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Title : HEMODYNAMIC EFFECTS OF PANCURONIUM IN CRITICALLY ILL CHILDREN

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Introduction. Pancuronium is a safe and effective muscle relaxant when used as an adjunct to general anesthesia in neonates and older children.^{1, 2} The tachycardia and increase in blood pressure which follow administration of pancuronium in children^{1, 2} does not contraindicate the use of this relaxant in the operating room. Nondepolarizing muscle relaxants are frequently utilized in conjunction with sedation to improve the ability to mechanically ventilate children in the intensive care unit.³ In these critically ill and often hemodynamically unstable patients, the tachycardia and hypertension which follow the administration of pancuronium might make the potential hazard outweigh the benefits of using pancuronium in the ICU setting. This study determines the hemodynamic effects of pancuronium when used in repeated doses in the intensive care of children.

Methods. Twenty-five children under two years of age admitted to the Intensive Care Unit for post-operative mechanical ventilation were studied. Patients were sedated with intravenous morphine sulfate, 0.05 to 0.1 mg/kg, and were hemodynamically stable for at least 10 min prior to each administration of pancuronium. All patients were mechanically ventilated to maintain PaCO₂ 35 to 40 torr. Heart rate, electrocardiogram, systolic blood pressure measured directly and mean arterial pressure were continuously monitored. Pancuronium, 0.05 to 0.1 mg/kg, was administered intravenously over 5 min every hour. Heart rate, systolic blood pressure, and mean arterial pressure were recorded approximately 2 and 10 min after injection. Hemodynamic changes were analyzed using Wilcoxon paired-sample test and analysis of variance.

Results. The 25 children studied had a mean age of 9.8 + 7.2 (S.D.) months. The patients were admitted to the ICU after surgical repair of tetralogy of Fallot, four patients (16 per cent), ventricular septal defect, four patients (16 per cent), transposition of the great arteries, eight patients (32 per cent), atrioventricular canal, four patients (16 per cent), truncus arteriosus, four patients (16 per cent), and tracheal stenosis, one patient (4 per cent). The hemodynamic results, summarized in Table 1, are tabulated using percentage of change from control measurements before administration of the pancuronium to maximum change 2 and 10 min after administration. Each patient received an average of ten doses (range 5 to 27 doses) of pancuronium during the study. None of the average heart rate or blood pressure changes was statistically significant. No patient had a heart rate change of + 10 per cent or more. Only one patient (4 per cent) had an average systolic blood pressure increase of 12 per cent above control 10 min after administration and mean arterial pressure increase of 10 per cent above control 10 min after administration. Three patients (12 per cent)

had blood pressure falls of more than 10 per cent after receiving pancuronium. No patient suffered any cardiovascular compromise that could be attributed to the administration of pancuronium.

Discussion. The insignificant hemodynamic changes demonstrated in this study are at variance with the large increases in heart rate (approximately 22 to 28 per cent) and blood pressure (approximately 16 to 19 per cent) noted by Bennett *et al.*,^{1, 2} who used pancuronium for intraoperative muscle relaxation in doses similar to those in this study. A number of factors might account for the difference in results. The patient populations are dissimilar. In this study, the patients had recently undergone major thoracic or cardiac surgical procedures, during which most had received pancuronium. On the other hand, the patients studied by Bennett *et al.*^{1, 2} had short, uncomplicated procedures and received only one dose of pancuronium. The small hemodynamic changes following repeated doses of pancuronium may result from a tolerance or tachyphylaxis to the anticholinergic effect. The speed of administration of the pancuronium may also be important. In the present study, each dose of pancuronium was infused intravenously over 5 min. Foldes⁴ suggests that the hemodynamic response to pancuronium is dose-related. Slow administration of pancuronium therefore may cause hemodynamic changes of smaller magnitude than the same dose given rapidly, without interfering with the relaxant properties of the drug. We conclude that pancuronium in combination with sedation, is safe and effective in the intensive care management of children requiring muscle relaxation.

References.

1. Bennett EJ, Bowyer DE, Giesecke AH, et al: Pancuronium bromide: A double-blind study in children. *Anesth Analg (Cleve)* 52:12-18, 1973
2. Bennett EJ, Daughety MJ, Bowyer DE, et al: Pancuronium bromide: Experiences in 100 pediatric patients. *Anesth Analg (Cleve)* 50:798-807, 1971
3. Stark AR, Bascom R, Frantz ID: Muscle relaxation in mechanically ventilated infants. *J Pediatrics* 94: 439-443, 1979
4. Foldes FF: Pancuronium bromide side effects. *JAMA* 225:418, 1973

Table 1. Hemodynamic Response to Pancuronium
Per Cent Change from Control
(Mean ± S.D.)

	2 Min	10 Min
Heart Rate	1.46 ± 3.8	0.86 ± 3.6
Systolic Blood Pressure	-2.57 ± 3.1	-2.22 ± 6.2
Mean Arterial Pressure	-2.34 ± 3.2	-2.16 ± 4.7