O1 Accuracy and precision of the ultrasound cardiac output monitor (USCOM 1A) in pregnancy: comparison with 3-dimensional transthoracic echocardiography

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Introduction: Women who become critically unwell during pregnancy present specific challenges for haemodynamic monitoring. Invasive devices are undesirable, as such women are usually breathing spontaneously, not sedated and may be labouring or coagulopathic.[1] The ultrasound cardiac output monitor (USCOM 1A, USCOM Ltd, Sydney, NSW, Australia) is entirely non-invasive, measuring cardiac output via a Doppler probe placed on the suprasternal notch. Previous studies of this device in pregnancy include small numbers measuring changes in cardiac output,[2] but none have assessed its accuracy in this patient population. Maternal haemodynamic changes such as increased aortic blood flow, displacement of the heart and increased left ventricular outflow tract diameter have potential to affect measurement. The aim was therefore to measure agreement between the USCOM and a reference method, in pregnant women.

Methods: Ethical approval was obtained and written informed consent was given by all participants. Ninety-two healthy women with a singleton pregnancy of 25 weeks of gestation onwards were recruited from antenatal clinics. In the left lateral position at rest, cardiac output was measured with the USCOM and three-dimensional transthoracic echocardiography (3D-TTE). A single operator performed all USCOM measurements, with a different operator performing all echocardiography. Both were blinded to results from the other device. Each USCOM trace was analysed using two modes: Flowtrace (FT) and Touchpoint (TP). A second, blinded USCOM reading was taken to assess reproducibility.

Results: USCOM readings were obtained in all 92, and 3D-TTE images in 85 participants. Mean cardiac output was 5.7. 7.7 and 6.2 L min^{-1}, measured by 3D-TTE, USCOM FT and USCOM TP respectively. Bland-Altman analysis of agreement between 3D-TTE and USCOM for measurement of CO is shown in the table below.

Bland-Altman analysis	USCOM FT	USCOM TP
Bias (L min^{-1})	+2.0	+0.4
Limits of agreement (L min^{-1})	-0.2 to + 4.2	-1.4 to +2.3
Mean percentage difference (%)	32.6	31.4

Mean percentage difference for measurement of stroke volume was 27% (FT) and 27.5% (TP). Intraclass correlation for repeated USCOM measurements was 0.9 (FT) and 0.86 (TP).

Discussion: The USCOM has acceptable agreement with 3D-TTE for measurement of cardiac output in pregnancy. The large positive bias, particularly in FT mode, may be due to the hyperdynamic cardiovascular state of pregnancy. The clinician should be aware of this when using the device, and we recommend the use of TP mode in this patient population.

References

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2. Lee SW, Khaw KS, Ngan Kee WD, Leung TY, Critchley LAH. Haemodynamic effects from aortocaval compression at different angles of lateral tilt in non-labouring term pregnant women. Br J Anaesth 2012; 109: 950-6

O2 Cardiac function and structure using transthoracic echocardiography in term HIV positive women

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Introduction: In South Africa up to 30% of pregnant women are human immunodeficiency virus (HIV) positive (+). These women may have cardiovascular problems including systolic dysfunction and may progress to dilated cardiomyopathy. The effects of pregnancy and HIV on haemodynamics have not been extensively researched[1] and in term women are unknown. This study compared haemodynamics in term HIV+ women with those of term healthy pregnant (HP) women, using transthoracic echocardiography (TTE).

Methods: After ethics approval, 30 term HIV+ women with CD4 counts >200 cells/mm^3 and on either highly active anti-retroviral therapy or single drug management and 40 term HP women, underwent TTE scanning.

Results: Assessment was possible in all 70 women. HP & HIV+ women were similar age and body mass index. Mean (SD) CD4 count andduration of therapy were 452±187.8 cells/mm^3 and 15.9±22.4 months, respectively. Inter-observer variability for left ventricular (LV) outflow tract diameter and LV velocity time integral was within 10 and 11 % of the mean values, respectively.

Variable	Healthy	HIV+
Mean arterial pressure (mmHg)	84 ± 15.2	82 ± 13.1
SVR (dyne.s/cm^5)	1237 ± 321	1323 ± 344
Cardiac index (L/min/m^2)	3.1 ± 0.70	2.8 ± 0.64*
LV mass (g)	170 ± 40.4	140 ± 38.8*
Fractional shortening (%)	40 ± 8.8	42 ± 6.3
LV end diastolic area (cm^2)	15.1 ± 2.7	17.2 ± 3.1*
Heart rate (BPM)	88 ± 13.1	83 ± 15.7
Septal IV relaxation (ms)	64 ± 17.3	63 ± 12.9
Septal s´ velocity (cm/s)	9.3 ± 1.7	8.5 ± 1.5*
Septal e´ velocity (cm/s)	12.4 ± 2.5	11.5 ± 2.4
Mitral valve E/A	1.6 ± 0.50	1.7 ± 0.65
Mitral valve E/septal e´	7.7 ± 2.13	7.7 ± 2.0
RV IV relaxation (ms)	37.5 ± 12.8	44.1 ± 10.4*
RV s´ velocity (cm/s)	17.0 ± 2.9	14.7 ± 3.1*
RV e´ velocity (cm/s)	18.7 ± 3.4	16.3 ± 4.1*
Pericardial effusion	21 (53)	25 (83)*
Size of effusion (cm)	0.3 ± 0.28	0.5 ± 0.20*

Data are mean ± SD, number (%). SVR: systemic vascular resistance: IV: isovolumetric; RV: right ventricle. Data compared using unpaired two-tailed t-tests with Welsh's correction. and Fisher's exact test. *P<0.05

Discussion: Compared with HP, HIV+ women had reduced cardiac index, LV and RV systolic myocardial velocities and increased LV ED areas in the presence of reduced LV mass. These findings suggest subclinical impairment of systolic function and limited diastolic impairment, reflecting reduced adaptation to the increased haemodynamic demands of pregnancy. Changes may be due to HIV or drug therapy.

Reference

1. Longenecker C, Mondo C, Le V, Jensen T, Foster E. HIV infection is not associated with echocardiographic signs of cardiomyopathy or pulmonary hypertension among pregnant Ugandan women. Int J Cardiol 2011;147: 300–2.

O3 Choice of drugs for neuraxial labour analgesia: An OAA approved survey of current practice

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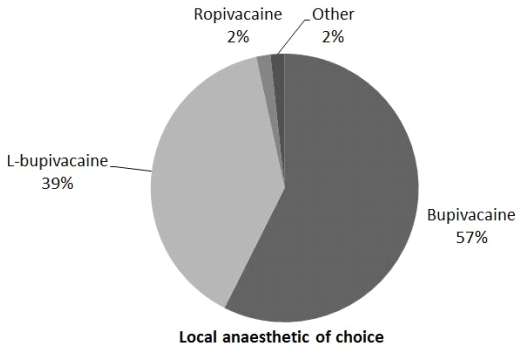
Introduction: Bupivacaine has been used to provide labour analgesia for many years. It is, however, extremely cardiotoxic if accidental overdose were to occur. This led to the search for newer agents and ropivacaine was introduced followed by L-bupivacaine. Although less potent, in high doses ropivacaine and L-bupivacaine are less cardiotoxic than bupivacaine. Some serious adverse incidents involving accidental intravenous bolus administration of dilute bupivacaine solution led to the release of the NPSA-21 safety alert in the UK.[1] It recommended the use of licensed premixed bags of local anaesthetic (LA) and adjuvants for use on labour wards. The aim of our survey was to investigate whether there is uniformity in the choice of LA and adjuvants used for maintenance of labour analgesia in the U.K. and whether most units have changed to using licensed bags of premixed LA and opioid.

Methods: An OAA approved on-line survey no.140 was distributed to lead obstetric anaesthetists in the UK.

Results: Questionnaires were sent to 197 units and the response rate was 80.2%



57% of units use low-dose bupivacaine for labour analgesia: 0.1% is the commonest concentration in which bupivacaine (83.6%) and L-bupivacaine (85.0%) are used. Fentanyl is the most frequently used additive (98.1%) and the favourable concentration used is 2 μg/mL (94.8%). Labour epidural analgesia is maintained using patient-controlled epidural analgesia (PCEA) by 29.8% (46/154) units while PCEA plus background infusion, continuous infusion and intermittent top-ups are used by 20.1% (31/154), 26.6% (41/154) and 21.4% (33/154) units, respectively. Only one unit reported using a computer integrated PCEA. 64.5% (102/158) of units use licensed premixed bags from a manufacturer while 10.1% (16/158) were prepared by hospital pharmacy. Some units use syringes rather than bags which are prepared in a pharmacy (17.7%) or on labour ward (1.9%).

Discussion: Despite concerns regarding its toxicity, bupivacaine is still the favoured local anaesthetic in the UK. In spite of the NPSA safety alert LA syringes with additives are still prepared on the labour ward. It may be useful to have revised recommendations for providing safe maintenance of labour epidural analgesia.

Reference

1.. Safer practice with epidural injections and infusions. NPSA, Patient Safety Alert 21, 2007.

O4 Haemodynamics using transthoracic echocardiography in women with untreated preeclampsia in South Africa

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Introduction: Preeclampsia (PE) is a life-threatening hypertensive disease of pregnancy. From an aetiological and clinical perspective it is important to understand haemodynamics and quantify cardiac output (CO) in women with untreated (UT) disease. Continuing previous work in Australia,[1] the aim of this study was to quantify haemodynamics in women with UTPE in South Africa (SA) using transthoracic echocardiography (TTE), as these women may represent a different phenotype and disease severity.

Methods: After ethics approval 15 HIV negative women with UTPE were recruited and compared with 40 healthy term pregnant (HP) women[+]. All underwent standardised TTE examination.

Results: Fourteen women (93%) had severe PE. Women were similar in body mass index, parity and age.

Variable	Healthy	Untreated PE
Gestation (weeks)	40 ± 1.8	36 ± 5.6*
Haemoglobin (g/dL)	10.7 ± 1.42	10.3 ± 1.9
Mean arterial pressure (mmHg)	84 ± 15.2	120 ± 11.9*
Cardiac index (L/min/m^2)	3.1 ± 0.70	3.6 ± 0.94
SVR (dyne.s/cm^5)	1237 ± 321	1592 ± 531*
Cardiac output (L/min)	5.7 ± 1.3	6.6 ± 2.1
SV (mL)	66 ± 14	79 ± 15.8*
CWI (mmHg.L/m^2)	266 ± 77.7	425 ± 109.7*
LV ED diameter (cm)	4.6 ± 0.44	4.5 ± 0.49
LV mass (g)	170 ± 40.4	216 ± 32.2*
Fractional shortening (%)	40 ± 8.8	40 ± 7.1
Heart rate (beats/min)	88 ± 13.1	83 ± 14.2
Septal s´ velocity (cm/s)	9.3 ± 1.7	8.4 ± 1.6
Biphasic septal s´ wave	6 (15)	7 (47)*
Mitral valve E/Septal e´	7.7 ± 2.13	10.5 ± 3.3*
TAPSE	2.6 ± 0.39	2.6 ± 0.36
Pericardial effusion	21 (53)	10 (67)
Size of effusion (cm)	0.3 ± 0.28	0.5 ± 0.24*
Longitudinal Strain (%)	-	-18.1 ± 3.7

Data are mean ± SD, number (%), SVR=systemic vascular resistance, SV=stroke volume, CWI=cardiac work index, LV=left ventricle, ED=end-diastolic, HR=heart rate, TAPSE=tricuspid annular plane systolic excursion *P<0.05 compared using unpaired two-tailed t-tests with Welsh's correction. [+]These SA women were also a control group for a study investigating haemodynamics in HIV positive women.

Discussion: Anaemia was common. Compared with term HP women, women with UTPE had increased SVR and SV and preserved systolic function with no change in HR or LVED diameter. Women with UTPE had reduced diastolic function, abnormal interventricular septum movement, increased LV mass and larger pericardial effusions than HP women. There is variability in haemodynamics between women; however TTE can assess cardiac function in individual women with PE.

Reference

1. Dennis AT, Castro JM, Simmons SW, Permezel M, Royse CF. Haemodynamics in women with untreated pre-eclampsia. Anaesthesia 2012;67:1105-18.