard W. Ostheimer
What's New in Obstetric Anesthesiology Lecture


Randomized trial of active vs. inactive TENS combined with standardized CSE. No difference in the duration or quality of analgesia was observed.

Other obstetric procedures (VBAC, cerclage, etc.)


Suturing the anterior to the posterior uterine wall with absorbable suture controlled hemorrhage and avoided cesarean hysterectomy.


Meta-analysis of various groups of studies aimed at reducing perineal trauma. Episiotomy appears to worsen the risk; spontaneous and vacuum deliveries reduced the risk vs. forceps. Antenatal perineal massage appeared protective in nulliparous women (but see reference #8). No clear benefit of "alternative" birthing positions (vs. supine) was found.


Patients randomized to 250 ml/hr had shorter labors and a trend towards less oxytocin use and lower cesarean rate than women randomized to 125 ml/hr.


**Pharmacology**


*Comment on: Br J Anaesth 1999 Oct;83(4):657-8*


*Comment on:* *Anaesthesia* 1999 Oct;54(10):994-8

### Postoperative analgesia

Patients were randomized to intrathecal bupivacaine + morphine 0.2 mg or nalbuphine 0.2, 0.8 or 1.6 mg. Nalbuphine 0.8 provided the longest lasting analgesia among nalbuphine groups, with less nausea and pruritus than morphine, but with a shorter duration of action.


*Orally administered narcotics produced satisfaction scores of 84-90/100: the authors suggest oral analgesics as an alternative to the more costly intravenous route.*


*Epidural morphine was more effective than placebo and there was decreasing rescue PCA morphine use up to a dose of 3.75 mg epidurally. Pruritus but not nausea was associated with epidural morphine but was not dose dependent.*

364. Yeh HM, Chen LK, Lin CJ, Chan WH, Chen YP, Lin CS, Sun WZ, Wang MJ, Tsai SK. Prophylactic intravenous ondansetron reduces the incidence of intrathecal morphine-induced pruritus in patients undergoing cesarean delivery. *Anesth Analg.* 2000;91:172-5. Ondansetron 0.1 mg/kg reduced intrathecal morphine (0.15 mg)-induced pruritus from 85% in controls or 80% in patients receiving IV diphenhydramine to 25%.

**PPS**


**Preeclampsia**

- **Anesthetic management**


- **Diagnosis**
  Major changes from the 1990 version of this document include: Use of Korotkoff phase V for determination of diastolic pressure and to eliminate edema as a criterion for diagnosing preeclampsia are discussed. In addition, the use as a diagnostic criterion of blood pressure increases of 30 mm Hg systolic or 15 mm Hg diastolic with blood pressure <140/90 mm Hg has not been recommended, because available evidence shows that women with blood pressures fitting
What's New in Obstetric Anesthesiology Lecture

*This description are not more likely to have adverse outcomes. Management recommendations have been updated as well, including new drug regimens for reduction of blood pressure.*


- **Hemodynamics and monitoring**

375. Bolte AC, Dekker GA, van Eyck J, van Schijndel RS, van Geijn HP. Lack of agreement between central venous pressure and pulmonary capillary wedge pressure in preeclampsia. *Hypertens Pregnancy.* 2000;19:261-71. *CVP and PCWP correlated poorly before treatment for pregnancy-induced hypertension, with a correlation coefficient of only 0.64. Correlation was even worse posttreatment (r=0.53). The mean difference was 3.5 ± 2.6 mm Hg before treatment and 4.9 ± 3.8 mm Hg posttreatment.*


- **Outcomes**


- Pathophysiology and causes
  (This is merely a selection of literally hundreds of references related to this mysterious disease!)


389. Franklin KA, Holmgren PA, Jonsson F, Poromaa N, Stenlund H, Svanborg E. Snoring, pregnancy-induced hypertension, and growth retardation of the fetus. *Chest.* 2000;117:137-41. *Hypertension and preeclampsia occurred more frequently in women who snored vs. those who did not; poor Apgar scores (7) and IUGR were also correlated with snoring mothers.*


What's New in Obstetric Anesthesiology Lecture


Preterm labor


Progress of Labor

In Sweden in the mid 1990's, epidural sufentanil was introduced as a means for reducing the amount of local anesthetic used in labor analgesia. This study compared the incidence of cesarean section or operative vaginal delivery before and after the introduction of opioid-local anesthetic mixtures. The odds ratio for instrumental delivery after vs. before the change was 0.72. For cesarean section, the risk was reduced in nulliparae (OR 0.79) but not multiparae (OR 0.93, 95% CI 0.80-1.07). Hospital stay greater than 4 days was reduced as well. The authors concluded that opioids added to local anesthetics reduced the risk of non-spontaneous delivery. Unfortunately, the retrospective nature of the analysis and the use of historical controls makes it likely that other factors, especially given the awareness of the rising tide of operative delivery during the mid 1990's, may have contributed to the reduction observed.


This study examined the risk of cesarean section among 1278 women delivered by 14 distinct obstetrician groups by logistic regression. They concluded that patient age, birth weight, induction, non-Caucasion race, and obstetrician group were independently correlated with cesarean section, but that epidural analgesia was not. The very high rate of epidural analgesia in their population (93%, range among obstetrician groups 81-98%) sharply limits the power of the study, but the result reinforces the idea that obstetrical practice style is an important contributor to the risk of cesarean section.


A preliminary report of another investigation into the practice style of obstetricians, this time with a twist: individual anesthesiologist identity was also coded. This is a paper to watch for in 2001.


Another "impact" or "sentinel event" study of the effect of rapid introduction of epidural analgesia to a hospital on the rate of cesarean section. In a charity hospital in Louisiana, the epidural rate increased in one year from 0% to 57%. The primary cesarean section rate was 9.6% vs. 11.0%, which was not a significant change. The forceps rate did significantly increase, from 2.0% to 6.1%. VBAC also increased after the introduction of epidural analgesia.

In a large multicenter study of over 1800 nulliparous women at term with spontaneous or induced labors, singleton cephalic presentations, and with effective epidural analgesia (VAS < 3 out of 10), the authors randomly assigned women to push immediately after reaching full cervical dilation or to delay expulsive efforts for 2 hours. The overall risk of "difficult delivery" (= C/S, midpelvic forceps or vacuum, low rotational instrumental delivery) was significantly reduced in the delayed pushing group (RR 0.79). The effect was greatest for midpelvic procedures, minimal for outlet procedures, and there was no effect on cesarean section. There was a slightly higher incidence of low cord pH in the delayed group, but overall indices of neonatal well-being were not different between the groups. Maternal intrapartum fever was increased in the delayed group (RR for T>38° C, 1.88). One important methodological flaw was that randomization occurred when full dilation was diagnosed, but cervical examinations during the 1st stage were not standardized; therefore some patients may have been fully dilated for some time prior to randomization. Furthermore, there was in fact a small difference in the length of the 1st stage (30 min shorter in the delayed group) and obstetricians were not blinded to the group assignment.

Retrospective study in a Taiwanese hospital actually found a lower risk of cesarean section in patients receiving epidural analgesia vs. those who did not, and the difference was even greater in nulliparae. This finding is unusual, and only a few other investigators have reported lower rates of cesarean section among parturients with patient-selected epidural analgesia. The usual association in such retrospective studies is a higher incidence, reflecting the multiple risk factors for cesarean section which also correlate with a request for labor epidural analgesia.

Over 2/3 of unplanned, vertex cesarean sections were due to lack of progress. However, 16% of such patients were delivered while in the latent phase by ACOG criteria, and 36% of cesareans performed at full dilation in the lack of progress group did not have prolonged second stages by ACOG definitions.

The authors retrospectively reviewed 4493 parturients labor records who received labor analgesia. Most received an "ultralight" mixture of bupivacaine 0.04% and fentanyl 1.7 mcg/ml. The odds ratio of cesarean delivery among women who received 3 or more top-ups during labor was 2.3 vs. that of those who required fewer than 3. The relationship persisted in patients receiving more concentrated bupivacaine (0.625 or 0.125%). Controlling for other risk factors for cesarean delivery (maternal age, BME, nulliparity, fetal weight, induction of labor) did not alter the result. This study offers important support for the idea that pain itself is a risk factor for cesarean section, and therefore that retrospective studies of epidural vs. other analgesics must control for this variable or be subject to selection bias. However, the study suffered from having no independent measure of labor pain other than the surrogate, number of boluses, and it appeared that the number of boluses per hour did not vary between patients undergoing cesarean or vaginal delivery.

Active management of labor alters the shape of the labor curve (partogram) from that defined by Friedman as normal.


This is the final report from National Maternity Hospital in Dublin which confirms a much earlier abstract of their experience with a fairly rapid introduction of on-demand epidural analgesia. This hospital is known for pioneering active management of labor and has sustained an enviably low C/S rate. During a rise in epidural analgesia use from 10% to 57%, the cesarean and instrumental vaginal delivery rates did not increase, though oxytocin use in the second stage increased. The authors believe that their policy of aggressive oxytocin supplementation after full cervical dilation yielded their result with regard to forceps, which is different from that reported by some randomized trials.


The latest randomized trial of epidural analgesia vs. an alternative, in this case intramuscular meperidine. The investigators excluded 188 of the originally recruited sample of 802 because they did not request any analgesia or were satisfied with 50% nitrous oxide (Entonox). The 614 remaining women were randomly assigned to meperidine or epidural analgesia; as in nearly every previous similar study, 23-31% of patients did not receive their assigned treatment. However, when analyzed on an intention-to treat basis, the rate of C/S was similar (12% epidural vs. 13% meperidine). Instrumental delivery rates were also similar.


This retrospective review of 123 labor records of women undergoing prostaglandin E2 cervical ripening and oxytocin induction. Labor curves were compared to Friedman's standard curves. Both the latent and active phases of labor were longer in the induced labors, particularly in nulliparous women. This study confirms the widely held notion that Friedman's curves, derived in the 1950's from 500 nulliparous women in spontaneous labor judged to be clinically "normal", does not describe the pattern seen in induced labor.


*Editorial on Loughnan, 2000, above.*

This review included some startling original data, a re-analysis of the Ramin et al. randomized trial of epidural vs. meperidine on rate of cesarean section (Obstet Gynecol 1995; 86:783-789). When the data from this 1995 study were properly analyzed on an intention-to-treat basis, no difference in the rate of cesarean section was observed between analgesic groups.

420. Shipp TD, Zelop CM, Repke JT, Cohen A, Caughey AB, Lieberman E. Labor after previous cesarean: influence of prior indication and parity. Obstet Gynecol. 2000;95:913-6. Cesarean section was performed in 28.7% of women with one prior C/S undergoing trial of labor vs. 13.5% of nulliparas. However, the rate was 13.9% in women whose first C/S was due to breech presentation. Perhaps surprisingly, the mean length of labor was shorter in the trial of labor patients, perhaps because their physicians intervened earlier.


422. Traynor JD, Dooley SL, Seyb S, Wong CA, Shadron A. Is the management of epidural analgesia associated with an increased risk of cesarean delivery? Am J Obstet Gynecol. 2000;182:1058-62. A retrospective analysis of factors related to cesarean section risk. Univariate analyses showed greater risk with higher fetal station and lesser cervical dilation at the time of epidural placement, as well as the number of epidural top-ups. After controlling for maternal age, maternal BMI, gestational age, infant birth weight, induction of labor, use of magnesium sulfate, and presence of chorioamnionitis, the adjusted odds of cesarean delivery associated with fetal station (odds ratio, 1.45; 95% confidence interval, 1.2-1.7) and epidural boluses (odds ratio, 1.55; 95% confidence interval, 1.3-1.8) during the first stage of labor remained significant. As with any retrospective study, the associations noted are not evidence of causality, because women requesting epidural analgesia early in labor likely do so because they are experiencing dysfunctional labor at the time of their request.

Workload, resources, training

423. Abouleish AE, Zornow MH, Levy RS, Abate J, Prough DS. Measurement of individual clinical productivity in an academic anesthesiology department. Anesthesiology. 2000;93:1509-16. Obstetric anesthesiologists were less "productive" as measured by time units per OR day and total ASA units per OR day, but the authors suggest that normalized clinical days per year is a better measure of clinical productivity.


The authors used a modification of classic industrial time and motion measurements to calculate the real cost of obstetric anesthesia services. If OB is covered on-demand, the mean cost per patient in labor was $325, versus $728 per patient if staffing was provided around-the-clock. The average indemnity reimbursement of $299 and the average Medicaid reimbursement of $204 were therefore inadequate. Breaking even was only possible with intermittent staffing and indemnity insurance because operating room cases could subsidize the losses on the labor floor.


After considering both the risks and costs of complications, as well as the success rate for attempted VBAC, the overall cost of a trial of labor compared to an elective repeat C/S ranged from a savings of $149 to a loss of $217 assuming the most optimistic success rate of 70%. Small changes in the success rate or increases in perinatal morbidity, as well as newly mandated increased length of stay for vaginal deliveries, will tilt the balance towards a net loss.


Commentary on the ASA practice guidelines for obstetric anesthesia (see Anesthesiology 1999; 90:600-611) by the committee chair.


The authors estimated costs of regional vs. intravenous analgesia from hospital cost data and included estimated costs of complications. The anesthesiologist cost of epidural analgesia was $258 per patient. The overall cost to society of epidural analgesia was $259-338 more than that for intravenous analgesia, depending on assumptions of nursing costs. The authors suggest that this cost difference should be analyzed quantitatively in terms of the better VAS scores obtained with epidural analgesia.


Anesthesiology experienced the single largest rate of decline of any specialty over the last decade. Sobering statistics for some of us!

Comment on: Johnson, Anaesthesia 2000 Feb;55(2):179-83
Oral Presentations

Moderator: Cheryl A. DeSimone, MD

2:00 - 3:00 pm

2:00 pm  REQUIREMENT FOR AND SUCCESS OF EPIDURAL BLOOD PATCH AFTER INTRATHecal CATHETER PLACEMENT FOR UNINTENTIONAL DURAL PUNCTURE
J. Spiegel, L. Tsen, S. Segal

2:15 pm  THROMBOCYTOPENIA AND PREGNANCY: A COMPARATIVE IN VITRO STUDY
H. Gorton, G. Lyons, E. Warren, M. Columb

2:30 pm  EVALUATION OF PLATELET FUNCTION IN THE PARTURIENT USING THE PLATELET FUNCTION ANALYZER (PFA-100®)
A. Nair, I. Arnold, J. Goolie-Scindain, C. Bodian, S. Hossain, Y. Beilin

2:45 pm  EFFECT OF EPIDURAL ANALGESIA ON THE H-REFLEX
M. Vidovich, C. Wong, T. Nishida

All Abstracts on this page are located in the Anesthesiology Supplement.
Poster Review #3
Moderator: Laurence S. Reisner, MD
3:00 - 4:15 pm

49 NEONATAL RESUSCITATION AND THE ANESTHESIOLOGIST
R. Gaiser, S. Lewin, T. Check, B. Gutsche

50 BMI PREDICTS CS IN MULTICENTER PROSPECTIVE COHORT STUDY
E. Bell, A. Hartle, D. Mayer, A. Olufolabi, B. Phillips-Bute, E. Spielman

51 COMPARISON OF TRUE 15° TABLE TILT VS. FULL LATERAL POSITION AFTER INDUCTION OF SPINAL ANESTHESIA FOR CESAREAN SECTION

52 DECREASED POSTPARTUM USE OF ORAL PAIN MEDICATION AFTER A SINGLE DOSE OF EPIDURAL MORPHINE

53 RAPACURONIUM FOR RAPID SEQUENCE INDUCTION IN ELECTIVE CESAREAN SECTION
B. Brueckner-Schmidt, I. Petzold, J. Brueckner

54 HOW FAST ARE WE?
V. Gunka, M. Douglas

55 REGIONAL VS GA FOR TWIN-TWIN TRANSFUSION SYNDROME REQUIRING FETAL SURGERY
L. Myers, J. Galinkin, R. Gaiser

56 MAGNESIUM SULFATE AND ANALGESIC REQUIREMENTS FOLLOWING CESAREAN SECTION
A. Habib, H. Muir, E. Bell, B. Phillips-Bute, J. Reynolds

57 LOW DOSE INTRATHecal MORPHINE IS NOT USEFUL FOR ANALGESIA AFTer POSTPARTUM TUBAL LIGATION

58 INTRAVENOUS CANNULE SIZE FOR OBSTETRIC HEMORRHAGE
K. Stoehr, C. Burkle, G. Vasdev

59 “CODE OB”: A PROTOCOL FOR PERIMORTEM CESAREAN SECTION
L. Selman, K. Lebowitz, D. Gambling

60 ONDANSETRON IN THE PREVENTION OF PRURITUS DURING ELECTIVE CESAREAN SECTION UNDER SPINAL ANESTHESIA
M. Dubuc, C. Crocheteire, E. Villeneuve

61 ELABORATE HAIRPIECE AS A CAUSE OF UNEXPECTED DIFFICULT INTUBATION.
K. Kuczkowski, J. Benumof

62 IS EPIDURAL ADMINISTRATION OF MORPHINE SAFE FOLLOWING DURAL PUNCTURE DURING COMBINED SPINAL EPIDURAL ANESTHESIA FOR C-SECTION?

63 A NEW CLASSIFICATION OF EMERGENCY LSCS: DOES IT WORK?
C. Duke, S. Brayshaw, R. Sashidharan

64 PERIOPERATIVE MORBIDITY IN OBSTETRIC HYSTERECTOMY: ELECTIVE VERSUS EMERGENCY
J. Friedman, P. Ramsey, K. Ramin, G. Vasdev

65 IS EPIDURAL OR INTRATHecal MORPHINE FOR POST C-SECTION ANALGESIA SAFE ON A BUSY POST-PARTUM FLOOR IN A LARGE TEACHING HOSPITAL?

66 HOW USEFUL WOULD AUTOTRANSFUSION BE IN THE MANAGEMENT OF OBSTETRIC HEMORRHAGE? A THEORETICAL ANALYSIS BASED ON HOMOLOGOUS TRANSFUSION PRACTICES DURING CESAREAN SECTION
J. Fong, L. Kump, E. Gurewitsch

67 POSTOPERATIVE PAIN AFTER “MINOR” SURGERY (POSTPARTUM TUBAL LIGATION) IS NOT MINOR
R. Marcus MD, C. Wong MD, T. Strauss-Hoder MS, J. Maly MD, C. Cummings, M. Avram PhD

68 CHOICE OF ANESTHETIC TECHNIQUE FOR CESAREAN SECTION IN WOMEN WITH PLACENTA PREVIA
S. Rutter, A. Martin, R. Russell, C. Grange

69 EDTA FREE 2-CHLOROPROCAINE AND EPIDURAL MORPHINE
G. Gershon, D. Williams, T. Barone

All Abstracts listed on this page are in the Anesthesiology Supplement.
The Society for Obstetric Anesthesia & Perinatology welcomes and thanks all representatives of industry for their support of this meeting, and for providing education through their exhibits.

A list of 2001 exhibitors follows ...

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Abbott offers a complete line of anesthesia trays... complete right down to the drugs...in both standard and custom formats. Fully equipped trays are available in dozens of configurations that meet your needs for epidural blocks, spinal and saddle blocks, peripheral and caudal blocks, and a variety of procedural configurations.

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Arrow International
Arrow International develops, manufactures and markets a broad range of clinically advanced disposable catheters and related products. The product offering includes central venous catheters, hemodialysis catheters, PICC catheters, wire reinforced Arrow-flex introducers as well as Arrow’s unique Arrowgard® infection protection surface treatment technology.

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B. Braun
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BD
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Spacelabs Medical will demonstrate clinical information solutions designed to help anesthesia practitioners manage patient care. Our Ultraview Care Network Monitors allow you to review and control patient vital signs and other information systems at the point of care. You will also see the advantages of our anesthesia delivery system, Bispectral Index module, OR Chart electronic documentation system, and 5-agent Multigas Analyzer - our completeperioperative clinical information system as well as our line of obstetrical products including the first maternal obstetrical monitor (MOM).

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May 1-4, 2002
34th Annual Meeting
Hyatt Regency Hilton Head
Hilton Head, SC

May 14-17, 2003
35th Annual Meeting
Point Hilton at Squaw Peak
Phoenix, AZ

May 12-16, 2004
36th Annual Meeting
Sanibel Harbor Resort and Spa
Ft. Myers, FL