Complications in children undergoing cardiac catheterization with general anesthesia

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Introduction: Diagnostic cardiac catheterization is now largely reserved for children with severe or complex heart disease whereas the requirement for pediatric interventional cardiac catheterizations has escalated. Children undergoing cardiac catheterization under general anesthesia are reported at higher risk for complications[1] and can be challenging to manage. We reviewed the experience at a tertiary Children's Hospital.

Methods: After Review Board approval, all children (≤18 yrs) that required general anesthesia for cardiac catheterization during the period January 1, 2005 to September 30, 2006 were identified from a prospective database. Anesthesia and catheterization information was obtained, including any adverse events recorded by the anesthesiologist and/or cardiologist. Cardiac catheterization for electrophysiologic studies or pacemaker insertion were not included.

Results: 916 catheterizations were identified: 37.5% were diagnostic, 27.7% interventional, and 34.8% endomyocardial biopsies. Infants <1 year of age (200 cases) comprised 21.8% of total patients. A total of 73 adverse events were noted in 54 patients. Their cardiac diagnoses were: congenital heart disease 42 (78%), s/p heart transplant (9%), cardiomyopathy (6%), pulmonary hypertension (6%), other (1%). Details about these 54 patients are presented in Tables 1, 2 and 3. Adverse events were regarded minor in 19 (35%) cases. Of the 8 patients that received chest compressions, 7 were cyanotic: tetralogy of Fallot/pulmonary atresia/aorto-pulmonary collaterals (4), hypoplastic left heart syndrome (2), tricuspid atresa/intact ventricular septum (1). The complication rates by procedure type were: diagnostic 9.6%, interventional 6.7% and biopsy 1.3%. Complication rate for infants was 14%. Overall complication rate was 5.9% and mortality rate was 0.22%.

Table 1: Selected details of anesthetic technique: number (%) of infants and children > 1 year of age

Age group	n (% total)	Preop inotrope	Arterial monitoring	Tracheal intubation	Induction Ketamine	Maintenance ketamine + propofol	PRBC transfused
>1 yr	26 (48%)	2 (8%)	0 (0%)	14 (54%)	8 (31%)	17 (65%)	2 (8%)
<1 yr	28 (52%)	3 (11%)	5 (18%)	19 (68%)	14 (50%)	15 (54%)	10 (36%)

Table 2: Number (%) of adverse events for infants and children > 1 year of age

Age	n	RS	CVS	Other	Code	Death	Total
>1 yr	26	13 (36%)	12 (33%)	4 (11%)	5 (14%)	2 (6%)	36
<1 yr	28	9 (26%)	15 (41%)	10 (27%)	3 (8%)	0 (0%)	37

Table 3: Initiating cause of adverse event

Respiratory system (n=19)		Cardiovascular system (n=23)		Other (n=12)	
Upper airway obstruction	4	Arrhythmias	15	Catheter trauma	3
Laryngospasm	4	Hypotension	6	Allergic reaction	2
Bronchospasm	4	Hypercyanotic spell	1	Drug error or side effect	2
Pneumonitis	3	Pulmonary hypertension	1	Monitoring error	1
Hypoventilation	2			Pyrexia	1
Pulmonary hemorrhage	2			Hypoglycemia	1
				Other causes	2

Discussion: This study represents the full catheterization experience because it includes adverse events recorded by the anesthesiologist and cardiologist. The complication rate was higher than that commonly reported for general pediatric anesthesia and similar to that previously reported by Bennett et al.[1] Higher risk groups included infants and patients with cyanotic heart disease. Diagnostic catheterization was no safer than interventional procedures, perhaps a reflection of the patients' complex heart disease. Cardiac and respiratory adverse events were both common, with arrhythmias being the most frequently noted problem. All the study patients were cared for by a small group of pediatric cardiac anesthesiologists. This may be a useful management strategy to consider for limiting mortality of these at-risk children.

Refs: Bennett D. et al: Pediatric Anesthesia 2005;15:1083-8