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**TITLE:** ANESTHETIC CRITICAL INCIDENTS ANALYZED USING COGNITIVE SCIENCE TECHNIQUES

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As in other complex dynamic worlds, incidents in anesthesiology develop and evolve through the combined action of several factors<sup>1,2</sup>. Human information processing and action can steer the evolving incident towards successful outcomes or towards negative outcomes<sup>3</sup>. Data about the cognitive aspects of human performance in incident evolution available from aviation, process control and other applications suggest parallels that should be observed in anesthesiologist information processing and action<sup>4</sup>. It is only recently, however, that any data has been collected about the cognitive aspects of anesthesiologist performance in incident evolution<sup>5</sup>.

This report contains the results of a retrospective study of critical incidents in anesthesiology analyzed from the point of view of the cognitive factors in human performance during incident evolution. The source of the incidents was a weekly quality assurance conference in a large training hospital. The data is based on the principal actor's case presentation and on analysis of the questions and commentary provided by other domain experts during this conference. In total, 9658 anesthetics generated 328 incidents. Of 84 cases with incidents presented over 6 months, 57 were recorded, transcribed and protocols constructed. Cases were analyzed in two ways. First, cases are classified based on the type of incident evolution that occurred. Second, a subset of the cases were classified based on the cognitive aspects of anesthesiologist performance that the incident's evolution and analysis of the expert commentary imply.

Analysis of the cases demonstrates that anesthesia incident evolution can be divided into several broad classes with different characteristics. In addition, many incidents highlight specific human cognitive strategies used for dealing with complex domains. Included in these are problems like knowledge activation and inert knowledge, situation awareness, and vulnerable strategies to reduce cognitive effort (e.g. knowledge compilation and the use of assumptions).

The cases provide a benchmark case series for the discussion of human performance in anesthesia. The analysis represents one of the first systematic applications of techniques of cognitive science to anesthesia incidents. The results are similar to our research results gathered from other domains (nuclear power, space, and commercial aviation) and support thesis that the cognitive aspects of human performance plays a major role in the genesis and evolution of anesthetic incidents.

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**Title:** ANESTHETIC MORBIDITY IN CONGENITAL HEART DISEASE PATIENTS UNDERGOING OUTPATIENT SURGERY

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**Introduction:**

Outpatient surgery has become an increasingly popular, safe, and efficient way for pediatric patients to undergo surgery. Patient selection is a key aspect if unexpected complications or hospital admissions are to be avoided. Most day surgery units (DSU) accept ASA I-II pts.<sup>1</sup> Patients with congenital heart disease (CHD) are often ASA II-III, and are therefore excluded from most DSU care. This study reviews the perioperative anesthetic morbidity in all CHD pts undergoing DSU procedures during a one-year study period (Jan 1990- Jan 1991).

**Materials and Methods:**

27 consecutive pts with CHD were identified. A detailed questionnaire was completed by the resident immediately after each procedure. The intraoperative course, immediate post-operative period (1-2 hrs), and any adverse events were recorded. Follow-up phone calls were completed at 24 hrs post-op by DSU nursing staff.

**Results:**

25 pts (18M, 7F) underwent 27 anesthetics. Age ranged from 6mos - 2.5yrs (median 5.2yrs). 20 pts were ASA II, 6 pts were ASA III. 4 pts had Down's Syndrome. Multiple CHD diagnoses were present (Table I). All pts had preop room air O<sub>2</sub> saturations >90%. 4 pts had congestive heart failure (CHF), felt to be compensated on a medical regimen. 12 had undergone palliative (2) or definitive (10) cardiac surgery. Anesthetic techniques used are summarized in Table II. 2 pts were noted to have an adverse event during the 27 procedures. One pt with unrepaired Tetralogy of Fallot had severe nausea and vomiting in the recovery room (RR) following a mask inhalation anesthetic (O<sub>2</sub>/N<sub>2</sub>O/Halothane). The RR stay was prolonged by several hrs, but the pt was discharged home on the day of surgery without problems over the next 24 hrs. One pt with Down's Syndrome and a small unrepaired VSD had airway obstruction and bradycardia on induction, relieved with oropharyngeal airway and atropine. His perioperative course was otherwise uneventful.

**Table I.**

CHD Diagnosis	#Pts
ASD	7
VSD	10
PDA	1
Coarctation	3
TOF	3
Tet/Pulm Atresia	4
TGA	1
DORV	1
AS	2
Other	3

**Table II.**

Anesthetic technique	#Pts
GA/Inhalation	12
GA/narc/relaxant	15

**Discussion:**

Patients with CHD can be considered as candidates for DSU surgery, even with ASA status II-III. Pts with moderate cyanosis (room air O<sub>2</sub> saturations <90%), or uncompensated CHF should be excluded. This review of pts with CHD undergoing outpatient surgical procedures revealed 2 adverse events during 27 anesthetics. Neither event resulted in unexpected hospitalization or adverse outcome.

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