



Inter-rater Agreement of a Non-invasive *UltraSound* Cardiac Output Monitoring (*USCOM*) Device In Emergency Department Patients

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Background

- Increasing ED length of stay is resulting in more critical care being delivered in the ED⁽¹⁾
- Early goal-directed therapy (EGDT) for severe sepsis and septic shock requires invasive hemodynamic monitoring in the ED⁽²⁾
- The pulmonary artery (PA) catheter has long been the mainstay for hemodynamic monitoring of critically ill patients in the ICU setting⁽³⁾
- Several technologies are available to provide non-invasive alternatives to PA catheterization and may prove useful in the emergency department (ED) setting
- The USCOM 1A uses continuous-wave doppler ultrasound technology to measure cardiac index (CI) and stroke volume index (SVI)
- The USCOM monitor has been shown to be a reliable hemodynamic monitoring tool when compared to the PA catheter in the ICU setting⁽⁴⁾
- The purpose of this study is to investigate the inter-rater agreement of this device when used by ED personnel (operators) with minimal training

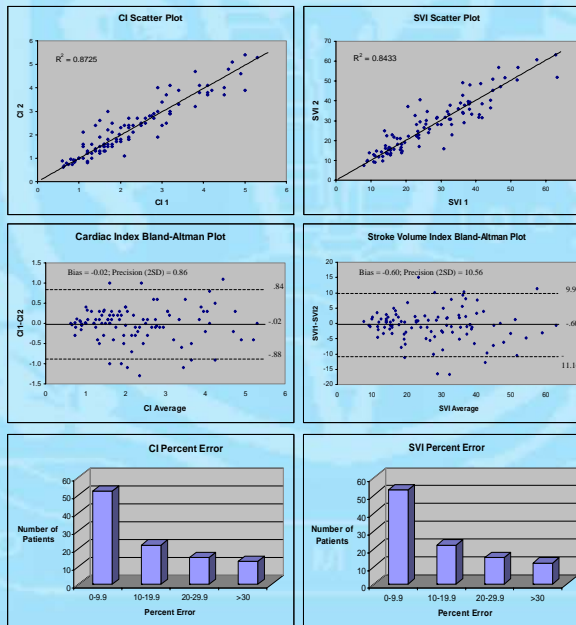
Methods

- Design:** Prospective observational validation study
- Setting:** ED with approximately 65,000 patient visits annually
- Duration:** Seven-month period, February to September 2005
- Inclusion criteria:**
 - Convenience sample of emergency department patients
- Exclusion criteria:**
 - Age < 18
 - Patients unable to tolerate supine position
- Study Protocol:**
 - Patient verbal consent was obtained
 - Paired measurements of cardiac index (CI), and stroke volume index (SVI) were obtained by two blinded operators
 - Operators were trained using a standard protocol
 - Operator was instructed to recognize an acceptable signal tracing
 - Operator then placed the USCOM probe at the sternal notch and optimized the signal
 - Once the operator was satisfied with the signal, 3 cardiac cycle tracings with the highest signal quality were selected
 - The USCOM software calculated the average CI and SVI from the 3 optimal cardiac cycle tracings
 - Abnormal CI was defined as < 2.5 L/min/m², abnormal SVI was defined as < 35 mL/m²

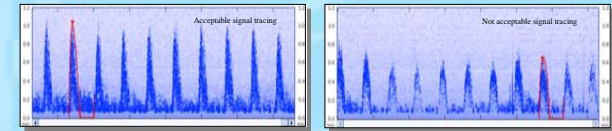
Results

Operators		Diagnosis	
Attending	35	Cardiac	22
Residents	31	Trauma	16
Medical Students	80	GI	13
Nurses	47	Infectious	10
EMTs	11	Respiratory	8
		Metabolic	5
		Other	27
Operator Experience		Statistical Analysis	
1-5 Exams	82	Applicability*	85.0%
6-10 Exams	14	Number of Pairs	102
11-15 Exams	7		
>15 Exams	41		
Patient Demographics		Mean Percent Error	
Total Patients Enrolled	107	CI	14.2% ± 13.3
Male	57 53.3%	SVI	14.4% ± 13.3
Female	50 46.7%		
Age (yrs)	49.5 ± 19.8	Pearson's Correlation (R ²)	
BSA (m ²)	1.9 ± 0.3	CI	0.87 (95% CI 0.86-1.00; p<0.001)
CI range (L/min/m ²)	0.6 - 5.3	SVI	0.84 (95% CI 0.81-0.96; p<0.001)
SVI range (mL/m ²)	7.7 - 63.0	Kappa	
		CI	0.83
		SVI	0.72

* acceptable doppler signal tracing was not obtained in 16 out of 107 patients



Consent for patient photograph on file at LLUMC



Conclusions

- The USCOM monitor is a feasible non-invasive hemodynamic monitoring device in the ED with acceptable inter-rater agreement when utilized by ED personnel involved in patient care
- The ease of use of this device suggests that further study is needed to examine the utility of this device in the hemodynamic assessment of critically ill patients presenting to the ED

Acknowledgement

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