Renal integrity in Sevoflurane Sedation with the Anesthetic Conserving Device in the ICU – A comparison to intravenous propofol sedation

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Background:

Since the approval of the Anesthetic Conserving Device (ACD, AnaConDa®, SedanaMedical, Syndbyberg, Sweden) in many European countries, volatile anesthetics can be easily considered for sedation in the intensive care unit (ICU) without the use of vaporizer techniques (1). Inhalational sedation has been studied with isoflurane compared to midazolam in ICU patients (2,3), but sevoflurane has scarcely been evaluated to date (4,5).
Increased inorganic fluoride levels following prolonged intraoperative sevoflurane exposure have been suggested to be potentially nephrotoxic, based on observations in the early 70ies following methoxyflurane anesthesia (6).

We evaluated the effect on renal integrity of a short-term inhalational postoperative sedation with sevoflurane using the Anesthetic Conserving Device (ACD) compared to propofol in the ICU.

Methods:

After approval from the IRB board, 125 patients following major abdominal, vascular or thoracic surgery were allocated to this prospective, randomized, single-blinded study, to either receive sevoflurane (n=64) via the ACD (endtidal 0.5-1 Vol%) or intravenous propofol (n=61) for postoperative sedation up to 24 h.

Serum creatinine concentration (sCr), urinary alpha-gluthatione-S-transferase (α-GST) and N-acetyl-glucosaminidase (NAG), inorganic fluorides, as well as urine output and fluid management were measured preoperatively, at the end of surgery, and at 24 h and 48 h postoperatively.

Besides time of sedation and ventilation, all adverse events during the study period until discharge from hospital were documented.

Results:

Time of sevoflurane and propofol sedation was similar in both groups (Tab. 1), but ventilator time was significantly shorter ($p<0.01$) in the sevoflurane group (10.2 4.5 vs. 13 5.7 h).

Inorganic fluoride levels (Fig. 1) increased significantly ($p<0.0001$) 24 h after sevoflurane exposure (39 25 µmol/l) compared to the propofol group (3 6 µmol/l), and remained elevated after 48 h (33 26 vs. 3 5 µmol/l).
α-GST levels were significantly increased at 24 h and 48 h postoperatively compared to preoperative values in both groups without significant differences between both groups (Fig. 2).
NAG (Fig. 3) and sCr (Fig. 4) remained unchanged throughout the study period in both study groups, and urine output and creatinine clearance were comparable between the two groups within the entire study period.

One patient in each group suffered from renal insufficiency requiring intensive diuretic therapy, but not dialysis during hospital stay. All other adverse events occurring postoperatively were comparable between both study groups (Tab. 1).

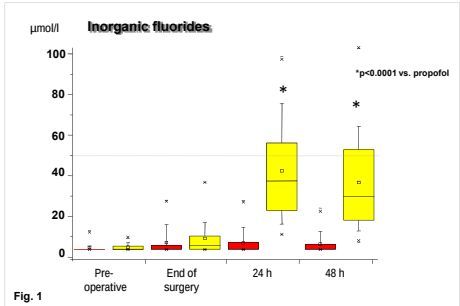

Fig. 1

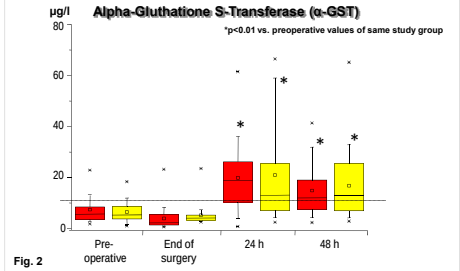

Fig. 2

Conclusions:

Short-term sedation with sevoflurane using ACD appears to be as safe as propofol with regard to renal function. Though inorganic fluoride levels were elevated after sevoflurane glomerular and tubular renal integrity were preserved throughout the hospital stay.

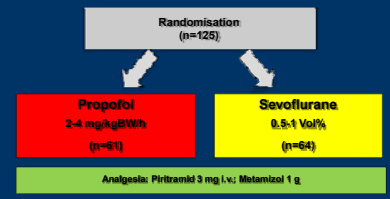

Table 1: Demographic and perioperative data. *p<0.05 vs. propofol

	Sevoflurane (n=64)	Propofol (n=61)
Age, yrs	67 ± 10	67 ± 8
Weight, kg	78 ± 18	80 ± 18
Gender, male/female	46/18	44/17
Duration of surgery, min	200 ± 108	188 ± 93
Sedation time in ICU, h	9.2 ± 4.3	8.3 ± 4.7
Ventilator time in ICU, h	10.2 ± 4.5 *	13.0 ± 5.7
Extubation time, min	54.5 ± 108.1 *	132.5 ± 113.9
LOS in ICU, h	30.9 ± 20.1	38.8 ± 45.9
LOS in Hospital, d	12.5 ± 5.6 *	15.8 ± 9.5
Adverse events, n:		
PONV	8	4
Agitation after extubation	3	1
Delirium	5	1
Respiratory insufficiency	3	4
Renal insufficiency	1	1
Polyuria	0	1
Re-operation	3	2
Long-term ventilation	1	4
Hospital mortality, n	1	2

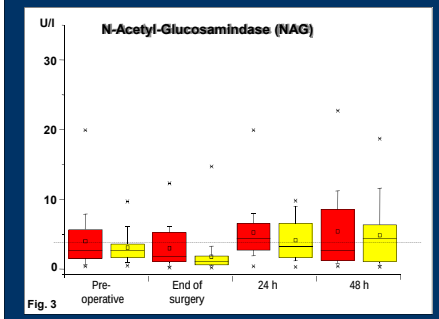

Fig. 3

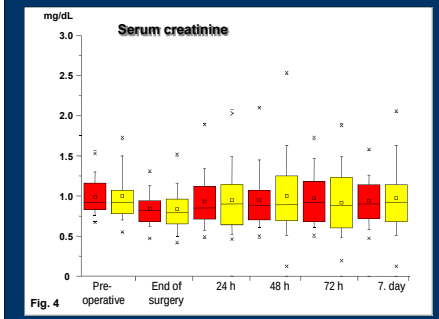

Fig. 4

References:

(1) Enlund M. Acta Anaesth Scand 2002; 46:506-11. (2) Sackey PV. Crit Care Med 2004; 32:2241-6. (3) Hanafy M. Eg J Anesth 2005; 21: 237-42. (4) Belda JF. Anesth Analg 2008;106:1207-14. (5) Röhm KD. ICM 2008; 34: 1683-9. (6) Cousins MJ. JAMA 1973; 225: 1611-6.