Hemodynamic monitoring in Swiss ICUs : results from a Web-based survey

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classic. The aim of the study was to assess a comprehensive analysis of the correlation of LVM between two different diagnostic techniques, transthoracic echocardiography (TTE) and 64-slice multidetector computed tomography (MDCT).

Methods A prospective cohort of 102 patients' LVM was quantified by TTE and MDCT in a row and blind study. We used the following test: intraclass correlation coefficient absolute agreement (ICCA) as a mixed model, concordance correlation coefficient of Lin (CCCL) to evaluate the accuracy, Passing–Bablock regression (PBR) to detect systematic errors and finally the range of Bland–Altman agreement.

Results There were 57 (55.8%) males, mean age 65 ± 13 years. ICCA was 0.67 (95% CI: 0.30 to 0.84), P <0.001; the CCCL was 0.67. The PBR ($Y = A + B * X$) was: A = –29 (95% CI: –170 to 64), B = 0.70 (95% CI: 0.51 to 0.98). The range of agreement of Bland–Altman showed a mean of X (TTE) – Y (MDCT) = –37.8 (95% CI: –47 to 72) g, there were two cases below the lower limit.

Conclusions Both methods show a level of consistency and acceptable accuracy, showing no systematic error constant rate (interval A contains 0) but there seems to be a discrete proportional error (interval B does not contain 1). As shown, the Bland–Altman range seems to slightly overestimate the TTE value against the MDCT, probably related to the quality of the echocardiography window.

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Coronary artery disease and differential analysis of a valve calcium score by transthoracic echocardiography

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Introduction Valvular calcification represents a form of atherosclerosis similar to that produced in the wall of the coronary arteries, so that the presence of mitral annular calcification (MAC), aortic valvular sclerosis and aortic root (AVRS) detected by transthoracic echocardiography (TTE) is associated with an increased risk for developing coronary artery disease (CAD). Coronary calcification and intracoronary lesions can be assessed by non-invasive coronary multidetector computed tomography (MDCT). The aim of this study was to determine whether a global valvular calcium score (GVCS) and/or partial (MAC and AVRS) assessed by TTE can predict critical values of calcium at the level of the coronary wall, the Agatston score (AS) and/or the presence of significant coronary lesions detected using MDCT.

Methods A prospective cohort of 82 patients with intermediate probability of CAD was referred for MDCT and then a TTE was performed in a blind way to calculate the GVCS and partial (range 0 to 15).

Results Mean age 65 ± 13 years, 46 (56.1%) males. The area under the curve (AUC) of AS was 0.69 (95% CI: 0.5 to 0.82), P = 0.05. The cut-off value of AS for a higher predictive value to identify the presence of CAD was ≥350 with a sensitivity (S) of 46%, specificity (E) of 86% and a positive predictive value (PPV) and negative predictive value (NPV) of 60% and 78%, respectively. The GVCS value for an AS ≥350 with a higher predictive value was 9. The AUC of GVCS was 0.73 (95% CI: 0.57 to 0.90), P = 0.01 so that a GVCS ≥9 predicts the presence of CAD with S = 36%, E = 97%, PPV = 83% and NPV = 79%. Spearman's rho correlation coefficient showed a direct association between AS and GVCS (r = 0.29, P = 0.03), between AS and MAC (r = 0.30, P = 0.03) as well as between AS and AVRS (r = 0.42, P = 0.004). The same coefficient was used to calculate the association between the presence of significant CAD (≥50% stenosis) detected by MDCT and GVCS (r = 0.32, P = 0.005), MAC (r = 0.06, P >0.05) and AVRS (r = 0.26, P = 0.03). When studying the relationship between single-vessel, double-vessel or triple-vessel CAD and GVCS, MAC and AVRS the following results were obtained respectively: r = 0.33 (P = 0.004), r = 0.06 (P >0.05) and r = 0.26 (P = 0.03).

Conclusions The quantification of valvular calcification using a GVCS by TTE correlates well with the presence of CAD detected by MDCT. This association was stronger when AVRS was used compared with MAC.

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National survey of the use of cardiac output monitoring tool in general adult ICUs in the United Kingdom

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Introduction Haemodynamic monitoring is essential for the management of critically ill patients. Currently there are various techniques available in clinical practice to measure cardiac output (CO) in ICUs including pulmonary artery catheter (PAC), oesophageal Doppler, lithium dilution cardiac output (LiDCO) and pulse-induced contour cardiac output (PiCCO) studies. In recent times PAC has been used less with less invasive methods becoming more popular. We conducted a telephone survey of the current CO monitoring practices in adult ICUs in the United Kingdom.

Methods All general adult ICUs in the United Kingdom were surveyed via telephone. The nurse-in-charge or the senior physician for the shift was consulted to ascertain which cardiac output monitors (COMs) were available for use, which was their first choice and if they used PAC in the past 12 months.

Results A total of 225 adult ICUs were surveyed and all the replies were recorded on paper (98% response). Two hundred and eleven (96%) units used at least one form of COM while the rest of the 14 units did not use any COM tool. One hundred and two (48%) use more than one form of cardiac output monitoring. Oesphageal Doppler was most popular (86/211, 41%), followed by LiDCO and PICCO both used in 73/211 (35%) of the units, and pulse contour analysis (14/109, 7%). Seven out of 211 (3%) units still use PAC as the preferred method of COM, of these two had other COM devices available and five used PAC only. Forty-six out of 211 (22%) units were using PAC at least occasionally. In contrast, a similar survey performed in 2005 [1] found PAC (76%) and oesophageal Doppler (53%) devices to be most commonly available. Among the other techniques. 33% of the ICUs use PiCCO and a further 19% use LiDCO systems for CO monitoring (Table 1).

Table 1 (abstract P32). Frequency of cardiac output monitoring across the United Kingdom

	2005 [1]	2010
PAC	76%	22% (46)
Doppler	53%	41% (86)
LiDCO	19%	35% (73)
PICCO	n/a	35% (73)
WC analysis	33%	7% (14)
Other	8%	n/a

Conclusions The results show the changes in COM over the past 5 years in comparison with a previous survey in 2005 [1]. There appears to be a steady decline in the use of PACs, with oesophageal Doppler becoming the most popular method of COM. LiDCO and PiCCO are used equally throughout the United Kingdom, with pulse contour analysis becoming less popular.

Reference

1. Esdaile B, Raobaikady R: **Survey of cardiac output monitoring in intensive care units in England and Wales.** *Crit Care* 2005, **9(Suppl 1):**P68. doi:10.1186/cc3131.

P33

Hemodynamic monitoring in Swiss ICUs: results from a Web-based survey

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Introduction Adequate and prompt implementation of hemodynamic monitoring is an essential component in the management of critically ill patients. The goal of the present survey is to assess hemodynamic monitoring strategies in Swiss ICUs.

Methods A self-reported Web-based questionnaire (36 multiple-choice questions) was sent by email to available physicians in charge of adult critically ill patients in Swiss ICUs. The survey examined two subjects: the monitoring tool used and how the clinicians address fluid responsiveness. Results where expressed as frequency (% of all replies) and/or presented as a mean rate.

Results We obtained 130 replies from 71% of selected Swiss ICUs (general, surgical, medical, etc.). Devices available were: echocardiography (Echo): 94.5%, PiCCO: 87.3%, Swan–Ganz: 80%, FloTrac™: 21.8%, oesophageal Doppler: 16.4%, LiDCO: 10.9%. The most often device used was: PiCCO: 56.7%, Swan–Ganz: 30.7%, Echo: 8.7%, FloTrac™: 3.1%, LiDCO: 0.8% respectively. Clinicians classified (from 1 to 5) the available devices in various situations as follows: during cardiogenic shock: Swan–Ganz (4.27), Echo (4.26), PiCCO (3.62), FloTrac™ (2.43); during septic shock: PiCCO (4.32), Swan–Ganz (3.76), Echo (3.32), FloTrac™ (2.59); during ARDS: PiCCO (4.09), Swan–Ganz (4.01), Echo (3.39), FloTrac™ (2.4). For most of the clinicians, the targeted arterial blood pressure was: 60 to 65 mmHg for 56.2%, 65 to 70 mmHg: 26.9%, 55 to 60 mmHg: 7.7%, 70 to 75 mmHg: 4.6% respectively. The parameters used to predict fluid responsiveness were: PPV: by 58.5% of clinicians, Echo parameters: 55.8%, passive leg rising (PLR) test: 53.8%, SVV: 50.0%, GEDV: 45.5%, CO: 45.4%, $ScvO_2$: 43.1%, systemic arterial pressure: 41.5%, pulmonary artery occlusion pressure (PAOP): 34.6%, EVLW: 33.3%, SVO_2: 31.9%, central venous pressure: 30.8%, variation of inferior vena cava diameter: 27.5%, ITBV: 21.4%, fluid balance: 14.6%, inferior vena cava diameter: 12.5%. Parameters used to stop the vascular filling were: high EVLW: by 51.8% of clinicians, high PAOP: 50.9%, low PPV: 42.6%, high GEDV: 42.0%, disappearance of lactates: 41.9%, Echo parameters: 39.5%, negative PLR test: 38.0%, high ITBV: 30.4%, increase in oxygen requirement: 25.6%, normal CO: 23.3%, elevated CO: 6.2%, high $ScvO_2$: 18.6%, high SVO_2: 13.3%.

Conclusions This study suggests that clinicians use diverse monitoring methods. Moreover, regarding the parameters used for the fluid management strategy, several parameters are used without a clear predominance for one of them. Furthermore, static indices remain used.

P34

Prediction of cardiac index by body surface temperatures, $ScvO_2$, central venous–arterial CO_2 difference and lactate

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Introduction Monitoring of the cardiac index (CI) is a cornerstone of intensive care. Nevertheless, most of the techniques based on indicator dilution and/or pulse contour analysis require central venous and/or arterial catheters. Several surrogate markers have been suggested to estimate CI including $ScvO_2$, central venous–arterial CO_2 difference ($CVACO_2D$) as well as body surface temperatures and their differences to body core temperature (BCT). It was the aim of our prospective study to evaluate the predictive capabilities of $CVACO_2D$, $ScvO_2$, surface temperatures and lactate regarding CI.

Methods In 53 patients (33 male; 20 female) with PiCCO monitoring, 106 datasets including surface temperatures of great toe, finger pad, forearm and forehead using an infrared noncontact thermometer (Thermofocus; Tecnimed) as well as lactate, $ScvO_2$, $CVACO_2D$ and pulse pressure (PP) were measured immediately before PiCCO thermodilution providing CI and SVRI. Statistics: SPSS 18.0.

Results Patients: 17/53 (32%) ARDS; 14/53 (26%) liver cirrhosis; 13/53 (25%) sepsis; 4/53 (8%) cardiogenic shock; 5/53(9%) various aetiologies. Thermodilution-derived CI significantly correlated to the temperatures of the forearm (r = 0.465; P <0.001), great toe (r = 0.454; P <0.001), finger pad (r = 0.447; P <0.001) and forehead (r = 0.392; P <0.001) as well as to $ScvO_2$ (r = 0.355; P <0.001), $SCVACO_2D$ (r = –0.244; P = 0.011) and pulse pressure (r = 0.226; P = 0.019), but not to lactate (r = –0.067; P = 0.496). ROC analysis regarding the critical threshold of CI <2.5 l/minute*sqm demonstrated the highest predictive capabilities for the differences (BCT – T-forearm) (ROC-AUC 0.835; P = 0.002; cut-off 4.6°; sensitivity 89%; specificity 71%) and (BCT – T-finger pad) (ROC-AUC 0.757; P = 0.017) as well as $ScvO_2$ (ROC-AUC 0.744; P = 0.024). $SCVACO_2D$ (ROC-AUC 0.706; P = 0.056) and lactate (ROC-AUC 0.539; P = 0.718) were not predictive. Multiple regression analysis (R = 0.725) demonstrated that age (P <0.001), PP (P <0.001), T-forearm (P = 0.024) and the difference (BCT – T-toe; P = 0.035) were independently associated with CI.

Conclusions Body surface temperatures and their differences to BCT are useful to estimate CI. The difference (BCT – T-forearm) provided the largest ROC-AUC (0.835; P = 0.002) regarding CI <2.5 l/minute*sqm. $SCVACO_2D$ does not provide information in addition to body surface temperatures and $ScvO_2$.

P35

Impact of hepatic venous oxygen efflux and carotid blood flow on the difference between mixed and central venous oxygen saturation

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Introduction The difference between central venous ($ScvO_2$) and mixed venous oxygen saturation (SvO_2) may vary widely. The objective of this study was to evaluate the impact of hepatic and renal venous oxygen efflux, femoral oxygen saturation and carotid artery blood flow on the difference between $ScvO_2$ and SvO_2 ($\Delta[ScvO_2 - SvO_2]$).

Methods Nineteen sedated and mechanically ventilated pigs (weight: 41.0 ± 3.6 kg) were subjected to sepsis (n = 8), hypoxic hypoxia (n = 3) and cardiac tamponade (n = 3) or served as controls (n = 5). Mixed, central and regional venous oxygen saturations (spectrophotometry), and carotid, hepatic and renal blood flows (ultrasound Doppler flow) were measured at baseline and 3 hourly, up to 24 hours. Hepatic venous oxygen efflux was determined as hepatic arterial + portal venous blood flow times hepatic venous oxygen content, and renal venous oxygen efflux as twice renal artery blood flow times renal venous oxygen content. A multiple linear regression analysis with backward elimination procedure was undertaken to define contributions of the variables to $\Delta[ScvO_2 - SvO_2]$.

Results Ninety-eight assessments were obtained (one to seven/animal). The backward elimination procedure yielded a best model containing hepatic venous oxygen efflux (r = –0.46, P <0.01) and carotid artery blood flow (r = 0.56, P <0.01; Figure 1). This final model accounted for 49.8% of variation in $\Delta[ScvO_2 - SvO_2]$ (R^2 = 0.498).

Conclusions Carotid artery blood flow and hepatic but not renal venous oxygen efflux predict some of the differences between mixed

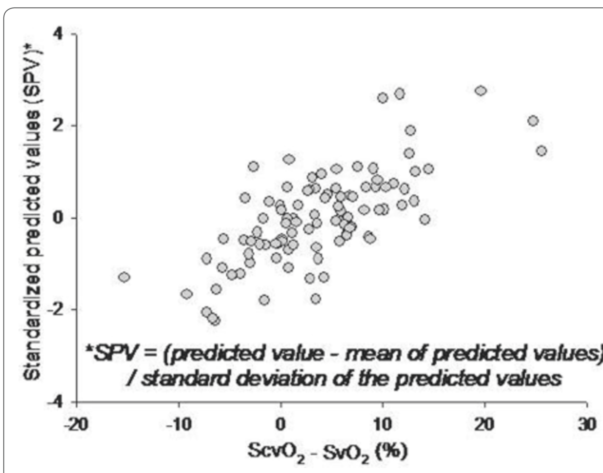

Figure 1 (abstract P35). Scatterplot of standardized predicted values versus $ScvO_2 - SvO_2$.