

## Citation

Geiduschek JM: Registry Offers Insight on Preventing Cardiac Arrests in Children. *ASA Newsletter* 62(6):16-18, 1998.

## Full Text

The Pediatric Perioperative Cardiac Arrest (POCA) Registry is now in its fifth year of operation. The POCA Registry was formed in 1994 under the combined auspices of the ASA Committee on Professional Liability and the Anesthesiology Subsection of the American Academy of Pediatrics. It is maintained by the University of Washington School of Medicine Department of Anesthesiology as a component of the ASA Closed Claims Project.

The purpose of the registry is to collect extensive information about cardiac arrests in anesthetized children and to provide an estimate of incidence. The goal in evaluating this information is to identify patients or patient groups at greatest risk for cardiac arrest, to elucidate causes of cardiac arrest and to define strategies for treatment and prevention of cardiac arrest.

The registry includes all "cardiac arrests" occurring in children 18 years of age or younger. *Cardiac arrest* is defined either as the need for chest compressions or as patient death during anesthesia or during recovery in the postanesthesia care unit. For each arrest, the participating institution submits a data form to the registry. Anonymity is maintained so that patient, physician and submitting institution cannot be identified.

Currently, 63 institutions are participating in the POCA Registry. Seventy-six percent of these are university-affiliated, and 51 percent are children's hospitals. A total of 262 cases have been submitted to the registry. For the completed years of 1994-1996, 205 cases were submitted from participating institutions administering approximately 750,000 anesthetics. The cardiac arrest or death rate from this period is approximately 2.8 per 10,000 anesthetics.

Twenty-one percent of arrests occurred during induction and 67 percent during maintenance. Thirty-one percent were emergency cases, and 16 percent were for procedures scheduled on an outpatient basis. Death within 24 hours of arrest was the final outcome for 43 percent of cases and death at 1-24 days following cardiac arrest for an additional 4 percent. Forty-two percent suffered no discernible injury, while 6 percent suffered a temporary injury that includes an increase in level of care (following resuscitation) or delay in recovery. Four percent had injuries that were considered permanent.

A comparison of age with ASA physical status and mortality is shown in Table 1.

**Table 1**

A Comparison of Age With ASA Physical Status and Mortality						
All ages	<1 Month	1-5 Months	6-12 Months	>12 Months	Mortality by ASA Status	

N	262	65	64	32	101	
ASA 1-2	50 (19%)	6 (9%)	11 (17 %)	9 (28%)	24 (24%)	3 (6%)
ASA 3	76 (29%)	5 (8%)	23 (36 %)	12 (38%)	36 (36%)	20 (26%)
ASA 4-5	136 (52%)	54 (83%)	30 (47 %)	11 (34%)	41 (41%)	99 (73%)
Mortality By Age	122 (47%)	43 (66%)*	25 (39%)+	12 (38%)+	42 (42%)+	
<p>*More than expected by chance alone (<math>p &lt; 0.01</math> by Chi square)  +Fewer than expected by chance alone (<math>p &lt; 0.01</math> by Chi square)</p>						

Children less than 1 month of age accounted for 25 percent of all arrests and had a 66-percent mortality. This mortality rate is significantly higher than any other age group and is possibly influenced by underlying patient condition since 91 percent were ASA physical status 3-5 compared to 78 percent in older patients. The most common cause of cardiac arrest in this age group was failure to wean from cardiopulmonary bypass following repair of congenital heart disease. This accounted for 30 percent of deaths in this age group.

An additional 24 percent of arrests occurred in children 1-5 months of age. The mortality for this group was 39 percent. Children less than 6 months of age and less than 12 months of age accounted for 49 percent and 61 percent of all case submissions, respectively. We currently do not have adequate data to calculate the incidence of cardiac arrest or death based on patient age. However, speculating that children under 1 year of age do not constitute the majority of children anesthetized, these findings support previous reports that children under 1 year of age appear to be more vulnerable to perioperative life-threatening adverse events than older patients.<sup>1-2</sup> (The POCA Registry is expected to provide further information about the relationship between age and outcome.)

The causes of cardiac arrest are listed in Table 2. There were no cardiac arrests resulting from an episode of malignant hyperthermia. One remarkable finding is that for 27 percent of cases submitted to the POCA Registry, a primary cause for cardiac arrest or death could not be determined in spite of on-site review. Also, only 9 percent of the arrests were attributed to respiratory-related problems such as airway obstruction, failure to intubate, inadequate ventilation or inadequate oxygenation.

**Table 2**

<b>Causes of Cardiac Arrest</b>		
	<b>N</b>	<b>Percent</b>
Airway Obstruction	17	6.5
Inadvertent Extubation	1	0.4
Bronchospasm	1	0.4

Pneumothorax	1	0.4
Inadequate Oxygenation	3	1.1
Presumed Respiratory: Etiology Unclear	2	0.8
Electrolyte Imbalance	4	1.5
Fluid Therapy Related	8	3.1
Air Embolism	7	2.7
Hemorrhage	23	8.8
Sudden arrhythmia	5	1.9
IV Injection of Local Anesthetic	4	1.5
Inability to Separate From Cardiopulmonary Bypass	19	7.3
Other Cardiac Cause	38	14.5
Presumed Cardiac: Etiology Unclear*	52	19.8
Central Line Complication	9	3.4
Other Equipment Problem	7	2.7
Wrong Medication	1	0.4
Wrong Medication Dose	6	2.3
Allergic Reaction	1	0.4
Relative Halothane Overdose <sup>+</sup>	16	6.1
Relative Overdose: Other Medication <sup>+</sup>	1	0.4
Multiple Events	11	4.2
Other Damaging Event	7	2.7
Etiology Unclear	18	6.8

*\*Presumed Cardiac: Etiology Unclear - Onset of Cardiac arrest was sudden with little or no advance warning (i.e., brief episode of bradycardia or sudden loss of signal from pulse oximeter) prior to the commencement of CPR. Other Etiologies determined not to be likely cause of arrest.*

*<sup>+</sup>Relative Overdose - Dose or concentration of medication or anesthetic agent delivered considered to be one that would not usually result in needing CPR.*

This finding contrasts sharply with those of the ASA Closed Claims Project for pediatric cases in which 43 percent of adverse events were considered to be respiratory in origin.<sup>3</sup> The difference in findings may result from differences in populations reviewed, in study inclusion criteria, or may reflect a change in causality. Many of the cases in the Pediatric Closed Claims Project database occurred before the era of routine utilization of pulse oximetry or

capnometry. In the POCA Registry, 99 percent of these cases had at least one of these monitors at the time of arrest. These monitors may be better for providing early warning of a respiratory complication and prompt interventions before a cardiac arrest occurs. It is possible that information gathered from the pulse oximeter and capnometer may result in an event being classified as cardiac in origin that otherwise would have been identified as respiratory.

The POCA Registry Director is Jeffrey P. Morray, M.D. Other members of the Registry Steering Committee include: Robert A. Caplan, M.D., Frederick W. Cheney, M.D., Karen B. Domino, M.D., Jeremy M. Geiduschek, M.D., Charles M. Haberkern, M.D., Alvin Hackel, M.D., Karen Posner, Ph.D., and Chandra Ramamoorthy, M.D. Beginning this year, we will be using a new version of our data collection form in order to capture more details of the resuscitation process.

The content of the new section is modeled after the "Utstein style" cardiac arrest reporting guidelines<sup>4</sup> Since perioperative cardiac arrests in children are rare events, we are encouraging increased participation in the POCA Registry. All anesthesiologists in the United States and Canada caring for children 18 years of age or younger in either a university-affiliated or community-based practice are eligible to participate. If interested, the necessary information for enrollment can be obtained from:

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## References

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Geiduschek JM: Registry Offers Insight on Preventing Cardiac Arrests in Children. *ASA Newsletter* 62(6): 16-18, 1998, is reprinted with permission of the [American Society of Anesthesiologists](#), 520 N. Northwest Highway, Park Ridge, Illinois 60068-2573.