Abstracts

The SmartVest: A smart system for remote, multi-parameter physiological monitoring

Pandian et al

Investigators at the Defense Bioengineering and Electromedical Laboratory (DEBEL) in Bangalore , India describe the development of a "SmartVest" a wearable, washable system for remote physiological monitoring.

According to the DEBEL team, the SmartVest offers several advantages over comparable systems, which include the SenseWear armband, the LifeShirt from Vivometrics, and the MagIC system, all of which are briefly outlined. The primary advantage of the SmartVest is its ability to simultaneously monitor a number of vital parameters including electrocardiogram (ECG), photoplethysmogram (PPG), body temperature, blood pressure (systolic and diastolic), galvanic skin response (GSR) and heart rate all in a single device, without the attention or intervention of the wearer. The SmartVest integrates into a washable shirt an array of sensors that are connected to a CPU with software for the continuous evaluation of physiological parameters. These data are sampled at 250 samples/s, digitised at 12-bit resolution and transmitted wirelessly to a remote physiological monitoring station for analysis. The system acquires good-quality ECG without using gel, and blood pressure (both systolic and diastolic) is measured by a non-invasive, cuffless method.

Importantly, the system also incorporates wireless communication and global positioning system (GPS) modules, allowing remote monitoring of the wearer's physiological signals and rapid localization of the wearer should the need for medical evacuation arise. As such, the SmartVest is ideal for applications involving military personnel, particularly while these are operational in the battlefield. Other possible wearers include firefighters, police, miners, divers, pilots, and astronauts (for whom GPS is of course somewhat less useful). (Medical Engineering and Physics , September 2007)

Mind the gap: localising epidural catheters via electrical stimulation

Charghi et al

In order to verify the position of epidural catheters, electrical stimulation using a catheter connected to a nerve stimulator is performed. This procedure, introduced only in the past few years, has contributed to an improvement in the success rate of correct epidural placement. Nevertheless, the disadvantage with this method is that normal saline is needed as a priming solution in order to enable sufficient electrical conduction, meaning that any air locks in the system will block the flow of current. To rectify this problem, researchers at Montreal General Hospital tested a new approach based on epidural stimulation using a single-port, metal coil-reinforced catheter containing a removable stylet (TheraCath). The Montreal team first examined the characteristics of stimulation (current, pulse width, peak level of myotomal contraction) enabled by this new method, and then determined its sensitivity, specificity, positive predictive value, and negative predictive value in comparison with the commonly-used technique for confirming epidural-space acquisition (ice test). These values were found to be 92, 83, 98, and 50%, respectively.

These results suggest that the TheraCath provides an effective electrostimulation of the epidural space, and further demonstrate its use to be straightforward and without complications. Further clinical testing should pave the way for routine use. (Regional Anesthesia and Pain Medicine , March-April 2007)

Efficacy and safety of high concentration lidocaine for trigeminal nerve block in patients with trigeminal neuralgia

K. R. Han, C. Kim, Y. J. Chae, D. W. Kim

Thirty-five patients with primary TN received trigeminal nerve blocks with 10% lidocaine. Success was defined as complete pain relief or mild pain without medication 1 day after the treatment. We followed the patients up every 2 months assessing for pain recurrence, sensory changes and other complications for a total of 3745 months (median 43 months). Twelve of the 35 patients (34.3%) responded favourably to the treatment and were considered as success. Eleven patients experienced complete pain relief and one could tolerate pain without medication 1 day after the blocks, which lasted for 3172 weeks. Four patients experienced mildly decreased sensation in the region of the face supplied by the nerve 1 day after the blocks; however, all recovered normal skin sensation in 6 months. There was neither allodynia nor other sensory discomfort. The pain intensity and current pain duration before treatment were significantly different between the two groups.

Conclusion: Trigeminal nerve block with high concentration lidocaine (10%) is capable of achieving an intermediate period of pain relief, particularly in patients with lower pain intensity and shorter pain duration prior to the procedure.

(International Journal of Clinical Practice, doi:10.1111/j.1742-1241.2007.01568.x)

Dynamic Interaction of Craniofacial Structures during Head Positioning and Direct Laryngoscopy in Anesthetized Patients with and without Difficult Laryngoscopy.

Kitamura, Yuji ; Isono, Shiroh ; Suzuki, Noriko ; Sato, Yumi; Nishino, Takashi

Background: The aim of this study was to examine how head

positioning and direct laryngoscopy alter arrangements of craniofacial structures.

Methods: Digital photographs of the lateral view of the head and neck were taken at each step of head positioning and direct laryngoscopy in age- and body mass index-matched patients with (n = 13) and without (n = 13) difficult laryngoscopy during general anesthesia with muscle paralysis. The images were used for measurements of various craniofacial dimensions.

Results: Both simple neck extension and the sniffing position produced a caudal shift of the mandible and a downward shift of the larynx, resulting in an increase of the submandibular space. Direct laryngoscopy during the sniffing position displaced the mandible and tongue base upward and caudally, and the larynx downward and caudally, increasing the submandibular space and facilitating vertical arrangement of the mandible, tongue base, and larynx to the facial line. These structural arrangements in response to direct laryngoscopy were not observed in patients with difficult laryngoscopy, whereas head positioning produced similar structural arrangements in patients with and without difficult laryngoscopy.

Conclusion: Increase in the submandibular space and a vertical arrangement of the mandible, tongue base, and larynx to the facial line seem to be important mechanisms for improving the laryngeal view during head positioning and direct laryngoscopy. Failure of these structural arrangements in response to direct laryngoscopy may result in difficult laryngoscopy. (Anesthesiology. 107(6):875-883, December 2007).

Craniocervical Motion during Direct Laryngoscopy and Orotracheal Intubation with the Macintosh and Miller Blades: An In Vivo Cinefluoroscopic Study.

LeGrand, Scott A. ; Hindman, Bradley J. ; Dexter, Franklin, Weeks, Julie B. M.P.T. ; Todd, Michael M.

Background: The aim of this study was to compare maximal segmental craniocervical motion occurring during direct laryngoscopy and orotracheal intubation with Macintosh and Miller blades.

Methods: Eleven anesthetized and pharmacologically paralyzed patients underwent two sequential orotracheal intubations, one with a Macintosh blade and another with a Miller in random order. During each intubation, segmental craniocervical motion from the occiput to the fifth cervical vertebra (C5) was recorded using continuous lateral cinefluoroscopy. Single-frame images corresponding to the point of maximal cervical motion for both blade types were compared with a preintubation image. Using image analysis software, angular change in the sagittal plane at each of five intervertebral segments was compared between the Macintosh and Miller blades.

Results: Extension at occiput-C1 was greater with the Macintosh blade compared with the Miller (12.1[degrees] +/- 4.9[degrees] vs. 9.5[degrees] +/- 3.8[degrees], respectively; mean difference = 2.7[degrees] +/- 3.0[degrees]; P = 0.012). Total craniocervical extension (occiput-C5) was also greater with the Macintosh blade compared with the Miller (28.1[degrees] +/- 9.5[degrees] vs. 23.2[degrees] +/- 8.4[degrees], respectively; mean difference = 4.8[degrees] +/- 4.4[degrees]; P = 0.008).

Conclusions: Compared with the Macintosh, the Miller blade was associated with a statistically significant, but quantitatively small, decrease in cervical extension. This difference is likely too small to be important in routine practice. (Anesthesiology. 107(6):884-891, December 2007.)

Monitoring of Neuromuscular Blockade at the P6 Acupuncture Point Reduces the Incidence of Postoperative Nausea and Vomiting.

Arnberger, Michael ; Stadelmann, Karin ; Alischer, Petra; Ponert, Regina ; Melber, Andrea ; Greif, Robert , M.M.E. Unibe

Background: Electrical stimulation of the P6 acupuncture point reduces the incidence of postoperative nausea and vomiting (PONV). The authors tested the effect of neuromuscular monitoring over the P6 acupuncture point on the reduction of PONV.

During anesthesia, neuromuscular blockade was monitored by a conventional nerve stimulator at a frequency of 1 Hz over the ulnar nerve (n = 110, control group) or over the median nerve (n = 110, P6 group) stimulating at the P6 acupuncture point at the same time. The authors evaluated the incidence of nausea and vomiting during the first 24 h. Fewer subjects in the acupuncture group required ondansetron as rescue therapy (27% vs. 39%; P = 0.086).

Conclusion: Intraoperative P6 acupuncture point stimulation with a conventional nerve stimulator during surgery significantly reduced the incidence of PONV over 24 h. The efficacy of P6 stimulation is similar to that of commonly used antiemetic drugs in the prevention of PONV. (Anesthesiology. 107(6):903-908, December 2007.)

Effects of the Beach Chair Position, Positive End-expiratory Pressure, and Pneumoperitoneum on Respiratory Function in Morbidly Obese Patients during Anesthesia and Paralysis.

Valenza, Franco; Vagginelli, Federica; Tiby, Alberto; Francesconi, Silvia; Ronzoni, Giulio; Guglielmi, Massimiliano; Zappa, Marco; Lattuada, Ezio; Gattinoni, Luciano

Background: The authors studied the effects of the beach chair (BC) position, 10 cm H2O positive end-expiratory pressure (PEEP), and pneumoperitoneum on respiratory function in morbidly obese patients undergoing laparoscopic gastric banding.

Methods: The authors measured elastance (E,rs) of the respiratory system, end-expiratory lung volume (helium technique), and arterial oxygen tension. Pressure-volume curves were also taken (occlusion technique). Patients were paralyzed during total intravenous anesthesia.

Results: In the supine position, respiratory function was

abnormal: E,rs was 21.71 +/- 5.26 cm H2O/l, and end-expiratory lung volume was 0.46 +/- 0.1 l. Both the BC position and PEEP improved E,rs (P < 0.01). End-expiratory lung volume almost doubled (0.83 +/- 0.3 and 0.85 +/- 0.3 l, BC and PEEP, respectively; P < 0.01 vs. supine zero end-expiratory pressure), with no evidence of lung recruitment (0.04 +/- 0.1 l in the supine and 0.07 +/- 0.2 in the BC position). PEEP was associated with higher airway pressures than the BC position (22.1 +/- 2.01 vs. 13.8 +/- 1.8 cm H2O; P < 0.01). Pneumoperitoneum further worsened E,rs (31.59 +/- 6.73; P < 0.01) and end-expiratory lung volume (0.35 +/- 0.1 l; P < 0.01). Changes of lung volume correlated with changes of oxygenation (linear regression, R2 = 0.524, P < 0.001) so that during pneumoperitoneum, only the combination of the BC position and PEEP improved oxygenation.

Conclusions: The BC position and PEEP counteracted the major derangements of respiratory function produced by anesthesia and paralysis. During pneumoperitoneum, only the combination of the two maneuvers improved oxygenation. (Anesthesiology. 107(5):725-732, November 2007.)

Persistent Low-frequency Spontaneous Discharge in A-fiber and C-fiber Primary Afferent Neurons during an Inflammatory Pain Condition.

Xiao, Wen-Hua ; Bennett, Gary J.

Background: Primary afferent nociceptor sensitization and its accompanying spontaneous discharge are believed to be the proximate cause of the spontaneous pain and hypersensitivity that follow an acute tissue injury. Evidence for this comes almost entirely from studies limited to the first few minutes to an hour or two after injury, when the inflammatory reaction to injury has just begun. However, there is evidence that inflammatory pain mechanisms differ from acute pain mechanisms and that the mechanisms that drive and modulate inflammatory pain may evolve over time.

Methods: The authors surveyed spontaneous afferent discharge in rats with hind paw inflammation evoked by complete Freund adjuvant over the entire 14 days of the inflammatory pain condition, as determined in parallel experiments assessing allodynia and hyperalgesia.

Results: Inflammation-evoked heat hyperalgesia, mechanoallodynia, and mechanohyperalgesia began within hours, persisted until at least day 7, and resolved by day 14. A large percentage (23%) of A fibers had spontaneous discharge 2 days after inflammation, but the incidence was much reduced (to 7-9%) by 7 and 14 days. At all times, the A-fiber discharge frequency was low (<3.0 Hz) or very low (<0.3 Hz). A large percentage (24%) of C fibers had spontaneous discharge 2 and 7 days after inflammation, but this also declined to near control levels by day 14; C-fiber discharge frequency was also always low (most at 0.3-1.0 Hz).

Conclusions: The pain, allodynia, and hyperalgesia associated with an established inflammatory condition are associated with a persistent low-frequency spontaneous discharge in both A-fiber and C-fiber sensory afferents. (Anesthesiology. 107(5):813-821, November 2007.)

Nitric Oxide: Involvement in the Effects of Anesthetic Agents.

Toda, Noboru; Toda, Hiroshi ; Hatano, Yoshio

Abstract: There has been an explosive increase in the amount of interesting information about the physiologic and pathophysiologic roles of nitric oxide in cardiovascular, nervous, and immune systems. The possible involvement of the nitric oxide-cyclic guanosine monophosphate pathway in the effects of anesthetic agents has been the focus of many investigators. Relaxations of cerebral and peripheral arterial smooth muscle as well as increases in cerebral and other regional blood flows induced by anesthetic agents are mediated mainly via nitric oxide released from the endothelium and/or the nitrergic nerve and also via prostaglandin I2 or endothelium-derived hyperpolarizing factor. Preconditioning with volatile anesthetics protects against ischemia-reperfusion-induced myocardial dysfunction and cell death or neurotoxicity, possibly through nitric oxide release. Inhibition of nitric oxide synthase decreases the anesthetic requirement. Involvement of nitric oxide in the effects of volatile, intravenous, and local anesthetics differs. This review article includes a summary of information about the sites and mechanisms by which various anesthetic agents interact with the nitric oxide-cyclic guanosine monophosphate system. Anesthesiology. 107(5):822-842, November 2007.)

Programming Pressure Support Ventilation in Pediatric Patients in Ambulatory Surgery with a Laryngeal Mask Airway

Javier Garcia-Fernandez, Gerardo Tusman, Fernando Suarez-Sipmann, Julio Llorens, Marina Soro, and Javier F. Belda

BACKGROUND: Anesthesia workstations with pressure support ventilation (PSV) are available, but there are few studies published on how to program flow-triggered PSV using a laryngeal mask airway (LMA) under general anesthesia in pediatric patients.

METHODS: We studied 60 ASA I and II patients, from 2 mo to 14 yr, scheduled for ambulatory surgery under combined general and regional anesthesia with a LMA. Patients were classified according to their body weight as follows: Group A 10 kg, Group B 1120 kg, and Group C >20 kg. All were ventilated in PSV using the following settings: positive end-expiratory pressure of 4 cm H2O, the minimum flow-trigger without provoking auto-triggering, and the minimum level of pressure support to obtain 10 mL/kg of tidal volume.

RESULTS: The flow-trigger most frequently used in our study was 0.4 L/min, ranging from 0.2 to 0.6 L/min. We found no correlation between the flow-trigger setting and the patient's age, weight, compliance, resistance, or respiratory rate. There was a good correlation between the level of pressure support (Group A = 15 cm H2O, Group B = 10 cm H2O and Group C = 9 cm H2O) and age (P < 0.001), weight (P < 0.001), dynamic

compliance ($P < 0.001$), and airway resistances ($P < 0.001$).

CONCLUSIONS: PSV with a ProsealTM LMA in outpatient pediatric anesthesia can be programmed simply using the common clinical noninvasive variables studied. However, more studies are needed to estimate the level of pressure support that may be required in other clinical situations (respiratory pathology, endotracheal tubes, or other types of surgeries) or with other anesthesia workstations.

Ketamine Does Not Increase Pulmonary Vascular Resistance in Children with Pulmonary Hypertension Undergoing Sevoflurane Anesthesia and Spontaneous Ventilation

Glyn D. Williams, Bridget M. Philip, Larry F. Chu, M. Gail Boltz, Komal Kamra, Heidi Terwey, Gregory B. Hammer, Stanton B. Perry, Jeffrey A. Feinstein, and Chandra Ramamoorthy

BACKGROUND: The use of ketamine in children with increased pulmonary vascular resistance is controversial. In this prospective, open label study, we evaluated the hemodynamic responses to ketamine in children with pulmonary hypertension (mean pulmonary artery pressure >25 mm Hg).

METHODS: Children aged 3 mo to 18 yr with pulmonary hypertension, who were scheduled for cardiac catheterization with general anesthesia, were studied. Patients were anesthetized with sevoflurane (1 minimum alveolar anesthetic concentration [MAC]) in air while breathing spontaneously via a facemask. After baseline catheterization measurements, sevoflurane was reduced (0.5 MAC) and ketamine (2 mg/kg IV over 5 min) was administered, followed by a ketamine infusion (10 μg · kg1 · min1). Catheterization measurements were repeated at 5, 10, and 15 min after completion of ketamine load. Data at various time points were compared (ANOVA, $P < 0.05$).

RESULTS: Fifteen patients (age 147, 108 mo; median, interquartile range) were studied. Diagnoses included idiopathic pulmonary arterial hypertension (5), congenital heart disease (9), and diaphragmatic hernia (1). At baseline, median (interquartile range) baseline pulmonary vascular resistance index was 11.3 (8.2) Wood units; 33% of patients had suprasystemic mean pulmonary artery pressures. Heart rate (99, 94 bpm; $P = 0.016$) and Pao2 (95, 104 mm Hg; $P = 007$) changed after ketamine administration (baseline, 15 min after ketamine; P value). There were no significant differences in mean systemic arterial blood pressure, mean pulmonary artery pressure, systemic or pulmonary vascular resistance index, cardiac index, arterial pH, or Paco2.

CONCLUSIONS: In the presence of sevoflurane, ketamine did not increase pulmonary vascular resistance in spontaneously breathing children with severe pulmonary hypertension.

The Clinical Impact of Preoperative Melatonin on Postoperative Outcomes in Patients Undergoing Abdominal Hysterectomy

Wolnei Caumo, Fernanda Torres, Nívio L. Moreira, Jr, Jorge A. S. Auzani, Cristiano A. Monteiro, Gustavo Londero, Diego F. M. Ribeiro, and Maria Paz L. Hidalgo

BACKGROUND: Melatonin has sedative, analgesic, antiinflammatory, antioxidative, and chronobiotic effects. We determined the impact of oral melatonin premedication on anxiolysis, analgesia, and the potency of the rest/activity circadian rhythm.

METHODS: This randomized, double-blind, placebo-controlled study included 33 patients, ASA physical status III, undergoing abdominal hysterectomy. Patients were randomly assigned to receive either oral melatonin 5 mg ($n = 17$) or placebo ($n = 16$) the night before and 1 h before surgery. The analysis instruments were the Visual Analog Scale, the State-Trait Anxiety Inventory, and the actigraphy.

RESULTS: The number of patients that needed to be treated to prevent one additional patient reporting high postoperative anxiety and moderate to intense pain in the first 24 postoperative hours was 2.53 (95% CI, 1.4112.22) and 2.20 (95% CI, 1.268.58), respectively. The number-needed-to-treat was 3 (95% CI, 1.355.0) to prevent high postoperative anxiety in patients with moderate to intense pain, when compared with 7.5 (95% CI, 1.36) in the absence of pain or mild pain. Also, the treated patients required less morphine by patient-controlled analgesia, as assessed by repeated measures ANOVA ($F[1,31] = 6.05$, $P = 0.02$). The rest/activity cycle, assessed by actigraphy, showed that the rhythmicity percentual of 24 h was higher in the intervention group in the first week after discharge ([21.16 ± 8.90] versus placebo [14.00 ± 7.10]; [$t = 2.41$, $P = 0.02$]).

CONCLUSIONS: This finding suggested that preoperative melatonin produced clinically relevant anxiolytic and analgesic effects, especially in the first 24 postoperative hours. Also, it improved the recovery of the potency of the rest/activity circadian rhythm.

The EpisureTM Syringe: A Novel Loss of Resistance Syringe for Locating the Epidural Space

Edward T. Riley, MD, and Brendan Carvalho, MBBCh, FRCA

INTRODUCTION: The Episure syringeTM is a unique spring-loaded loss-of-resistance (LOR) syringe with a coaxial compression spring within a Portex PulsatorTM LOR syringe. This syringe supplies a constant pressure while the operator is advancing the Tuohy needle.

METHODS: We evaluated the syringe using an artificial model of the ligamentum flavum, an anesthetized pig, and women who desired epidural analgesia for labor.

RESULTS: The operator, using the spring-loaded syringe, was able to stop the forward movement of the needle, so that compared with a standard LOR syringe less of the needle protruded out the back of the laboratory model. Satisfactory labor analgesia in the human study and radiograph analyses in the porcine model confirmed epidural placement in all attempts.

CONCLUSION: The spring-loaded syringe is a potentially useful LOR syringe that provides a reliable, objective end-point for identification of the epidural space.