

Identification of a High Risk Subset of POCA Registrants: Potential Impact on Practice Recommendations for Successful Resuscitation

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Introduction: The Pediatric Peri-operative Cardiac Arrest (POCA) registry, which evolved through the original ASA Closed Claims Project, affords multi-institutional analysis of peri-operative cardiac arrest (CA). From this registry, four primary anesthesia-related causes of CA were determined: cardiovascular (35%), respiratory (28%), medication-related (22%), and equipment-related (5%). However, these studies have determined that there are multiple areas of overlap in the etiologies of CA (1-2). Moreover, practice guidelines which may have been devised from data obtained from registries like POCA may not adequately address technical issues relevant to the resuscitation of these individuals. We propose that we may enhance our ability to identify high risk patients by stratifying them according to procedural risk factors, patient-specific disease states or co-morbidities. To test our hypothesis we have conducted a limited analysis of twenty-eight cases that would fit the POCA definition of peri-operative CA within our institution during the period from 2002 -2006 (1).

Methods: Studies were approved by our institutional IRB. Patients (N=28) were initially analyzed to determine the prevalence of CA by procedure. From this group, the two most common procedures associated with CA were further analyzed by age and cause as would be reported to the POCA registry. Other outcomes investigated included estimated blood loss (EBL) standardized with respect to percent of estimated blood volume (EBL/EBV), death vs. successful resuscitation, effectiveness of cardiopulmonary resuscitation (CPR) as measured by return of ETCO₂, measurable blood pressure and heart rate, and days spent in the intensive care unit (ICU). Our control group consisted of patients with similar morbidities undergoing a similar procedure who did not suffer CA (N = 73). Data were statistically analyzed using an unpaired t test; effectiveness of CPR was analyzed using Fisher's exact t test.

Results: Prevalence of CA was greatest in patients undergoing cardiac catheterization (17.9%, n=5) or posterior spinal fusion (PSF) (17.9%, n =5). PSF patients were significantly older than cardiac catheterization patients (0.7 ± 0.3 years vs. 15.3 ± 1.3 years, $p < 0.001$). CA in the cardiac catheterization group was attributed to a specific untoward intra-procedural event such as perforation of the myocardium or great vessels. CA in the PSF group was attributed to hypovolemia, which occurred at the time of skin closure. EBL/EBV approached but did not reach statistical significance in PSF patients who arrested compared with those who did not ($92 \pm 49\%$ of vs. $71 \pm 58\%$). Chest compressions instituted in PSF arrests as part of CPR were ineffective in the prone position but effective once the patients were turned supine ($p < 0.01$). ICU admission days following surgery were not significantly different between PSF patients who arrested and those who did not (2.75 ± 2.06 days versus 2.78 ± 3.88 days).

Conclusions: In our subset of patients, we identified two procedures as resulting in the largest number of intra-operative CA, those undergoing cardiac catheterization, and an older population of high risk patients undergoing PSF. Since cardiac catheterization patients have been previously characterized as a high risk group, we focused our attention on the PSF patients (1). Underlying diagnosis in this PSF group was similar to a previously reported high risk group of PSF patients with neuromuscular scoliosis who experienced significant intra-operative blood loss (3). However, EBL/EBV was not significantly higher when comparing CA versus non-arrest PSF groups, suggesting that other factors may have

contributed to CA. Although there was one death in the PSF arrest group, ICU days were not significantly increased in PSF patients without arrest, as compared to those who did arrest, underscoring the reversible nature of this type of CA when adequate intra-operative resuscitation and early post-operative intervention occurs. Contrary to current studies and subsequent practice recommendations, CPR was ineffective in the prone position (4). This may have been affected by the use of the Jackson table which does not provide a surface for counter pressure and suggests that turning supine may be logistically more important in these cases. The acuity of the position change and institution of compressions may be vital to the effectiveness of resuscitation. This finding may suggest that current practice recommendations for CPR in the prone position may need further study.

References: (1) Posner, *et al.*, 2002; (2) Lee *et al.*, 2006; (3) Edler, *et al.*, 2003; (4) Mazer, *et al.*, 2002