Use of Portable Transthoracic Echocardiography for Assessing Volume Status in Healthy, Term Parturients

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Background: Hemodynamic management decisions in the parturient can be challenging. Clinical signs, including HR, BP and urine output are insensitive. Invasive monitors, including CVP and PA catheters, have a reported 3% complication rate in pregnant patients. Anesthesiologists may be able to use transthoracic echocardiography (TTE) to estimate volume status non-invasively.

Methods: We conducted a prospective observational study of healthy, singleton parturients >37 weeks EGA scheduled for elective CD. TTE, using a phased array transducer (Zonare Medical Systems Z.one P4-1c), was used to obtain 2-D cardiac images (4.0 MHz). Subjects were positioned head up 30 degrees and in semi-left lateral tilt for all images. Left parasternal short axis (LPSA) and apical 4-chamber (A4C) views were recorded for a minimum of 6 cardiac cycles at each time period. A 2nd set of baseline exams were obtained following the first in a subset of patients for internal validity. Following baseline recordings, 1L of crystalloid was infused IV over 15 minutes. LPSA and A4C images were then obtained in the same fashion as the baseline studies immediately following the fluid bolus and 10 minutes later.

Ease of obtaining LPSA and A4C images was recorded by the investigators using a 5-point scale (EOE score). Measurements were performed using program software. Left ventricular end diastolic area (LVEDA) [LPSA views] and left ventricular end diastolic volume (LVEDV) [A4C views] were measured from 3 consecutive cardiac cycles at each of the time intervals. Areas and volumes were averaged and compared between time periods. Coefficients of variance (Cv) were calculated for the exams to determine precision. Ease in obtaining LPSA and A4C views were compared using the Wilcoxon signed rank test.

Results: Obtaining adequate LPSA views was easier than A4C views (P<0.001), with median EOE scores 2 and 3.5 respectively. LPSA views were obtained in all patients, while A4C views were obtained in only 45% of patients due to positioning and pregnant body habitus limitations. BMI, however, was not correlated with ease of exam.

The comparative precision of the measurements was not significantly different between approaches or time intervals based on the calculated Cv, which ranged from 7.2 to 10.2% across all groups.

LVEDA and LVEDV were greater at 0 and 10 minutes following 1L crystalloid infusion as compared with baseline measurements. Pre-bolus average values were 12cm² and 93mL, immediately post bolus 15cm² and 115mL, and 10 min post-bolus 13cm² and 102mL for LVEDA and LVEDV respectively.

Conclusions: Our data suggest that anesthesiologists can obtain precise, non-invasive measurements of LVED area and volume to guide fluid management decisions. LPSA is the easiest, quickest, and least intrusive TTE exam approach for the parturient. This technology could be adapted to managing more hemodynamically complex patients in the future.

References:
1. Young. Best Pract Res Clin OBGYN 2001;15