

Date :
 Title : TRACHEAL EXTUBATION AFTER CARDIAC SURGERY IN CHILDREN
 Authors : J. D. Glenn, M.D., H. F. Don, M.D., P. A. Ebert, M.D., N. H. Cohen, M.D., and M. A. Matthay, M.D.
 Affiliation: Departments of Anesthesia and Surgery, University of California, San Francisco, California 94143

Introduction. As the performance of surgical procedures for the total correction of congenital heart lesions in the very young child is increasing, we reviewed our recent results with this problem to determine after surgery 1) the incidence of unsuccessful tracheal extubation; 2) the factors that predict an unsuccessful outcome to extubation, in particular a postoperative increase in weight potentially suggesting increased lung water; 3) factors influencing the need for prolonged mechanical ventilation; and 4) the mortality associated with unsuccessful extubation.

Methods. We reviewed the medical records of all patients less than two years of age who had had cardiomy and who were admitted to our Medical-Surgical Intensive Care Unit during 1979. The records of 95 of 100 patients were available. Statistical significance was determined, where appropriate, by chi-square analysis, Student's *t* test, or multiple regression analysis.

Results. The mean age (\pm SD) of the group was 9.8 ± 6.4 months with a range of 6 days to 23 months. The distribution of diagnoses was as follows: tetralogy of Fallot, 21 patients (22%); transposition of the great arteries, 16 (17%); ventricular septal defect, 14 (15%); atrioventricular canal, 12 (13%); truncus arteriosus, 10 (10%); and miscellaneous, 22 (23%), which included combined lesions. The purpose of the majority of these procedures was total correction rather than palliation. Following removal of the endotracheal tube at various time intervals after the surgical procedure, reintubation was required in 12 patients (13%). Two patients were reintubated twice, and two patients, three times. The reasons for reintubation are shown in the table and include both respiratory and hemodynamic factors. Factors significantly predictive of failure to extubate successfully were decreased age ($P < 0.02$) and the diagnosis of truncus arteriosus ($P < 0.005$). Factors having no statistically significant predictive value were the body weight prior to extubation, expressed either as percentage of the preoperative weight or as a percentage of predicted body weight; urine output prior to extubation (ml per kg body weight); preoperative hematocrit; or preoperative use of inotropes or diuretics. Although not statistically significant, the data suggested that tracheal extubation on the day of surgery was associated with a high rate of reintubation (18 per cent of 28 patients), as was the diagnosis of transposition of the great arteries (19 per cent of 16 patients). Fourteen patients (15 per cent) of the entire group were mechanically ventilated for more than 48 hours during the postoperative period. Significant predictors of the need for prolonged mechanical ventilation were decreased age ($P < 0.05$) and the diagnosis of transposition of the great arteries ($P < 0.001$). A total of 11 patients died, *i.e.*, 12 per cent of the study group. Of these,

all three patients who required reintubation after extubation in the operating room died. In contrast, no other patient who required reintubation died, and all patients were eventually extubated successfully, although two patients required cardiopulmonary resuscitation at the time of reintubation. There was no other known significant morbidity connected directly with the act of reintubation.

Discussion. The necessity to reintubate the trachea occurred in 13 per cent of patients. This suggests that failure to maintain satisfactory spontaneous ventilation in the period following cardiac surgery was a significant problem in our patients. Several other conclusions may be drawn from our data. First, the corrective repair of truncus arteriosus or transposition of the great arteries was associated with an increased incidence of respiratory and hemodynamic problems following tracheal extubation, particularly in the younger age group. Second, removal of the endotracheal tube on the day of surgery was associated with not only a high incidence of reintubation, but also probably with increased mortality. We cannot say that the deaths occurring in these patients would have been prevented had they been left intubated for a longer period of time, but an increased vulnerability to respiratory failure may exaggerate the consequences of circulatory instability in the early postoperative period. This does not imply that tracheal extubation should never be undertaken on the day of surgery, but that it should be approached cautiously in patients with other risk factors such as age and diagnosis. Third, in this physiologically precarious group of patients, 75 per cent of those requiring reintubation survived without obvious adverse sequelae. Fourth, the failure of a postoperative increase in body weight to be predictive of the outcome of endotracheal extubation was surprising, as we expected this to be an indicator of a clinically significant increase in lung water. Finally, further study of this important topic should include a search for other factors as yet poorly defined, such as a more detailed description of both the underlying pathophysiology and the individual surgical procedure.

Table 1. Reasons for Reintubation

Reason	(n)*
Cardiac arrest	2
Respiratory arrest	1
Respiratory distress and/or hypoperfusion	10
Upper airway obstruction	
Stridor	1
Hematoma	2
Bradycardia	2

*Includes data from those having more than one reintubation.