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Evaluation of regional work from ECG-gated SPECT images through solution of equations of continuity for fluids—mechanical cardiac work calculated using thin wall model

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Regional contraction work (RCW) of left ventricle (LV) was evaluated from cardiac perfusion images of ECG-gated single photon emission computed tomography (ECG-SPECT). The mechanical work was computed as a product of force and displaced distance. Force was determined from Laplace's law under a rectangle pressure. Deformation of wireframe representing LV was calculated from equations of continuity for two-dimensional fluids. Experiments were performed with homemade life-sized cardiac models. Total contraction work

(TCW) and stroke work (SW) were 524.0 ± 166.1 mJ/beat and 709.8 ± 169.5 mJ/beat, respectively, in normal subjects ($n = 23$). Moderate correlation was seen between TCW and SW ($y = -43.4 + 0.779x$, $r = 0.815$). The regional contraction amplitude (RCA), synchronous contraction index and RCW were

$35.4 \pm 3.5\%$, $95.4 \pm 3.1\%$ and 5.58 ± 0.97 mJ cm⁻²/beat in normal subjects, whereas those in patients with decreased ejection fraction (EF) 30% ($n = 6$) were $19.6 \pm 7.7\%$, $64.4 \pm 32.2\%$ and 2.58 ± 0.82 mJ cm⁻²/beat ($p < 0.0001$, Student's t-test). There was a poor correlation between RCW and RCA ($y = 1.648 \pm 0.116x$, $r = 0.501$) in normal subjects, suggesting that it might not be suitable to use RCA as an alternative to evaluate RCW.

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Outcome of cardiopulmonary resuscitation in septic intensive care unit patients already on high doses of vasopressor agents

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Background: There is limited data from intensive care units from USA that describes poor survival (3-4%) in patients on vasopressor agents who have a cardiopulmonary arrest (CPA). However, outcomes of CPA specifically in septic patients already on high doses of vasopressor agents are lacking. We evaluated such patients in our study.

Methods: We retrospectively identified all the CPA that occurred in our Medical-Surgical intensive care unit from January 2012 till December 2013 from the hospital cardiopulmonary resuscitation (CPR) registry. We defined high doses of vasopressors as follows: norepinephrine or epinephrine infusion > 1 mcg/kg/min, dopamine or dobutamine > 20 mcg/kg/min, and phenylephrine > 200 mcg/min. Patients with septic shock who had CPA while on any of these high vasopressors were included in the study. Data regarding their demographics, length of CPR, immediate return of spontaneous circulation (ROSC), 28 day mortality and survival to hospital discharge were collected.

Result: 44 patients were included in the analysis who had a CPA while on one or more of high dose vasopressors. Their average age was 59 ± 17 , and were predominantly female (57%). All the patients had a witnessed arrest in the ICU and were already intubated and on mechanical ventilation at the time of arrest. The predominant initial rhythm was pulseless electrical activity (68%), followed by asystole (23%). Mean duration of CPR was 21 ± 11 minutes. 55% of the patients were on a single agent high dose vasopressor (39% norepinephrine or epinephrine, 11% dopamine or dobutamine, 5% other). 45% of the remaining patients were on high doses of combination of two or more vasopressor agents. Eight patients (19%) had ROSC after the initial CPR. However, all of these eight patients arrested again within twenty four hours and died. Six of these had their code status changed to 'Do not attempt resuscitation' after the first ROSC. There was no survivor at 28 days and no one made it to hospital discharge.

Conclusion: Patients with septic shock already on high doses of vasopressor agents who have a cardiopulmonary arrest will most likely not survive. This information can be useful for physicians in guiding families regarding end of life resuscitation decisions before CPA occurs in refractory septic shock patients.

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