A452

TITLE: THE FAST FLUSH TECHNIQUE DOES MEASURE THE DYNAMIC FREQUENCY RESPONSE OF THE ENTIRE MONITORING SYSTEM.

AUTHORS: B Kleinman, MD, S Powell, P Kumar MD, R Gardner PhD
AFFILIATIONS: Dept of Anes, Loyola Univ Med Ctr, Maywood IL 60153; Dept Med Informatics, LDS Hosp, Salt Lake City, UT 84143

BACKGROUND: The fast flush test (FFT) allows the physician to test in vivo the natural frequency (fn) and damping coefficient (ζ) of any monitoring system. Recent investigations[1,2] have challenged the validity of the FFT. These investigations hypothesize that the measured fn and ζ may not be representative of the whole monitoring system -- particularly the distal catheter. To determine whether this is so, we measured the fn and ζ simultaneously at two points in the system.
METHODS: The monitoring systems, studied were a two inch catheter of differing internal dimentions (16/18G Deseret Medical) attached to pressure connecting tubing (36 and 72 inches) terminated by a transducer with a fast flush device (Spectramed, Oxnard, CA). A 22G transducer tipped catheter (Millar Instruments, Houston, TX) was positioned one inch within the distal catheter. The system was filled with 0.9 NS, any visible bubbles were eliminated, and was stabilized by the use of a leakproof manifold (Fig. 1). Flush testing was performed. Simultaneous square wave tracings were recorded at the Spectramed transducer (S) and one inch within the distal catheter by Millar transducer (M). From these tracings the fn[3] and ζ were measured by standard techniques. Means of three consecutive measurements (fn; ζ) were determined. Significant differences between groups was determined by student's t-test. P <0.05 was considered statistically significant.
RESULTS: There were no differences between fn and ζ at S and M for systems involving 36 and 72 inches of tubing and 16 and 18 G catheters (see Table I).
DISCUSSION: This study is the first to experimentally confirm that the FFT activates the whole system. The fn, ζ of the system is the same at the proximal transducer, as well as in the more remote and distal catheter.

REFERENCES: 1. Crit Care Med 1980; 8:683-689
2. Anesthesiology 1989; 71:893-906
3. Anesthesiology 1981; 54:227-236

Table I: Comparison of natural frequency and damping as recorded at S (fS, ζS) to simultanvous recordings at M (fM, ζ).

	16G			
	fS	fM	ζS	ζM
36"	27.4 ± 1.3	27.1 ± 0.7	0.19 ± 0.01	0.20 ± 0.00
72"	12.8 ± 0.6	12.3 ± 0.2	0.26 ± 0.01	0.25 ± 0.02
	18G			
	fS	fM	ζS	ζM
36"	23.7 ± 0.8	24.2 ± 0.4	0.31 ± 0.01	0.30 ± 0.01
72"	16.1 ± 0.5	16.1 ± 0.5	0.28 ± 0.01	0.25 ± 0.01

fS, fM in Hz ± SEM   ζS, ζM no units ± SEM

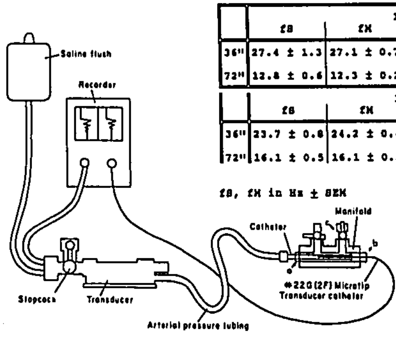

Fig 1. Experimental design where a and b are leak proof bushings. Stopcock c is open to atmosphere.

A453

TITLE: ARE PULSE OXIMETRIC AND CAPNOGRAPHIC MONITORING RELIABLE DURING LAPAROSCOPIC SURGERY FOR CHOLECYSTECTOMY ?

AUTHORS : J.B. Nyarwaya, MD, K. Samii, MD, J.X. Mazoit, MD, J.C. De Watteville, MD.
AFFILIATION : Services d'Anesthésie-Réanimation et de Chirurgie Générale, Université Paris-Sud, Hôpital de Bicêtre 94275 Le Kremlin Bicêtre, France.

Laparoscopic procedures may induce a decreased cardiac output (CO) and increased systemic vascular resistances (1), which may respectively generate an increased $D(a\text{-}A)CO_2$ (2) and altered SpO_2 signal (3). These changes may even be more severe during laparoscopy for cholecystectomy which is performed with a head-up tilt. The aim of this study was to assess the reliability of capnographic ($P_{ET}CO_2$) and pulse oximetric (SpO_2) monitoring to predict $PaCO_2$ and SaO_2 during operative laparoscopy for cholecystectomy.

Sixteen ASA PS I-II patients (5 M/11F, aged 27-78 yrs, weighing 50-100 kg), undergoing laparoscopic cholecystectomy gave their informed consent after institutional approval. Induction of anesthesia used thiopental, fentanyl and atracurium. After intubation, ventilation was controlled and anesthesia was maintained with N_2O/O_2 (60/40) and isoflurane (0,5-1%). CO_2 was used for abdominal insufflation. SpO_2, $P_{ET}CO_2$, CO (measured by bio-impedance) and arterial blood gases were measured before surgery (T_0) and at 30 min intervals with various degrees of head-up tilt and intra-abdominal pressure. $D(a\text{-}A)CO_2$ was calculated as $PaCO_2\text{-}P_{ET}CO_2$. ANOVA and regression analysis were used for comparisons.

We obtained 76 measures with abdominal pressure between 0 and 35 mmHg and tilt between 0 and 15 degrees. CO significantly decreased with increasing tilt and abdominal pressure as compared to control values (P<0.001). At T_0, $D(a\text{-}A)CO_2$ was 4.2 ± 2.4 mmHg (range 0-10 mmHg) and $SpO_2\text{-}SaO_2$ varied between -1 and + 2%. These parameters remained stable with time and none was significantly modified by tilt or abdominal pressure (figures).

Laparoscopy for cholecystectomy induced a marked decrease in CO as previously described (1). However, neither D(a-A)CO2 nor SpO2-SaO2 did change with tilt or increased abdominal pressure. In conclusion, $P_{ET}CO_2$ and SpO2 provide reliable informations on $PaCO_2$ and SaO_2 during laparoscopy for cholecystectomy

References. 1. Johannsen G. et al. Acta Anaesth Scand 1989, 33: 132-6. 2. Hoffman R.A. et al. Am Rev Respir Dis 1989, 140: 1265-8. 3. Tremper K.K. et al. Anesthesiology 1989, 70:98-108.