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**Are ventilators safe to prevent accidental volutrauma?** Steven CNUDDE*, Jan Paul MULIER*, Thomas DECKMYN**. AZ Sint-Jan AV Brugge*, Ruddershove 10, 8000 Brugge; A.Z. Sint-Lucas Brugge**.

**Introduction**

The goal of this study was to evaluate the performance of eight ventilators in the “breathing bag mode” with a closed APL valve and without compressing the breathing bag. This situation might happen in case of technical failure or human error like forgetting to switch or to open the APL valve. We measured the airway pressure and the time when the alarm went off.

**Methods**

An American breathing bag was connected for manual ventilation. Fresh gas flow was set at 12 L/min. Each ventilator was connected to an artificial Pulmo test lung (Blease) with a maximum capacity of 1.2 L. The compliance was set at 23 ml/cmH2O. The adjustable pressure limiting (APL) valve and the pressure alarm were set to the maximum. At time zero, the fresh gas flow was opened to 12 L/min, without compression of the breathing bag. The airway pressure was monitored. A high frequency pulse, given on the pressure transducer recorded the time when the alarm went off. A ventilator was considered at risk if the artificial lung inflated over its maximum volume or had a pressure above 20 cmH2O for more than 5 seconds, and dangerous if no alarm did go off in that time.

**Results**

<table>
<thead>
<tr>
<th>Ventilator type</th>
<th>APL valve setting</th>
<th>Alarm setting</th>
<th>First alarm</th>
<th>Time first alarm</th>
<th>Later alarm</th>
<th>Risk profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excel 210 SE</td>
<td>75 cmH2O</td>
<td>100 cmH2O</td>
<td>sustained pressure</td>
<td>17 sec</td>
<td>apnoe</td>
<td>dangerous</td>
</tr>
<tr>
<td>Excel 410</td>
<td>75 cmH2O</td>
<td>100 cmH2O</td>
<td>sustained pressure</td>
<td>18 sec</td>
<td></td>
<td>dangerous</td>
</tr>
<tr>
<td>Datex as3</td>
<td>80 cmH2O</td>
<td>80 cmH2O</td>
<td>high peep</td>
<td>5 sec</td>
<td></td>
<td>at risk</td>
</tr>
<tr>
<td>Aestiva 5</td>
<td>70 cmH2O</td>
<td>99 cmH2O</td>
<td>apnoe</td>
<td>17 sec</td>
<td>sustained pressure</td>
<td>dangerous</td>
</tr>
<tr>
<td>Dräger titus</td>
<td>70 cmH2O</td>
<td>98 cmH2O</td>
<td>no alarm</td>
<td></td>
<td></td>
<td>dangerous</td>
</tr>
<tr>
<td>Dräger cato</td>
<td>70 cmH2O</td>
<td>98 cmH2O</td>
<td>no alarm</td>
<td></td>
<td></td>
<td>dangerous</td>
</tr>
<tr>
<td>Medec neptune</td>
<td>70 cmH2O</td>
<td>70 cmH2O</td>
<td>high pressure</td>
<td>3 sec</td>
<td></td>
<td>at risk</td>
</tr>
<tr>
<td>Dräger julian</td>
<td>70 cmH2O</td>
<td>98 cmH2O</td>
<td>no alarm</td>
<td></td>
<td></td>
<td>dangerous</td>
</tr>
</tbody>
</table>

**Discussion**

We might consider the artificial limit of 20 cmH2O and 5 seconds as being at risk. Inflation above the total lung capacity is more dangerous than inflation to a high pressure with a small lung volume as mentioned by Dreyfuss (1) in 1992. Most healthy lungs have peak pressures during ventilation far below 20 cmH2O, suggesting that inflation above 20 cmH2O might hyperinflate and damage the lungs (2). Real lungs will react differently than the artificial lung. The artificial lung was small and has a fixed compliance. However when pressure reaches 20 cmH2O the reactions of different ventilators will not be different. The size of the breathing bag and its compliance are important. Only one ventilator of each type is measured and therefore no statistical analysis is needed. None of the examined ventilators are safe. Every ventilator should improve its alarms and if possible technically protected by a valve that opens when necessary.

**Conclusion**

All ventilators were considered at risk or dangerous. Correct alarm settings and vigilance remains the cornerstone of safety.

**References**

1. Dreyfuss D., Saumon G., *Barotrauma is volutrauma, but which volume is the one responsible?*, INTENSIVE CARE MED., 18, 139-141, 1992.
Outcome after cardiac surgery: morbidity and mortality, hospital readmission, level of activity and dependency on medical care. Y. DEVRIENDT, C. INGELS, P. J. WOUTERS, I. MILANTS, G. VAN DEN BERGHE. Department of Intensive Care Medicine, University hospital Gasthuisberg, Leuven, Belgium.

Introduction

Four years after high risk cardiac surgery, we evaluated the patient long term outcome: survival, incidence of hospital readmission, medical care requirement and the level of activity to know how much they depend on their relatives and society.

Methods

After institutional ethical approval and informed consent, we assessed the long-term outcome of 477 patients who had been admitted to the ICU after cardiac surgery during 12 months. Patients, or if unavailable the referring physician or next of kin, were contacted by phone. Some data were collected from the hospital database or the civil registration services. Types of cardiac surgery were isolated coronary surgery (N = 285), isolated valve repair (N = 106), corrections of congenital anomalies, combined surgery and transplant surgery (N = 86). Long term outcome was quantified as (a) mortality (ICU, in-hospital, 2 years, 3 years and 4 years), (b) incidence of hospital re-admission and (c) level of activity and medical care requirements at 4 years assessed by the Karnofsky Score. The Karnofsky Performance Scale (1) was originally designed to determine the objective activity level of patients older than 17 years. The scale ranges from 0% (dead) to 100% (normal activity, no complaints, no evidence of disease). A score of 60% is an important threshold as patients scoring 60% or higher are able to take care of most of their own needs, requiring only occasional assistance.

Results

The mortality rates were available for 477 patients with an Euroscore predicted hospital mortality of 9.2%. 10 patients died during intensive care (2.1%), 8 of acute cardiovascular collapse and 2 of multiple organ failure with no detectable septic focus. 16 died in-hospital (3.4%). The cumulative mortality rate 2 years after surgery was 6.9% (32 patients), 3 years after ICU admission was 10.8% (50 patients) and after 4 years 15.7% (73 patients). (The mortality rate 4 years post-hospital discharge was 12%). The cause of late, post-hospital discharge mortality was identifiable for 50 patients (68%). The most prevalent cause was cardiovascular disease (39%), followed by malignancy (23%) and neurological complications (8%). Hospital readmission for any reason during 4 years following cardiac surgery was required for 133 hospital survivors (28.7%). Data on the Karnofsky score were available for 381 patients. More than 80% of the study patients reached a Karnofsky index of more than 60%, indicating an acceptable level of autonomy. 4 years follow-up, survivors revealed a median Karnofsky score of 80%.

Discussion

After this high risk surgery we observed a lower in-hospital mortality (3.4%) than the Euroscore predicted and a 4 years cumulative mortality rate of 15.7%. BOUCHER et al. (2) find a 5 years survival of 85.9% in a group of 329 patients who had undergone cardiac surgery. The Karnofsky score showed a successful functional outcome in 84.6% of the patients. HELLGREN et al. (3) reported a 5 years survival of 68% in a group of 225 patients after heart valve surgery with prolonged intensive care of 8 days or more. In comparison with other outcome studies after cardiac surgery we have an acceptable rate of mortality and level of activity after this high risk surgery.

We did not perform a baseline analysis of the Karnofsky score before surgery. We could not assess the impact of surgery and intensive care on this score.

The impossibility to interview all the patients personally could have caused bias in the Karnofsky data.

Conclusion

Four years after ICU admission following high-risk cardiac surgery, cumulative mortality was 15.7%.

A large number of hospital survivors needed hospital readmission during that time. However survivors revealed a very acceptable level of activity and medical care requirement, as indicated by the Karnofsky Score, with 80% of them leading an independent life.

References

Introduction

LMA complications as dysphagia (4%), sore throat (10%) and neurovascular (1) lesions are related to the cuff pressure of the LMA. We therefore compared the classic-LMA (C-LMA) and the disposable-LMA (D-LMA).

Methods

After ethical committee approval and informed consent 44 adult ASA I-II patients were randomly assigned to one of the following groups:

- Group I: Classic-LMA nr 4: anaesthesia with 33% O2 in 67% air.
- Group II: Disposable-LMA nr 4: anaesthesia with 33% O2 in 67% air.
- Group III: Classic-LMA nr 4: anaesthesia with 33% O2 with 67% N2O.
- Group IV: Disposable-LMA nr 4: anaesthesia with 33% O2 with 67% N2O.

“Pressure cells” were attached to each LMA at 3 different locations corresponding to the hypopharynx, lateral pharynx and tongue base. Before insertion the “pressure cells” were zeroed.

After insertion the cuff was inflated until the pressure of 35 mmHg, few adjustments were made until the just seal. The patients were not allowed to breathe spontaneously. The cuff pressure (CP) and Pharyngeal mucosal pressure (PMP) were measured after insertion, every minute during 10 minutes and every 5 minutes until the end of anaesthesia. The patients were questioned in the hour following their arousal about sore throat or dysphagia. Statistical analysis was performed by using the Kruskal-Wallis test. P < 0.005 was considered significant.

Results

No patient complained of dysphagia or sore throat.

Discussion

Despite the higher pressures recorded with the C-LMA we did not observe a higher incidence of complications related with the use of the classic-LMA. The complications depend on many other factors: duration of anaesthesia, size of the LMA, number of insertion attempts,… (2).

Conclusion

The results of the present trial indicate that CP and PMP of the C-LMA were significantly higher during anaesthesia with or without N2O compared with the D-LMA.

References

Effectiveness of early exercise in critically ill patients. Dr. S. Galle 1, C. Burton 1, B. Clerckx 2, C. Robbeets 3, R. Pillen 2, H. Leclercq 2, K. Caluwé 1, B. Lommer 2, Prof. A. Wilmer 1, Prof. T. Troosters 1, Prof. P. Ferdinande 1, Prof. R. Goseling 1. Faculty of Kinesiology and Rehabilitation Sciences, Respiratory Rehabilitation 1, Intensive Care Medicine 1, University Hospitals KU Leuven, Leuven, Belgium.

Introduction
Critically ill patients often have prolonged ICU and hospital stay, associated with deconditioning and muscle weakness (1, 2, 3). This prospective trial examined whether daily cycling session program while still bed-bound could reduce the level of deconditioning and thus reduce ICU and hospital stay.

Methods
Stable patients, ventilatory supported for at least 5 days and who had an expected stay of at least another week on the ICU, were randomized into an experimental and a control group. Patient with physiological instability and physical or neuropsychiatric instability were excluded. The protocol was in accordance with the ethical standards of our hospital’s committee for the protection of human subjects and written consent was obtained. Both groups received identical medical treatment and daily sessions of chest physiotherapy and functional rehabilitation. In addition, the exercise group was treated with active or passive cycling sessions for 20 minutes per day using a bedside ergometer. Functional status was assessed using item 1 of the Berg Balance Scale (BBS), Functional Ambulation Categories (FAC) and the Physical Functioning item of the SF-36 Health Questionnaire. The quadriceps strength was measured with a microFET. Six-minute walking distance (6MWD) at hospital discharge and length of ICU and hospital stay were registered. Data were statistically analyzed with Wilcoxon rank sum test (nonparametric statistics) because of absence of normally distributed variables. Significance was set at p < 0.05.

Results
59 patients have been included of which 31 were randomized into the experimental group and 28 in the control group. No differences in gender, age, length, weight were observed. There was a tendency towards a higher APACHE II score in the experimental group (15.5 ± 6 vs 12.6 ± 5.3 p = 0.067).

Table 1

<table>
<thead>
<tr>
<th></th>
<th>ICU DISCHARGE</th>
<th>HOSPITAL DISCHARGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experimental group</td>
<td>Control group</td>
</tr>
<tr>
<td>Days on ICU/in hospital</td>
<td>22 (15-29)</td>
<td>21 (15.5-32)</td>
</tr>
<tr>
<td>Quadriceps Force (N)</td>
<td>103 (62-168)</td>
<td>130 (91.5-159)</td>
</tr>
<tr>
<td>BBS sit to stand</td>
<td>0 (0-2.5)</td>
<td>0 (0-2)</td>
</tr>
<tr>
<td>FAC</td>
<td>0 (0-2)</td>
<td>0 (0-2)</td>
</tr>
<tr>
<td>6 min walking distance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SF-36 physical function score</td>
<td>21 (18-23)</td>
<td>15 (14-21)</td>
</tr>
</tbody>
</table>

Data are median and (mean IQR).

Discussion
An expected lower functionality was observed at ICU discharge. Quadriceps force and BBS were also comparable at hospital discharge. In the BBS we took the percentage of each group with score 2 or more, this indicates they could stand up without help.

Notwithstanding we did not observe any difference in ICU and hospital stay, the FAC and the 6 Minute Walking Distance test at hospital discharge are better in the experimental group, but the results were not statistically significant. A closer analysis of the subgroup of patients at hospital discharge with a FAC score of 4 or 5 showed that the number of patients that could walk independently was higher (p = 0.19). In the experimental group 78% could walk independently, while this proportion was 54% in the control group. Additionally the 6MWD test was also better (p = 0.12) in the experimental group.

In the SF-36 physical function score, that quantifies the subjective functionality at hospital discharge, we see a statistic significant difference (p = 0.024) in favour of the experimental group, indicating they felt less limited. More patients were directly discharged home in the cycling group.

Conclusion
No differences in length of ICU and hospital stay were found in the two groups. A daily cycling session did not show clinical benefits at discharge from ICU. A consistent trend towards better functionality at discharge from hospital was observed in the cycling group. Interim analysis indicates that early exercise in critically ill patients improves subjective functional status at hospital discharge. Further investigation and more patients need to be recruited to confirm these results.

References
Introduction

Thoracic epidural is the gold standard for the management of postthoracotomy analgesia. Electrical stimulation (ES) has been recently introduced to facilitate the placement of epidural needles and catheters (1). Using electric stimulation, the intercostal muscle contractions allow the proper positioning of the epidural catheter (2). The purpose of the study was to evaluate the benefits of ES in terms of postoperative analgesia in thoracic surgery.

Methods

After IRB approval and informed consent, 20 adults ASA2-3 patients undergoing anterolateral thoracotomy were randomised to control group (group 1, n = 10) or ES (group 2, n = 10) thoracic epidural catheter placement (Stimulong Plus, Pajunk®, Gmbh, Geisingen, Germany). The insertion of catheter was performed in sitting position, using the loss-of-resistance technique, with a median approach, at Th2-3, Th3-4 or Th4-5 interspace and was advanced 4 cm into the epidural space. In group 2, the negative lead of the nerve stimulation (Stimulex, BBraun®, Melsungen, Germany) was connected to the catheter. The ES (1 Hz, 0.3 ms) was gradually decreased from 5 mA until intercostal muscles motor response on the operated side disappeared. Ropivacaine 0.5% was used perioperatively and general anesthesia was induced and maintained with propofol (BIS target : 40-60) and remifentanil. For the postoperative period, a continuous infusion of ropivacaine 0,15% plus fentanyl 2 mcg/ml was started at a rate of 6 ml/h with additional bolus injection of 3 ml every 60 minutes if VAS was ≥ 4, combined with an increase of the infusion by 2 ml/h. Analgesia was evaluated with a visual analog scale (VAS) during the first 24 postoperative hours, at rest and during coughing.

Statistical analysis was performed using Student’s t-test and Fisher’s exact test or log Rank Test when appropriate, with p value < 0.05 considered significant.

Results

The groups were comparable for age, gender, weight and level of epidural insertion. At rest, the incidence of painful events (p = 0.145) and painful patients (p = 0.131) VAS > 4 was not statistically different. During coughing, the incidence of painful patients (p = 0.048) and painful events (p = 0.008) was lower in group 2, with a 38.2% relative risk decrease of the rate of painful events (95% CI 53.7% - 17.5%). No statistical difference was found between groups for shoulder pain (p = 0.602). The rate of complications was the same in both groups.

Conclusion

Postoperative analgesia with TEA was satisfactory at rest in both groups, but better during coughing in patients receiving ropivacaine and fentanyl administered through an unilateral guided ES placed thoracic epidural catheter than through a conventional epidural catheter.

References

Introduction

Selected MnSSER amplitude reduction has been demonstrated to indicate objectively the onset of median nerve anesthesia following infraclavicular brachial plexus block before the appearance of clinical signs (1). The aim of the study was to compare the Median, Radial and Ulnar Nerve Somato Sensory Evoked Responses (MnSSER, RadSSER, UlnSSER) with the usual clinical pinprick and cold tests during the onset of a ropivacaine (R) infraclavicular block.

Methods

After giving informed consent, infraclavicular block using the Raj technique was performed in 15 ASA 1 patients using 40 ml of 0.5% R. Median and ulnar nerves were stimulated at the wrist level (1 Hz). The intensity of the stimulation was adjusted according to the patient’s clinical response. Radial nerve was stimulated in the bicipital groove at the arm level using the same stimulation setting. The respective peripheral MnSSER, UlnSSER and RadSSER were recorded at the Erb point (cutaneous projection of the peripheral end of the brachial plexus = P10) and at the parietal controlateral cortex (N20). The SSER were recorded before the block performance (baseline) and thereafter continuously during 30 min using an Axon™ Epoch 2000™ (1 trace = 100 sweeps ; low and high bypass filters = 50 and 750 Hz, respectively ; artifact rejection threshold = 25 µV). The cold and pinprick tests were performed simultaneously every 3 minutes to assess the sensory blockade in the respective cutaneous median, ulnar and radial nerves supplies. The clinical evaluation of the infraclavicular block was considered successful when pV AS (pinprick V AS) and cV AS (cold V AS) were greater than 8 on a respective 10 points analogic visual scale. Results were expressed as mean ± SD. Data were compared using analysis of variance (one way ANOVA) and the least significant difference test or chi² analysis when appropriate (p < 0.05 as significant).

Results

MnSSER and UlnSSER were recorded in every patient while RadSSER could not be elicited in 6 patients due to anatomical problem at the bicipital groove requiring too high amplitudes of stimulation associated with pain. Figure 1 depicts the time evolution of the mean amplitude of peripheral (P10) and central (N20) SSER of the median nerve and the mean pVAS and cVAS for the 15 studied patients. The mean time to observe the earliest SSER 20% amplitude decrease at Erb’s point derivation was 4.2 ± 1.1 min, 5.6 ± 1.8 min and 5.2 ± 1.8 for the median, ulnar and radial nerves, respectively. In contrast, the cold and pinprick tests were greater than 8 only after 17.1 ± 1.6 min and 19.6 ± 1.2 min for the median nerve ; 17.9 ± 2.1 min and 19.1 ± 1.6 min for the ulnar nerve ; 19.7 ± 2.4 min, 20.3 ± 1.9 min for the radial nerve after R injection. No significant modification of the latency of the peripheral SSER was observed.
Conclusion

The monitoring of peripheral MnSSER, UlnSSER and RadSSER provides an effective, early and objective assessment of the sensory blockade of the brachial plexus during the onset of an infraclavicular block, bypassing the clinical subjectivity. However, the MnSSER and UlnSSER at the wrist are more reliable than the RadSSER at the bicipital groove. In the future, the indication of the use of MnSSER or UlnSSER in the clinical practice must be defined in the context of uncooperative patients, children, patients under general anesthesia.

References
Introduction

Accidental dural perforation (DT) and post dural puncture headache (PDPH) are two common complications of obstetric regional anaesthesia. PDPH is incapacitating, interferes with maternal-infant interaction and is a cause of increased staff workload and prolonged hospitalisation. We report on all cases of DT and PDPH in a tertiary care obstetric teaching anaesthesia unit, using predominantly combined spinal epidural anaesthesia (CSE), over a 10 year period.

Methods

Following institutional approval, the obstetric anaesthesia database of a tertiary care teaching hospital was searched to identify all patients that experienced a DT or PDPH between Jan 1st 1997 and Oct 31st 2006. Since 1997 all patients having received obstetric anaesthesia are visited on the second postpartum day and data is prospectively gathered on all patients. The anaesthetic and obstetric charts of all patients with the diagnosis of DT and PDPH were retrospectively evaluated. Data were analysed using Chi-square analysis.

Results

During the study period, 17610 patients received regional anaesthesia. Those lost to follow-up were not used in the analysis, thus 17198 patients remained. An accidental DT occurred in 55 patients. This is a DT-rate of 0.32%. Of these 31 (56%) developed PDPH and 26 (47%) required a blood patch (BP). Four patients (7%) needed a repeat BP. Inserting an epidural catheter intrathecally and leaving it there for at least 24 hours does not reduce the incidence of PDPH or BP. In 27 patients the epidural catheter remained intrathecally for at least 24 hours. The incidence of PDPH was 52% and the need for BP was 44%. In 28 patients no catheter remained intrathecally. The incidence of PDPH was 61% and the need for BP was 50%.

A further 34 patients developed PDPH without a clear DT. This also occurred in patients who were treated with an epidural and in a similar incidence as in those treated with a CSE. Thus 65 patients in our population developed PDPH (PDPH-rate 0.38%). The need for BP occurred in 82% of these patients and in 15% a repeat BP was required. The interval between regional block and onset of PDPH is 32 ± 20 hours. The interval between regional block and onset BP is 68 ± 31 hours. The interval between BP and repeat BP is 46 ± 19 hours. Caffeine was not successful in treating PDPH.

Discussion and conclusion

In our teaching unit, using predominantly CSE, PDPH and DT occur with a similar incidence as reported in the literature. Contrary to some evidence, intrathecal catheters do not protect against PDPH or BP in our series. The incidence of BP and repeat BP in the present study confirms previous data.

References

Preoperative versus postoperative cyclooxygenase-2 inhibition for laparoscopic cholecystectomy.
S. SOLLIER, M.D., C. VANLERSBERGHE, M.D., F. CAMU, Ph.D. Department of Anesthesiology, University of Brussels VUB Medical Center, Brussels.

Background

Surgery is associated with a rapid increase of proinflammatory cytokines with subsequent induction of cyclooxygenase-2 (COX-2) activity (1). COX-2 selective inhibitors alleviate postoperative pain (2, 3). We investigated whether the preoperative use of parecoxib (PRX) decreased the postoperative need for additional analgesia medication.

Methods

The study design was double-blind, randomized and placebo-controlled and was approved by the Ethics Committee of the University. Patients gave oral informed consent. Thirty-six patients were randomly assigned to three treatment groups: preoperative parecoxib and postoperative placebo (group PRX/Plac), preoperative placebo and postoperative parecoxib (group Plac/PRX) and preoperative and postoperative placebo (group Plac/Plac). Randomisation was computer generated. Coded syringes containing parecoxib 40 mg and matched placebo were administered either before surgical incision or at wound closure. The anesthesiologist and PACU nurses were blinded to the sequence of drug administration. Anesthesia was standardized to propofol-remifentanil TCI technique with air/oxygen ventilation to normocapnia. Postoperatively, all patients were titrated to analgesic comfort level with fractionated doses of piritramide (2 mg/dose) by PACU nurses. Vital signs, PONV, VAS scores at rest and on movement (sitting position) and piritramide consumption were followed on admission to PACU and each hour for 6 hours. Statistical tests included Chi square, single factor Anova and 2-way Anova with repeated measures and Bonferroni posttests. P < 0.05 (*) was considered statistically significant.

Results

The groups were equally balanced for age, weight, height, but with predominance of female patients in the PRX/Plac group. Although diastolic blood pressure decreased in the PRX/Plac group, no differences were noted between groups with respect to mean arterial pressure and heart rate. Oxygen saturation and respiratory rate improved significantly after 3-4 h in the PRX/plac group versus Plac/Plac group. VAS scores at rest and on movement were summarized by the area under the curve (AUC_6h). No meaningful differences were found for pain intensities between the three groups. Preoperative parecoxib reduced cumulative (6 h) piritramide consumption by 28% vs. the two other groups. PONV was minimal in all groups (nausea 0-3%, vomiting 0% in all groups).

Discussion

Preoperative parecoxib decreased piritramide consumption in comparison with its postoperative administration and with placebo, suggesting that postoperative inflammatory reactions to surgery could be obtunded. The decreased opioid consumption improved respiratory rate and oxygen saturation in the PRX/Plac group. Vital signs and side effects remained comparable in all groups.

References

Comparison of two compartmental pharmacokinetic models to predict the time course of the propofol plasma concentration during the first 5 minutes after a bolus injection. Hilde Van Kerckhoven, M.D., Eric P. Mortier, M.D., D.Sc., Jan F. P. Van Bocxlaer, Ph.D.*, Michel M. R. F. Struys, M.D., Ph.D. Departments of Anesthesia and Medical Biochemistry/Clinical Analysis*, Ghent University, Gent, Belgium.

**Background**

It was aimed at comparing the accuracy of the Schnider (1) and Marsh (2) 3-compartment pharmacokinetic (PK) model for propofol to predict the plasma concentration trajectory of propofol during the first 5 minutes.

**Methods**

After ethics committee approval and written Informed Consent, 10 patients received a bolus dose of propofol (2.5 mg/kg) within 10 seconds in a large forearm vein. Propofol arterial blood samples were collected (contralateral from the injection of propofol) at 0, 30, 60, 120, 180, 240 and 300 seconds after injection. Propofol (bound and free) plasma concentrations were analysed using a validated gas chromatographic-mass spectrometric method with Solid-Phase Micro Extraction. The time course of the propofol plasma concentration as predicted by both PK models was simulated using RUGLOOP II (Demed, Temse, Belgium). We calculated the prediction error of the predicted concentration (PE = (measured-predicted/predicted). 100) and the mean median absolute prediction error calculated as the mean from MDAPEi (MDAPEi = median {|PEij, j = 1, ..., Ni}).

**Results**

The time course of the measured/predicted concentration of propofol and the measured/predicted error versus time of both models is depicted in figure 1 and 2, respectively.

The mean (SD) was -40.50 (53.08)% and -25.90 (36.80)% for Marsh and Schnider, respectively. The mean MDAPEi is 60.22 (28.24)% and 39.45 (21.38)% for Marsh and Schnider respectively.

**Conclusions**

Both models show a large error in the first minute after injection due to re-circulation phenomena. The mismatch in the first 5 minutes is larger in the March model than in the Schnider model, shown by the larger PE and MDAPE. Moreover, the error in the Schnider model is fading out in time, but not in the Marsh model. As such, the Schnider model is more accurate to predict the time course of the propofol plasma concentration after a bolus of propofol.

**References**

**Evaluation of the pressure characteristics of the new Kanmed Warmcloud body warming device in healthy volunteers.** S. VANHERPEN, P. COSAERT, K. REYNTJENS, A. CHAFAI, T. DEFLOOR, M. STRUYS.

**Introduction**

This study aims to evaluate the pressure characteristics of a new patient body warming device (Kanmed Warmcloud, Kanmed AB, Sweden), consisting of a warm air flow generator connected to an inflatable, disposable air mattress positioned underneath the patient. Besides adequate temperature management, this device possibly reduces the risk of developing pressure sores in the perioperative setting.

**Materials and Methods**

Twenty healthy subjects (11 male, 9 female; aged 20-55; BMI 19.3-38) volunteered to participate in this protocol after institutional ethics committee approval and signed informed consent.

We recorded the pressures generated in the lower back and the pelvic area with a sensor mattress device (FSA, Vista Medical Europe BV, The Netherlands) and we compared the pressures generated by the standard operating table mattress (WM) with those generated by the body warming device with increasing pressure settings (20, 25, 30, 35, 40, 45, 50, 55 and 60 mbar) in supine and right lateral decubitus. Since temperature management was not the issue of the investigation, the temperature setting of the device was kept on 36°C. All pressure recordings were repeated for reproducibility purposes (hence R1, R2, Z1, Z2).

Pressure recordings were made using a standard portable computer with FSA recording software. Statistical analysis of the results was performed with Sigmastat 2000 (SPSS inc. USA). We used repeated measures ANOVA for maximum and average pressures.

**Results**

The maximum pressure measurements obtained are as shown in figure 1 below. Maximum and average pressure measurements showed equal statistical significant differences.

**Discussion**

In this study we evaluated the pressure characteristics of the new KanMed WarmCloud body warming device in healthy volunteers. We tested possible pressure relieving properties of this device in healthy volunteers and compared these properties to those of a standard slow-release operating mattress in supine and right lateral decubitus. We limited our measurements to pressure recordings of the pelvic area since generally the highest pressures are recorded in that region. On the other hand, this enabled us to use a pressure sensor device measuring pressures up to 200 mmHg. Our results indicate that at all pressure settings, the recorded mean and maximum pressures with the KanMed WarmCloud device are significantly lower than with the standard operating mattress we used. Pressures recorded in lateral decubitus were higher than in supine position. Since this protocol was performed in healthy volunteers, we cannot draw any conclusions concerning decreased risk of pressure sores in surgical patients, but similar pressure reducing characteristics can be expected.

**Conclusions**

All preset pressures of the Kanmed warming device, in supine and right lateral decubitus, resulted in enhanced patient comfort with decreased pressures generated in the lower back and pelvic area. This characteristic could possibly prevent pressure sores. Therefore it may be useful to test the body warming device in surgical procedures with protracted immobilisation of patients.

**References**