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TITLE: EFFECTS OF ATRACURIUM ON ELEVATED INTRACRANIAL PRESSURE DURING ROUTINE ENDOTRACHEAL SUCTION

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Despite sufficient sedation, as the basic treatment in patients with elevated intracranial pressure (ICP) during routine endotracheal suction (ETS), brisk bucking or caughing may occur, causing unacceptable increases in ICP. The aim of this study was to evaluate the effects of atracurium on ICP and cerebral perfusion pressure (CPP) during routine ETS.

After institutional approval, 9 patients (x̄=40±12 years, mean body weight 78±11 kg) with moderate increased ICP (19±7 mm Hg) were investigated. Heart rate (HR), mean arterial pressure, $paCO_2$ and epidural ICP (Gaeltec™) were recorded on an integrated data bank (HP 758534 A™). All patients were controlled hyperventilated ($paCO_2$ 30±2 mm Hg) and continuously sedated with midazolam (5 mg h^{-1}) and sufentanyl (1.0 mcg kg^{-1} BW h^{-1}). After a bolus dose of propofol (0.5 mg kg^{-1} BW) routine ETS was performed without the use of muscle relaxants (phase I). 4 hours later neuromuscular (nm) monitoring was established. The response of the adductor pollicis muscle was recorded (Accelerograph nm transmission monitor ™). Train of four (TOF) stimulation was applied every 15 seconds. Subsequently a bolus dose of atracurium (0.4 mg kg^{-1} BW; ED 95x2) was administered. When there was no response to TOF stimulation, a 50 Hz tetanus was applied for 5 seconds and neuromuscular blockade was quantified by means of the posttetanic count (PTC) [1]. ETS was performed as described before (phase II). Changes in ICP were recorded and CPP was determined. Diaphragmatic movements, bucking or coughing were visually registrated (absent, slight, moderate or severe). Statistical analysis was performed by Friedmann- and Wilcoxon-Wilcox test ($p<0.05$; x±SD).

HR and $paCO_2$ remained unchanged during the whole investigation period. **Phase I:** Moderate (n=7) and severe (n=2) bucking or coughing was observed in all patients during ETS. ICP increased significantly, and CCP decreased non sifignicantly (Table). **Phase II:** ETS was performed 159±54 sec after atracurium application (PTC 1.1±1.4). There was no bucking or caughing (n=7), slight diaphragmatic movements were observed in 2 patients. ICP and CCP remained unchanged (Table).

ETS is a potent trigger for diaphragmatic movement by reflex activation of the phrenic nerve. The subsequent increase of the intrathoracic pressure is the most important factor of ICP increase during routine ETS without muscle relaxation. Despite sedation, controlled hyperventilation and stable hemodynamics, significant increases in ICP were seen during ETS. However, CCP decreased non significantly. This effect might be caused by a slight hemodynamic response du to ETS without nm blockade. Following deep nm paralysis no changes in ICP and CPP were found during ETS. In conclusion muscle relaxation with an intermediate acting non depolarizing muscle relaxant is imperative in patients with compromized cerebral dynamics. Atracurium was used in this study for nm blockade because of its rapid onset, intermediate duration of action, and independency of hepatorenal function [2,3].

	ICP (mm Hg)		CPP (mm Hg)	
	Control	ETS	Control	ETS
Phase I	19±7	27±5*	63±11	59±18
Phase II	19±7	19±7	66±12	65±11

Table: Effect of diaphragmatic movement on intracranial (ICP) and cerebral perfusion pressure (CPP) without (Phase I) and after (Phase II) neuromuscular blockade with atracurium (0.4 mg kg^{-1}BW) during endotracheal sucion (n=9; x̄±SD ;*=p<0.05 vs control).

References

1. Viby-Mogensen J, et al: Anesthesiology 55:458,1981
2. Chapple DJ, et al: Br J Anaesth; 55:11,1983
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Title: IS URINARY CORTISOL EXCRETION MEASUREMENT DURING SURGERY A USEFUL GAUGE OF STRESS RESPONSE?

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Introduction: There are many reports about plasma cortisol measurements during operations.[1] However few reports about short period of urinary cortisol excretion measurement during surgery were found. The purpose of this study was to elucidate the usefulness of urinary cortisol excretion measurement as a gauge of stress response during the operation.

Methods: Forty adult patients (42 to 82 years of age) who were scheduled to undergo elective abdominal surgical procedures, agreed to participate in a research protocol, approved by the ethics committee of our institute. The patients were divided randomly into 2 groups: Group 1 (n=19) underwent general anesthesia; Group 2 (n=21) underwent general anesthesia with epidural anesthesia. Blood samples and hourly urine samples were taken immediately after the patients' bladders were catheterized (control) and further samples were taken after 1, 2 and 3 hours after skin incision. Plasma cortisol concentrations (PCC, μg/dl) and hourly urinary cortisol excretions (UCE, μg/hr) were measured via fluorescence polarization immunoassay. The data was expressed as mean±SEM. Hormone changes were analyzed using the one-way ANOVA. The group comparisons were carried out using the unpaired t-test. Significance was achieved with a p value of less than 0.05.

Results: The data is given in the table.

Discussion and Conclusion: Cortisol secretion is regulated by episodic secretion of pituitary ACTH, which increases under conditions of stress, such as anesthesia and surgery.[2] The increase of the PCC values in both groups was considered to be due to the stress response from surgical stimulation. However as shown in the table, the PCC values are the same throughout the operation in both groups, but the UCE values, continued to rise throughout the operation and show group 2 to have lower values than group1. This suggests that a further increase of cortisol secretion occurred during the course of surgery, as a result of surgical stimulation. The UCE levels at 3h rose to 15.4 times that of the control level, while the PCC at 3h only increased by 2.8 times. After 3 hours, the PCC values appeared to level off. We assumed that this was because when the cortisol secretion became greater than the saturation level of cortisol binding to the globulin, excessively free cortisol, which was lipo-soluble and unstable in serum, was likely to be excreted in the urine in large quantities. We considered that in order to evaluate the level of excess secretion of cortisol, it was useful to know the UCE levels. Furthermore, the significant differences between the two groups were found in the UCE, except the control level, whereas no significant differences were found in the PCC. This suggests that attenuation of the stress response to surgical stimulation by epidural anesthesia was highlighted by the UCE, and not by the PCC.

Therefore we concluded that the measurement of the UCE was a useful gauge of the stress response during the operation.

References: 1) Arch Intern Med 147: 1273, 1987
2) Endocrinology 94: A115, 1974

TABLE: The control values of urinary cortisol excretion were total volumes collected immediately after the bladder was catheterized. More than an hour had passed since each patient's last urination.

	PCC(μg/dl)		UCE(μg/hr)	
	Group 1	Group 2	Group 1	Group 2
control	11.2±1.2	13.2±1.6	5.6±1.0μg	9.3±2.0μg
n	20	20	17	20
1h	25.2±2.1[a]	23.4±1.3[a]	15.9±2.3*	7.6±1.4
n	20	21	18	21
2h	29.2±2.1[a]	26.3±1.9[a]	50.7±12.3[a]*	25.4±4.4[ab]
n	13	18	12	18
3h	31.1±3.6[a]	27.6±2.1[a]	86.3±15.9[abc]*	45.4±9.8[abc]
n	9	11	7	11

a : p<.05 versus control values b : p<.05 versus 1h values
c : p<.05 versus 2h values * : p<.05 between the groups