

# **ORAL PRESENTATIONS**

## **ANESTHETIC MANAGEMENT OF INFANTS WITH HYPOPLASTIC LEFT HEART SYNDROME UNDERGOING HYBRID PROCEDURES FOR STAGE I PALLIATION.**

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**Introduction:** Hybrid paediatric cardiac surgery is an emerging field that combines skills and techniques used by paediatric cardiac surgeons and interventional paediatric cardiologists. This close collaboration has traditionally been the hallmark of the management of difficult lesions. Stenting the ductus arteriosus and banding of the pulmonary arteries (PA) is an alternative approach for the initial palliation of patients with hypoplastic left heart syndrome (HLHS). This technique achieves the same goals of the classic technique without ever needing to use cardiopulmonary bypass and without interrupting cerebral blood flow, therefore reducing the risk of complications. Usually this approach is done in a cardiac catheterization laboratory and the management of these patients under such conditions presents with a unique set of challenges to the anaesthesia care team. We review our experience in the anaesthetic management of the first two patients with HLHS who underwent hybrid procedures in our country.

**Methods:** A retrospective observational review of the anaesthetic records of two patients with HLHS who underwent initial palliation by a hybrid approach.

**Results:** The preoperative diagnosis on both cases was of HLHS, with an ASA classification of IV. Patients were 9 and 19 days of age with a respective weight of 2725 and 3590 grams. None of the patients were on inotropic support prior to the surgery. Patients underwent general anaesthesia induction with ketamine, atropine, fentanyl. Muscle relaxation was achieved either with pancuronium or Rocuronium. Prostaglandin perfusion was maintained during the surgery. Both patients had orotracheal intubation and were mechanically ventilated without any difficulty. After induction patients had placed a central venous catheter in the right external jugular vein, and arterial catheters in the right radial and right femoral arteries. Via a median sternotomy, branch PAs were banded using 3,5 mm Gore-Tex rings. Once the ductus size was measured by initial angiography, the proper size self-expandable stent was deployed over a wire positioned in the descending aorta via the ductus. Although blood loss was not significant, transfusion with pRBCs was made to maintain a haematocrit above 40%. During the surgical procedures the patients started inotropic support with dobutamine. Average anaesthesia and surgery times were 255 min and 173 min respectively. At the end of the procedures the patients were transferred to the ICU and were extubated and off inotropic support in less than 24 hours without any major problem.

**Discussion:** The hybrid stage I palliation of neonates with HLHS has gradually become a valid option. This procedure avoids cardiopulmonary bypass in the first days of life and is well tolerated. Nevertheless this technique is usually done in the cardiac catheterization laboratory and, as with any procedure done in a remote location, it presents with new and unique challenges to the anaesthesia care team regarding the coordination of resources and anaesthetic care.

## **Comparing the neuroendocrine response and iv patient controlled analgesia after open and laparoscopic appendectomies.**

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**Introduction.** With laparoscopic surgery smaller incision, less tissue damage, less inflammatory and stress response and less postoperative pain is aimed at.

**Purpose.** The aim of this study is to compare the neuroendocrine response caused by surgical stress and the postoperative analgesia scores between open and laparoscopic appendectomies in children.

**Methods.** 60 patients between aged 6-14 with ASA I-II physical status were randomly divided into two groups. No premedication was administered and after the iv cannulation blood samples are taken for prolactine, cortisol and glucose levels. After the standard monitorisation (electrocardiography, non-invasive blood pressure and pulse oximetry) general anaesthesia was induced with 1-2 mcg/kg fentanyl, 5-7 mg/kg thiopental and 0.5 mg/kg atracurium. Patients were intubated and sevoflurane was used for the maintenance of anaesthesia. Mean arterial pressure, heart rate, saturation and eTCO<sub>2</sub> were recorded at regular intervals. The blood samples were taken before the general anaesthesia induction, 30 minutes after the first incision and 30 minutes after the surgical operation. For the iv PCA, morphine was used with a bolus dose of 20 mcg/kg. Mean arterial pressure, heart rate, saturation, sedation and VAS (visual analogue scale) scores were recorded postoperative at every 1-2-4-12-24 hours. The side effects were also recorded.

**Results.** There were no significant differences between the two groups for mean arterial pressure, heart rate, saturation and eTCO<sub>2</sub>. In our study the increase in cortisol, glucose and prolactine levels were the same for both groups. The preoperative levels were significantly lower than 30 minute postoperative levels. There were no differences between postoperative analgesic consumption, VAS and sedation scores between the two groups. No side effects were recorded.

**Conclusion.** The studies with adults also showed no significant differences in endocrine responses to surgical stress between open and laparoscopic appendectomies. There are also no differences in both paediatric groups in our study. Thus we concluded that the reason why no differences in postoperative pain and endocrine response in both groups is due to small incision in the open surgical group and to pneumoperitoneum in the laparoscopic group.

## **POST-OPERATIVE OPIOID REQUIREMENTS IN CHILDREN UNDERGOING LAPAROSCOPIC APPENDICECTOMIES VERSUS THE OPEN PROCEDURE.**

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**Background.** Acute appendicitis is the most common surgical emergency in children. Recent studies suggest that laparoscopic techniques confer benefits over the open technique, especially with regard to reduced post-operative analgesia requirements<sup>i</sup>. It is thought that the laparoscopic procedure is significantly less painful, and there is also a reduced need for rescue analgesia<sup>ii</sup>. However, pain after laparoscopic appendicectomies can be significant and difficult to treat, and this may be due to the operative procedure itself e.g. prolonged abdominal distension and inadequate emptying of the abdominal cavity resulting in shoulder tip pain<sup>iii</sup>. Laparoscopic work is increasingly being used in children. The aim of this audit was to look at children who had undergone appendicectomies, with a particular view to looking at post-operative analgesia requirements.

**Material and methods.** Patients were identified retrospectively using our pain database. All children undergoing an appendicectomy were prescribed an NCA or PCA post-operatively. The time period over which data was collected was approximately one year.

**Audit End Points** included: **1** morphine usage **2** pain scores **3** PCA duration. Demographic data was also collected. A STUDENT T test was used to compare parametric data and Mann Whitney or Chi square test was used for non parametric data as appropriate.

**Results.** We managed to recruit 17 patients who underwent the laparoscopic procedures, two had to be excluded because of incomplete data, and 31 who underwent it open, 6 of which were excluded because of incomplete data. Total morphine consumption was 47.75mg (**95% CI** 27.41- 68.09mg) in the open group vs. 27.24 mg (95% CI 6.37-48.12mg) in the laparoscopic group. Average pain scores were 3.35 (95% CI 2.39-4.30) in the open group vs. 3.2 (**95% CI** 1.73-4.67) in the laparoscopic group. The total amount of time spent on NCA/PCA was 2.86 days (95% CI 2.01-3.71 days) in the open group vs. 2.03 days (**95% CI** 1.06-3.01 days) in the laparoscopic group. None of the results were statistically significant.

**Conclusion.** From our audit, there is no significant difference between laparoscopic and open techniques in analgesia requirements. Thus pain and morphine consumption associated with laparoscopic techniques is significant.

**References.** <sup>i</sup> Till H, Lochbuhler H, Kellnar S et al. PCA in Paediatric Surgery; A Prospective Study Following Laparoscopic & Open Appendicectomy Paediatr Anaesth 1996; 6 (1): 29-32 <sup>ii</sup> Lintula H, Kokki H, Vanano K. Single Blind Randomised Clinical Trial of Laparoscopic Vs Open Appendicectomies in Children. Br J Surg. 2001; 88 (4): 510-14 <sup>iii</sup> MoutonWG, Bessel JR, Outen KT, Maddern GJ. Pain after Laparoscopy Surg Endoscopy 1999; 13 (5): 445-48

## **IS THERE ANY IMPACT OF VOLATILE ANESTHETIC AGENTS ON THE INTRAOPERATIVE EVENTS IN PEDIATRIC NEUROENDOSCOPIC THIRD VENTRICULOSTOMY? SEVOFLURANE V.S. ISOFLURANE.**

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**Introduction:** Neuroendoscopic third ventriculostomy (NTV) becomes a popular alternative to standard ventriculoperitoneal shunting due to its higher incidence of success, the speed and simplicity, minimal morbidity and very low mortality with freedom from lifelong dependence on ventriculoperitoneal shunting as well as shunt-related complications. However, during this procedure hemodynamic and electrocardiographic changes were reported very frequently. Aim of this prospective randomized study was to evaluate if there is any impact of volatile anaesthetic agents on the intraoperative events in paediatric NTV.

**Material and methods.** After IRB approval and parents' written informed consent 50 paediatric patients were randomly divided into two groups; following anaesthesia induction and tracheal intubation, anaesthesia was maintained with 0.5 MAC either isoflurane (Group I; n=25) or sevoflurane (Group S; n=25) and 50% N<sub>2</sub>O in O<sub>2</sub> and remifentanil 0.25 µg·kg<sup>-1</sup>·min<sup>-1</sup> infusion. Demographic data, duration of the procedures, heart rate and invasive blood pressure at five minutes intervals, the total amount of irrigation fluid used, any complications during the perioperative complications were recorded.

**Results and discussion:** During procedure 5 patients (20%) in Group S and 7 patients (28%) in Group I experienced bradycardia (p =0.7416). One patient in group S (4%) had venous bleeding controlled with irrigation. Except bradycardia, none of the patients experienced any rhythm rather normal sinus rhythm. We observed that there is no difference at the hemodynamic and electrocardiographic changes during NTV between sevoflurane vs. isoflurane. The central nervous system plays an important role in the regulation of cardiac function and vasomotor tone. During fenestration of the third ventricle floor or rapid inflow of the irrigation fluid, above mentioned structures become ischemic due to reduced regional cerebral perfusion or due to direct trauma. This can lead to bradycardia or other types of cardiovascular responses. We suspect the arrhythmia in NTV might be due to rapid inflow of irrigation fluid. If irrigation solution is applied rapidly, even in small volumes, the local pressure from this may cause hypertension and bradycardia. However none of our children in our study developed hypertension or bradycardia during irrigation. Inflation of the balloon during fenestration in NTV causes local pressure, and this may produce signs that mimic increased ICP. In this study, 20% of the patients in Group S and 28% of the patients in Group I experienced bradycardia during fenestration of the third ventricle floor and balloon dilation, the problem resolved upon deflation of the balloon. This response is a clear indication that balloon causes local pressure. We observed that there is no difference at the hemodynamic and electrocardiographic changes during neuroendoscopic third ventriculostomy between the two different volatile agents; sevoflurane v.s. isoflurane.

**Conclusions.** This result suggests that hemodynamic and electrocardiographic changes during NTV are resulted from being at the close proximity to the vital structures such as medulla oblongata, hypothalamic centres, midbrain and pons, there is no correlation between anaesthetic agents used for maintenance.

**References:** Baykan N, Isbir O, Gercek A et al. J Neurosurg Anesthesiol 2005;17:33-7.

## EXTRAVASCULAR LUNGWATER MEASUREMENT IN CRITICALLY ILL CHILDREN.

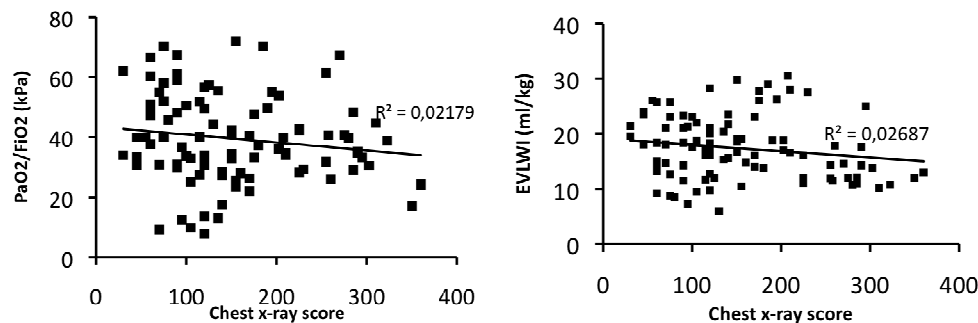
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**Introduction.** Measurement of extra vascular lung water index (EVLWI) quantifies the amount of pulmonary oedema and might be useful in the treatment of critically ill children. EVLWI can reliably be determined at the bedside (1). The goal of this study was to compare EVLWI with several surrogate markers of lung water, a chest x-ray score of pulmonary oedema and severity of illness score in critically ill children.

**Methods.** Prospective observational study in a university hospital. We included mechanically ventilated critically ill children admitted to our PICU with the need for advanced hemodynamic monitoring. EVLWI and other hemodynamic variables, blood gas samples, and a chest x-ray were obtained within a 3 hour time frame. Two experienced radiologists assessed the chest x-ray's independently and determined a score for pulmonary oedema. This score is semi continuous and ranges from 0 (no pulmonary oedema) to 390 (alveolar oedema involving entire pulmonary region) (2). Subsequently the correlation between various parameters was determined. The severity of illness was determined using PIM and PRISMII score.

**Results.** 103 measurements in 24 patients were analyzed, two children died. Mean age was 2 years (range 0.2 – 8.3). Mean number of ventilator days was 10.3 days (range 2 – 20). Mean EVLWI was 16.8 ml/kg (8.3 – 29.0), mean  $\text{PaO}_2/\text{FiO}_2$  was 41.3 kPa (range 15.8 – 70.3) and mean chest x-ray score was 162 (range 75 – 281). Inter-observer agreement for chest x-ray score was moderate with a weighted kappa of 0.53. There was no significant correlation between EVLWI, chest x-ray score,  $\text{PaO}_2/\text{FiO}_2$ , A-a gradient or severity of illness score. However there was a significant correlation between age and mean EVLWI value per patient ( $r = -0.72$ ;  $p < 0.001$ ).



### Conclusions.

1. In critically ill children there was no correlation between EVLW, chest x-ray score of pulmonary oedema or surrogate markers of lung water.
2. EVLWI correlated with age and measured values were higher compared to adult values.

**References:** 1. *Pediatr Crit Care Med* 2009; 10: 227-33. 2. *Chest* 1985; 88: 649-52.

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## THORACOSCOPIC REPAIR OF TRACHEOESOPHAGEAL FISTULA AND ESOPHAGEAL FISTULA ATRESIA IN INFANTS - PERIOPERATIVE MANAGEMENT

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**Introduction.** Congenital esophageal atresia occurs in 1:2000 – 1:3500 live born. A surgical repair of this malformation should be performed in a few days after birth. Applying thoracoscopic methods created a new challenge for pediatric anesthesiologists.[1]

**Purpose.** The main purpose of this work was evaluating the safety and efficacy of thoracoscopic repair of congenital esophageal atresia (EA) with tracheoesophageal fistula (TEF) and the influence of the new method of operation on hemodynamic and ventilation parameters of 28 infants operated in The Pediatric Surgery Department of The University of Medicine in Wrocław from August 2005 to April 2009. The course of anesthesia and postoperative period of treatment were assessed.

**Materials and methods.** 28 infants (16 males and 12 females) who underwent thoracoscopic EA/TEF were included in the analysis. The post-conceptual age of patients varied between 31 – 42 hbd (median 36,3), the average weight was 2257 g (900-3700). 27 infants had congenital atresia of the upper part of esophagus with tracheoesophageal fistula and 1 patient was squalled to two-stage procedure because of a long distance between two parts of esophagus. 12 children suffered from associated malformations such as VATER syndrome -2 patients, congenital heart failure – 3 patients, anal atresia -2 patients, duodenal atresia-1 patient, pylorostenosis-1 patient, Pierre-Robin Syndrome - 2 patients, Edward's Syndrome -1 patient. All procedures, except 1, were performed within 24 to 48 hours. General anesthesia with intubation were performed for all children. Thiopentone, atracurium and fentanyl were used for the induction of anesthesia. Sevoflurane was used for maintenance of anesthesia. The heart rate, noninvasive blood pressure, saturation, end tidal pressure of CO<sub>2</sub>, temperature (central and peripheral) were continuously measured.

**Results.** All procedures were successfully completed without conversion. The average operative time was 110min (65-160min). The process of insufflations was connected with an increase of heart rates, blood pressure and etCO<sub>2</sub>. The most serious problem during anesthesia was high level of etCO<sub>2</sub> which caused frequent changes of parameters of ventilation. Difficulties with maintaining correct body temperature were noted especially during first 4 procedures. This problem was partly solved by starting the process of warming gases used for insufflations. After operation all patients were transferred to the Pediatric Intensive Care Unit. The average time of mechanical ventilation was 4,7 days (4-8). The average stay at PICU lasted 6 days for 16 children without associated malformations and 11 days for the rest. There were 2 cases of accidental tracheal opening and 1 case of intraoperative damage of trachea. The stay of these children at PICU was longer and lasted about 22 days (10-99). All children survived except one who died on the 8th day of stay in PICU (with Edward's Syndrome).

**Conclusion:** The thoracoscopic repair of EA/TEF is an effective method and based on our experience could be the procedure of choice if performed by an experienced endoscopic pediatric surgeon. The process of anesthesia needs an experienced pediatric anesthesiologist. Special attention should be paid to maintaining the correct value of etCO<sub>2</sub> and keeping temperature at regular range. The application of this new operating technique does not influence the postoperative period in any negative way [2].

**References:** 1. Lobe TE, Rothenberg SS, Waldschmidt J. Thoracoscopic repair of esophageal atresia in an infant: a surgical first. *PediatrEndosurg Innov Tech* 1999;3:141–148. 2. Holcomb GW, Rothenberg SS, Bax KMA, et al. Thoracoscopic repair of esophageal atresia and tracheoesophageal fistula: a multi-institutional analysis. *Ann Surg* 2005;3: 119-126 .

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## PRELIMINARY EXPERIENCE WITH DEXMEDETOMIDINE IN NEONATAL ANESTHESIA;

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**Introduction.** This study aimed to assess hemodynamic responses to nociceptive stimuli when dexmedetomidine is used as an adjuvant anesthetic to sevoflurane in newborn patients submitted to surgery for laparotomy.

**Method:** Sixteen newborn were included to this study. Dexmedetomidine ( $1 \mu\text{g kg}^{-1}$ ) was infused during 10 minutes and maintenance infusion was obtained with dexmedetomidine ( $0.5\text{-}0.8 \mu\text{g kg}^{-1} \text{h}^{-1}$ ) until the end of surgery. Patients were intubated (oro-tracheal intubation) and mechanically ventilated with 65%  $\text{N}_2\text{O}$  in 35%  $\text{O}_2$  during the anaesthesia. Sevoflurane was administered 0.1 - 0.2 %. Mechanical ventilation was adapted to maintain an end-tidal  $\text{CO}_2$  level of 33–36 mmHg and  $\text{SpO}_2$  in the range of 95–100%. We recorded measurements of hemodynamic parameters during the anaesthesia. These data were assessed before anaesthesia induction and maintained every 5 min during the operation time.

**Results:** No significant differences were observed measurement intervals compared to the baseline levels in DBP, SBP and HR. Three patients needed supplemental ketamine doses only ones. Sevoflurane concentration was  $0.16 \pm 0.05$  %. No patient needed more than 0.2 % sevoflurane concentration. Comparing to the baseline values a remarkable decrease in temperature all the observation times, it was not achieve statistical significant. ( $p > 0.05$ ). Mean effective dose was  $0.5 \mu\text{g kg}^{-1} \text{h}^{-1}$ . This dose obtained hemodynamic stability and effective anaesthesia.

**Discussion:** The current study, showed that an initial dose of dexmedetomidine ( $1 \mu\text{g kg}^{-1}$ ) followed by a maintenance dose of  $0.5 \mu\text{g kg}^{-1} \text{h}^{-1}$ , as an adjuvant to sevoflurane anaesthesia, in newborn submitted to laparotomy, kept the heart rate and blood pressure stable, also in periods of heightened surgical stimulation.

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## EFFECT OF KETAMINE COMPARED TO PROPOFOL ON EMERGENCE AGITATION IN CHILDREN AFTER SEVOFLURANE ANAESTHESIA.

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**Background.** Emergence agitation after sevoflurane anaesthesia seems to be more frequent in preschool children [1]. Different drugs have been used to decrease its occurrence with variable efficacy. The aim of our study was to compare the preventive effects of the propofol to ketamine in the emergence agitation's appearance in children undergoing elective parietal surgery.

**Material and methods.** After ethics committee approval and parental consent, we performed a randomized double blind study including children aged between 2 and 6 years, ASA status 1-2 and scheduled for elective parietal surgery. Anaesthesia was induced with 6% sevoflurane and a regional block was performed using bupivacaine 0.25%. Anaesthesia was maintained with sevoflurane 2% and O<sub>2</sub>+N<sub>2</sub>O at 0.5. Children were allowed to regain spontaneous ventilation. The children were randomly allocated to receive at the end of surgery and after stopping N<sub>2</sub>O and sevoflurane: serum saline (group S); propofol 1 mg kg<sup>-1</sup> (group P) or ketamine 0.25 mg kg<sup>-1</sup> (group K). In recovery room, Paediatric Anaesthesia Emergence Delirium scale (PAEDs), Ramsay scale and Children's Hospital of Eastern Ontario Pain Scale (CHEOPS) were recorded every 5 minutes. The duration of sevoflurane inhalation, and the time to eye opening were also noted. Were excluded patients with ineffective block or CHEOPS more than 9. We used ANOVA test to compare quantitative variables and Chi-square test for qualitative variables. Differences were considered significant at  $p < 0.05$ .

**Results.** Sixty two children were enrolled (GS=21, GP=20 and GK=21). Ten patients were excluded, nine for CHEOPS more than nine and one because of failure of the block. Demographic data and the duration of sevoflurane inhalation were similar in the 3 groups. The incidence of emergence agitation as well as the time to eye opening was not significantly different between the three groups. The incidence of sedation was higher in ketamine group (*Table 1*).

	GS (n=18)	GP (n=15)	GK (n=19)	<i>p</i>
<b>Agitation (PAEDS ≥ 16/20)</b>	5.5%	0%	5.3%	<i>n</i> <i>s</i>
<b>Sedation (Ramsay &gt;2)</b>	5.5%	13.3%	31.6%	<i>n</i> <i>s</i>
<b>Time to eye opening (mn)</b>	11 ± 7	10 ± 4	11 ± 6	<i>n</i> <i>s</i>

**Conclusion.** Propofol seems to reduce emergence agitation after sevoflurane anaesthesia with lower sedation compared to ketamine.

**References:** Anesthesiology 1997; 87:1298–300.

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## THE EFFECT OF PREMEDICATION WITH COMBINATION OF HYDROXYZINE AND MIDAZOLAM IN DIFFERENT DOSES ON THE POSTOPERATIVE AGITATION

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**Introduction:** The introduction of short acting anesthetic agents introduced a new problem called emergence agitation in pediatric patients (1). The effect of hydroxyzine on agitation as a premedicant has not yet been studied. The aim of this study was to investigate the effect of premedication with combination of hydroxyzine and midazolam in different doses on postoperative agitation.

**Methods:** Following ethical committee approval, 100 children aged between 2-10 years scheduled for inguinal surgery were randomly allocated into 5 groups. Patients were orally premedicated with 0.5 mg.kg<sup>-1</sup> midazolam in Group M, 0.5 mg.kg<sup>-1</sup> hydroxyzine in Group H, 0.5 mg.kg<sup>-1</sup> midazolam with 0.25 mg.kg<sup>-1</sup> hydroxyzine in Group MH<sub>2</sub>, 0.25 mg.kg<sup>-1</sup> midazolam with 0.5 mg.kg<sup>-1</sup> hydroxyzine in Group M<sub>2</sub>H and 0.25 mg.kg<sup>-1</sup> midazolam with 0.25 mg.kg<sup>-1</sup> hydroxyzine in Group M<sub>2</sub>H<sub>2</sub>. Parental separation, sedation level just before induction and induction quality were assessed. All patients received general anesthesia combined with caudal block. Agitation was assessed with a 10 point-scale (2) with 15 minutes intervals at the 1<sup>st</sup> postoperative hour and with 30 minutes intervals thereafter. Recovery and hospital discharge times were recorded. Data were evaluated by using ANOVA and chi-square tests.

**Results:** Mean sedation score of Group MH<sub>2</sub> was significantly higher (4.1±0.9) than the other groups. While mean parental separation score (1.3±0.5) and induction quality score (1.1±0.4) of the Group MH<sub>2</sub> were significantly lower, mean recovery time (42±5.9 min) was longer than the others. Postoperative agitation was significantly lower in the Groups MH<sub>2</sub>, M<sub>2</sub>H and M<sub>2</sub>H<sub>2</sub> compared to children premedicated with the either drugs alone.

**Conclusion:** Oral premedication by midazolam combined with hydroxyzine seems to decrease the postoperative agitation significantly regardless of the combination doses while combination of hydroxyzine with 0.5 mg.kg<sup>-1</sup> midazolam results in longer stay in recovery unit.

### References:

1. Lapin SL, Auden SM, Goldsmith LJ Reynolds AM. Effects of sevoflurane anesthesia on recovery in children: a comparison with halothane. Paediatr Anaesth 1999; 9: 299-304.
2. Meyer RR, Münster P, Werner C, Brambrink AM. Isoflurane is associated with a similar incidence of emergence agitation/delirium as sevoflurane in young children--a randomized controlled study. Paediatr Anaesth. 2007 Jan;17(1):56-60.

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## HOW ARE OUR PATIENTS AT HOME – AN AUDIT OF REGIONAL ANAESTHESIA AND FOLLOW UP IN DAY CASE SURGERY

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**Introduction.** In 2002 the Department of Health (United Kingdom) produced guidelines proposing by 2008, 75% of elective surgery should be done as day cases<sup>1</sup>. 100% of day case patients should be discharged with analgesics and instructions about pain control<sup>2</sup>. In the first 48 hrs, less than 5% should report severe pain on verbal pain score and more than 85% should report mild or no pain after discharge. All patients should be followed up at home as indicated in the Audit Commission review<sup>3</sup>. A prospective audit was performed to examine and compare our practice against set standards.

**Methods.** Approval from the Hospital Clinical Audit Department was obtained. Parents were consented to participate in a telephone survey. Anaesthetic, recovery and post discharge information were collected on a proforma.

**Results.** During the period of August 2008 to January 2009, 58 patients were recruited. Mean age was 3.86 yr (range 0.3 – 12 yr) and mean weight was 10.6 kg. Amongst others, 29% of the procedures were circumcisions, 25% inguinal hernia repairs and 25% orchidopexy. Regional anaesthetic techniques include caudal (49%), ilioinguinal (24%), penile (22%), rectus sheath (2%) and ilioinguinal plus genitofemoral (3%) blocks. 53 cases used 0.25% levobupivacaine and 5 cases 0.5% levobupivacaine. 43% of the blocks were done by consultants, 39% by senior trainees of which 69% were supervised by consultants, 12% by fellows and 3% by junior trainees. Intraoperatively, Paracetamol was used in 41% of patients. In recovery, 17% of patients complained of pain with scores > 3. All patients were treated and discharged from recovery with no pain. 76% of parents responded to the post discharge telephone survey. There was history of vomiting (13%), leg weakness (4%) and itching (2%). One patient was readmitted with history of stridor. Parents used a numerical pain scoring system to ascertain the pain at home. 77% of patients had pain scores less than 5 but 23% had pain scores more than 6. 18% of patients received their first analgesia between 6-10 hrs; Paracetamol and Brufen were used in 49%. 85% of parents were satisfied with the delivery of the day case service. 100% received verbal instructions regarding pain control. None of these patients were followed up by day case staff despite participating in our telephone survey.

**Conclusion.** Pain scores at home were not meeting the required standards and follow up was not in keeping with the Audit Commission standards of good practice.

**References.** 1. UK Department of Health. Delivering the NHS Plan. London: Department of Health; 2002. 2. The Royal College of Anaesthetists. Raising the Standards 2<sup>nd</sup> ed. London: The Royal College of Anaesthetists; 2006. 3. Audit Commission. Day Surgery – Review of National Findings. London: Audit Commission; 2001.

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## FEWER TEARS: AN AUDIT CYCLE OF PAIN AFTER PAEDIATRIC DAY CASE SURGERY

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**Introduction.** Increasing numbers of surgical procedures are being performed as day cases, but previous reviews suggest that a significant number of paediatric patients have pain at home afterwards<sup>1</sup>. The routine practice of our day-care unit is to recommend that patients use their own familiar simple analgesics rather than providing take-home packs. A previous audit of pain after day surgery revealed that 10% of patients experienced severe pain and only 44% had mild or no pain. It was noted that in many cases of moderate or severe pain the child had not been given regular analgesia, and that the doses given were frequently inadequate for their weight. A newly developed protocol gives written instructions to every family attending the day-care unit regarding regular analgesia in the post operative period and a Patient Group Directive allows nursing staff to recommend weight-based doses of over-the-counter analgesics. This re-audit examines whether the new system improves pain management, ensures delivery of suitable, regular doses and promotes parental satisfaction.

**Methods.** 100 patients were audited prospectively, using local guidelines and the Royal College of Anaesthetists Audit Compendium<sup>2</sup> standards, including:

- 100% patients discharged with verbal and written instructions about pain control and analgesics available at home
  - <5% reporting severe/unbearable pain, and >85% reporting mild or no pain after discharge
  - >85% parent/carer reporting "satisfied" or "very satisfied" with pain management after discharge
- Hospital data were collected regarding surgical and anaesthetic details and analgesia given in hospital for each participant. Parents were given a data form to record analgesia given, pain severity and satisfaction with pain relief during the first 48 hours post-operatively, with a reply-paid envelope for postal return.

**Results.** 94 hospital forms and 63 parent forms were returned. 97% of children were discharged with analgesia available at home, 90% received the leaflet and 98% remember receiving verbal advice regarding pain control. 95% felt they received adequate information. Only 65% gave analgesia regularly but encouragingly 70% and 69% used suitable doses based upon weight for paracetamol and ibuprofen respectively. Overall, 66.7% reported mild or no pain while 5% reported severe or unbearable pain. It is notable that of those reporting moderate or worse pain, analgesia was often only given as needed despite receiving written and verbal advice. 90% of parents reported "Excellent" or "Good" pain control, and 84% were "satisfied" or "very satisfied" with the system with only 6.5% unsure, and 1.6% unsatisfied.

**Conclusions.** The new system of written advice for use with over-the-counter analgesics has improved pain scores and helps to ensure paediatric patients are not under-dosed. However despite advice, a large number of parents still do not give analgesia regularly and these patients tend to have higher pain scores. Parent satisfaction overall is good.

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## HUMAN FACTORS ON THE CUTTING EDGE: AN OBSERVATIONAL STUDY OF PEDIATRIC CARDIAC SURGERY

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**Introduction.** Pediatric cardiac surgery (PCS) is an ideal model to study the coordinated efforts of team members in a complex organizational structure. We explored the impact of human factors on intraoperative non routine events and adverse outcomes in Pediatric Cardiac Surgery.

**Methods.** Prospective observations of PCS procedures were conducted by two researchers from the patient pick-up for surgery to the patient hand-off in the intensive care unit. Complexity scores were calculated using the AristotleR scoring system and outcomes were coded as: 1) uncomplicated hospital stay, 2) mild morbidity, 3) major morbidity, 4) death. Process of care was divided into seven epochs: 1) pre-op/transport to OR, 2) pre-surgery/anesthesia induction, 3) surgery/pre-bypass, 4) surgery/bypass/repair, 5) surgery/post-bypass, 6) transport to ICU, 7) handoff.

Events were extracted and coded into compensated or uncompensated major and minor events.

Based on NIH definitions, adverse events were defined as unintended incidents in care that may result in adverse outcomes or may require additional care efforts to prevent adverse outcome. Depending on the outcome, they were described as compensated (no adverse outcome) or uncompensated. Linear regression and analysis of variance (AOV) were used to analyze relationships between epochs, complexity, number of events and outcome. Variables such as age, weight, decompensation, pre-op intubation, complexity, surgery duration, pre-surgery/anesthesia induction duration, number of minor events/case, and cardiopulmonary bypass were tested in a forward stepwise logistic regression as predictors of cases with 1 or more major events.

**Results.** In the 13-month study period, 102 (29%) of 345 cases were observed. The study group median age was 119 days (range 1-5758), and the median complexity was 12.1 (range 5-24.5). The overall study mortality was 4.8% (N=4), with no intraoperative mortality. An average of 1.2 (range 0-6) major events occurred per case. The most common type of major event was cardiovascular (N=15, 16%), while most events occurred during the surgery/post-bypass epoch (N=41, 45%). Cognitive compensation was the most common defense mechanism (N=38, 41%) for major events. An average of 15.3 minor events (range 2-35) occurred per case. The most common type of minor event was communication and coordination failure (N=315, 26%). Minor events occurred most frequently during the surgery/bypass epoch (N=385, 31%). Surgery duration (mean=201 min; SD=91 min) correlated with case complexity. AOV showed significantly higher case complexity, longer surgery duration and higher number of major events/case with death outcomes compared to other outcome groups ( $p<0.01$ ). Using a logistic regression model we found that complexity OR=1.29 (1.05-1.57,  $p=0.0131$ ) and surgery duration OR=1.01 (1.00-1.02,  $p=0.0475$ ) were both significant predictors of major events.

**Discussion.** We demonstrated that major and minor events occur regularly during PCS and their number increases with case complexity and impacts outcome. Observation by qualified observers is an excellent method to identify latent failures and provides tools to improve the quality of peri-operative processes and to reduce non routine events.

**Reference:** Barach P. et al. A prospective observational study of human factors, adverse events, and patient outcomes in surgery for pediatric cardiac disease. *J Thorac Cardiova Surg.* 2008 Dec;136(6):1422-8.

## THREE REGIMENS OF MULTIMODAL ANALGESIC IN TREATMENT OF PAIN AFTER CARDIAC SURGERY WITH CARDIOPULMONAR BYPASS.

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**Introduction.** Our objective is to study the efficacy of wound catheters delivering a continuous infusion of levobupivacaine into a multimodal postoperative analgesia therapy after cardiac surgery with CardioPulmonar Bypass in children.

**Methods.** Three different guidelines of multimodal analgesia in the treatment of pain after cardiac surgery with cardiopulmonary bypass have been studied. It has been evaluated day by day the pain, worst pain during the treatment and degree of sickness. We studied 600 children aged from 1 to 9 years divided in three groups. GROUP 1 (111 patients) with iv morphine in a PCA/NCA system with first dose of 50µg/Kg, bolus of 10µg/Kg and infusion at 4µg/Kg . GROUP 2 (176 patients): They only received iv morphine (but with first dose of 100µg/Kg, bolus of 10µg/Kg and infusion at 10µg/Kg.). GROUP 3 (115 patients): a continuous wound catheter was placed adjacent to the sternum by the surgeon at the end of the procedure. The local anaesthetic was levobupivacaine 2cc/h (maximum dose 0,4 mg.kg.h) and iv morphine in a PCA/NCA system with first dose of 100µg/Kg, bolus of 10µg/Kg and no infusion.

In all patients it was administrated iv paracetamol 15 mg.kg/6hours. During the first postoperative three days pain was evaluated by APS using the scales from our hospital protocol, and categorized as 0=none (EVA 0), 1=mild (EVA: 1-4), 2=moderate (EVA 5-7), 3=severe (EVA:8-10). The total morphine consumption, catheter-related complications and parent satisfaction measured by a qualitative scale were evaluated at the third postoperative day in all groups.

Pain was statistically analysed using Fisher,s Exact test, while the Kruskal-Wallis test was used in the analysis of morphine dose/weight and the sickness appearance with the Pearson's Chi-square test.

**Results.** Significant differences have been found with respect to the presence of moderate pain, being lower in GROUP 3. The apparition of sickness also has significant differences. In the morphine dose, resides there is no significant difference between the three groups, it can be observed a minimum Standard deviation in GROUP 3, which indicates a very homogeneous treatment.

Moderate pain	PAIN DAY 1	PAIN DAY 2	PAIN DAY 3
GROUP 1 (p<0,001)	0,66+/-0,74 (16,2%)	0,59+/-0,64 (8,2%)	0,44+/-0,75 (8,3%)
GROUP 2 (p<0,001)	0,55+/-0,68 (8,59%)	0,47+/-0,61 (4,1%)	0,35+/-0,61 (7,2%)
GROUP 3 (p<0,001)	0,21+/-0,52 (5,2%)	0,20+/-0,48 (3,3%)	0,14+/-0,38 (1,26%)

Sickness	DAY 1	DAY 2	DAY 3
GROUP 1 (p<0,001)	4,5%	2,78%	0
GROUP 2 (p<0,007)	1,14%	0,58%	0
GROUP 3 (p<0,003)	0	0,9%	0,27%

	Morphine dose (µg)/Weight(Kg)
GROUP 1 (p<0,623)	341,8+/-193 (median:290,83)
GROUP 2 (p<0,623)	472+/-1453 (318,18)
GROUP 3 (p<0,623)	589,38+/-4,44 (333,3)

**Discussion:** The multimodal analgesia offers a good pain control, decrease of adverse effects and it allows the application of standard treatments. It is necessary to design analgesic protocols for paediatric surgery patients. The treatment of post-surgery pain should be analysed and controlled in a process of continuous improvement.

## AUDIT OF PAEDIATRIC ANAESTHETIC RECORD KEEPING

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**Introduction.** Anaesthetic record helps to facilitate the provision of care during and after anaesthesia. It is an aid in provision of future anaesthesia and also a legal document. It is also part of Compliance with NHSLA health standards. To ensure effectiveness RCOA recommends standards<sup>1</sup> and regular audit of anaesthetic notes. The recent NICE guidelines<sup>2</sup> (CG 65) even though is for patients above the age of 18, we think it is quite applicable for children's as well.

**Aim.** To establish whether anaesthetists at St George's hospital are documenting all stages of paediatric anaesthesia and also to ensure that temperature is also documented.

**Method.** Retrospective review of anaesthetic records was done to collect all the data. All paediatric patients having General Anaesthetic and admitted to Jungle ward over a 2 week period (6<sup>th</sup>-20<sup>th</sup> January 2009) were collected. A tick box Performa was used to examine 73 points which was broken down into 5 sections Pre-op, Plan, Intra-op, Anaesthetic Chart and Post-op. A Score is given if recorded appropriately and Score 0 if not recorded.

**Results.** Over 2 week period, 85 anaesthetic records looked at which were filled in by combination of consultants and trainees

	Recorded >80%	Recorded < 80%
Pre-Op	Patient name, name of anaesthetist, date, medical history, allergies	ASA, weight, airway, Teeth
Anaesthetic Plan	Premed, blocks	Induction, IV line, Risks
Intra Op	Operation, name of anaesthetist, airway technique, machine check, induction method, type of ventilation, drugs, maintenance, Monitoring, signature,	Name of surgeon, Grade of surgeon, ET size, easy difficult, cuffed/ uncuffed, ET length, airway pressure, eye taped, position, Warming method
Anaesthetic flow chart	Time, FiO <sub>2</sub> , ET CO <sub>2</sub> , MAC, Saturation, HR, BP, Fluid type, amount	Drug units, Temperature if >30mts

Legibility -30% of the records difficult to read

**Discussion.** In record keeping "if it is not written down, it didn't happen". In this audit we found out that there is excellent documentation of anaesthetic flow chart but there are lot of improvements to be made on all point that scored less than 80%. This is particularly true with regards to temperature.

When new trainees come in they have to be educated with regards to documentation. Also importance of NICE guidelines should be reiterated to anaesthetic and nursing staff. Encouraging risk management courses may help better documentation. Making the anaesthetic chart tick box driven might solve some of the problems.

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## ADVANTAGES OF THE ULTRASOUND-GUIDED TECHNIQUES FOR PLACEMENT OF CENTRAL VENOUS CATHETERS IN PAEDIATRIC PATIENTS. LEARNING CURVE OF THE USE OF ULTRASOUNDS.

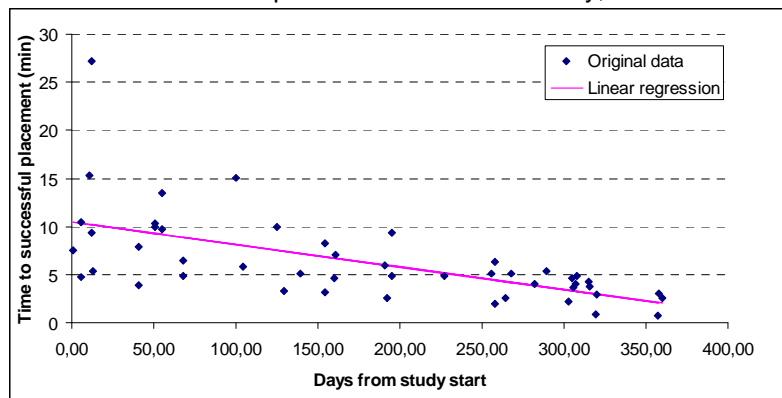
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**Introduction.** The aim of this study is to analyse the advantages of using ultrasound-guided central venous catheter placement with respect to landmark techniques in paediatric patients. Two main aspects have been evaluated: success at first attempt and inadvertent arterial punctures. As additional objective, the learning curve of the paediatric anaesthesiologist in the use of this ultrasound technique is described.

**Methods.** A retrospective study of 98 paediatric patients that needed central venous catheter placement (jugular or femoral) has been carried out. The patients are divided in two groups: GROUP A, central venous catheter placement using landmark techniques; and GROUP B, using ultrasound-guided technique. This activity was performed from 30th of April 2008 to 30th of April 2009 and only 3 paediatric anaesthesiologists with no experience in the use of the ultrasound-guided technique worked in the study. In all patients, the following variables have been registered: age, weight, foreseen surgery, site of attempt of the central venous catheter (jugular or femoral), ultrasound-guided or landmark technique, success in the 1<sup>st</sup>, 2<sup>nd</sup> or 3<sup>rd</sup> attempt, anatomical site change, time to successful placement and inadvertent artery punctures. The samples are homogeneous in what respects to mean age and mean weight. The Pearson's Chi-Square test has been used to obtain the statistical significance in the comparison between the two groups (qualitative variables are used). A linear regression based on least squares method has been calculated to analyse the learning curve of the use of ultrasounds.

**Results.** The success in the first attempt with patients from GROUP A appeared only in 22.2% of the cases while the percentage of success with patients from GROUP B was 56.6%. Inadvertent artery punctures appeared in 66.7% of the cases in GROUP A, being this value only 13.21% with patients from GROUP B. With respect to the learning curve of the use of ultra-sound techniques, the time to successful placement decreases with experience  $m=-0.024$  min/day; correlation coeff = 0.61.



**Conclusions:** 1. The success in the first attempt using ultrasound-guided techniques is more frequent ( $p<0.025$ ) than using landmark techniques. Related with this fact, the overall time for central venous catheter placement is shortened in paediatric patients. 2. The inadvertent artery punctures decreases with statistical significance ( $p<0.001$ ) by making use of ultrasound techniques. 3. The experience of the anaesthesiologist using ultrasounds shortens the time to successful placement of the central venous catheter and diminishes the inadvertent artery punctures.

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## Age-specific web-based information to prepare children and parents for anaesthesia and surgery

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**Introduction.** Despite the use of verbal and written information prior to anaesthesia and surgery many children and parents still arrive to the OR unprepared for the experience. The goal of this project was to create a web-based age-specific information system that may improve children and parent comfort prior to anaesthetic induction.

**Background.** Following a preparation period of 9 months involving a multidisciplinary team (nurses, doctors, advertising agencies and web-designers) plus extensive interviews with children and parents the information system was launched at our hospital in November 2006.

The system is interactive and contains for example age-specific cartoons, web-books, videos and interviews with pre-school and school children as well as teenagers. It also contains information for parents in 25 languages. The site has an average 1500 visitors monthly, including visitors from more than 20 different countries to date.

**Patients and methods:** During 2007, 5857 children underwent examinations, treatments or surgical procedures associated with anaesthesia of which 3562 (61%) were elective.

During the audit period September-December 2007, 2076 children underwent anaesthesia of which 1350 (65 %) were elective.

The information system is available to both elective and acute patients but this initial follow-up has focused on patients admitted for elective surgery.

All families whose children were planned for elective procedures associated with anaesthesia were encouraged in their scheduling letter to visit the web-site prior to their hospital visit.

A questionnaire was prepared for parents and distributed to them immediately following the anaesthesia induction. The parents were asked to answer the questions during their stay in the waiting room and collected by the staff at the recovery unit.

**Results:** 94% of the respondent parents felt well-informed after visiting the website. 93 % of the respondent parents also felt that their child was well-informed after the visit. When asked what they would like to receive as supplemental information to future pre-anaesthetic visits to the anaesthesiologist, most preferred web-based information over written information or an operating room tour (table 1). 22 % of the respondent felt well-informed after visiting the web-site and expressed no need for additive information to the pre-anaesthetic visit to the anaesthesiologist.

### Table 1

What information would you like to receive in the future as a complement to the regular pre-anaesthetic visits to the anaesthesiologist?

Web-site information: 47%  
Written information: 17%  
Operation-room visit: 14%  
No need for additive information: 22%

**Limitations/Future development:** Despite that parents and children were encouraged to visit the web-site at the regular preoperative meeting with the anaesthesiologist still only a minority in fact did so (30%). To generate even better results substantial efforts are needed to improve the use of this information tool.

**Conclusions:** Based on the results of the audit of our web-based information system we conclude that it was well received by the families and was preferred to more traditional options, e.g. written information and pre-anaesthetic operating room tours. This web-based information system provides a new, modern and effective tool to provide pre-anaesthetic information.

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## IMPROVING COMMUNICATIONS FOR CHILDREN WITH SPECIAL NEEDS IN HOSPITAL – AN ANAESTHETIC PERSPECTIVE

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**Introduction.** Children with special needs may suffer from extreme anxiety associated with medical procedures, but are not always well served by conventional information resources. Many of our patients with complex special needs have learning and communication disabilities making it difficult for them to tolerate treatment. We wished to improve our ability to share information with them, both before and on the day of surgery. We investigated the methods of communication used by children in special education and also gathered information from their parents.

**Methods.** A survey was distributed to all parents of children attending 7 local special schools. The questionnaire asked about the challenges faced by each child and the level of concern felt by the parent about aspects of the hospital process. It also asked about methods of assisted communication used by the child and asked parents to suggest how we might improve their child's experience at the hospital. The survey was approved by the schools and our hospital service evaluation department, who did not consider formal ethical approval to be necessary. Data were entered anonymously into a Microsoft Access database for analysis.

**Results.** 629 questionnaires were distributed and 178 (28.3%) were returned, a good response rate from this population. The challenges faced by the children, aged 2-18 years, include disabilities of learning 91.6%, communication 85.4%, mobility 38.2%, behavioural control 53.4%, emotional control 45.5%, sight 20.8% and hearing 9.6%. Parents expressed high levels of concern about anaesthesia, surgery and their child being in postoperative pain, and moderate concern about fasting their child, inpatient care and hospital acquired infection. Most parents help to prepare their children for new experiences using their own explanations (79.2%), but also use story books, DVDs, social stories and symbol systems. 37.6% children use Makaton signing, 26.4% use symbol assisted communication and 21.3% use PECS (picture exchange communication system). The most common suggestions for improving hospital care for children with special needs were to minimise waiting times, to provide a quiet, private waiting area, to ensure that staff members understood the implications of learning and communication difficulties, and to provide single rooms for inpatient care.

**Discussion.** Communicating with children with learning and communication difficulties presents a challenge for healthcare workers, but efforts to use communication resources familiar to the child and parent are greatly appreciated. We are developing symbol assisted information and labelling on our day-case ward, including a timeline of the steps in the anaesthetic process. In addition to our efforts to exchange information preoperatively with parents on the specific requirements of each child and our provision of a "home-from-home" waiting area, we hope that improved communication will reduce the need for heavy sedative premedication or restraint for children with special needs. Initial experience with these new resources has been extremely positive from the perspective of both families and staff members.

The Symbol Software was purchased by the hospital's Critical Care Directorate.

## AUDIOVISUAL AID MODERATES THE EXISTING RELATIONSHIP BETWEEN PARENTS' AND CHILDREN'S ANXIETY JUST PRIOR TO ANAESTHESIA

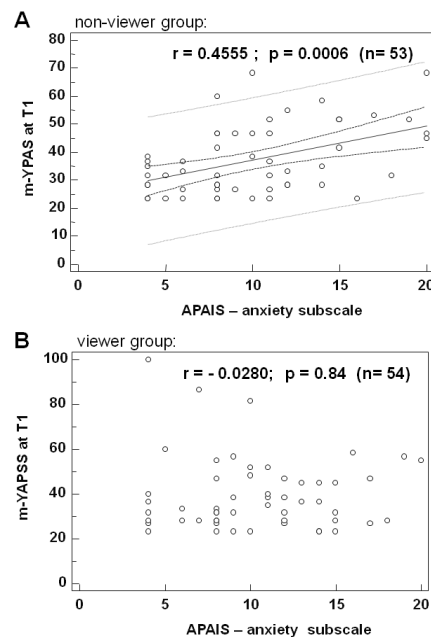
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**Background and goal of study.** Clinically significant anxiety during the preoperative period is as frequent as 50-75%. Anxiety during induction is conventionally associated with 'distress on awakening' and is known to cause postoperative maladaptive behaviour while parents' concerns may even further influence children's anxiety [1]. The present study was designed to test the hypothesis that exposure to a short film (3 min.) could modulate the relationship between parents' and children's anxiety as well as the child's anxiety at induction. This audiovisual aid [*hereafter* AVA] depicts the journey of a little boy and his friend Mr. Dragon to 'Greenland', a metaphor for the operating theatre.

**Materials and methods.** After approval by the local Ethics Committee, 107 children (4-8 years old) entered the study, which was randomised, controlled and blinded with the following inclusion criteria: ASA I or II, day care surgery and good Dutch comprehension of both child and accompanying parent. Subjects previously exposed to surgery and/or anaesthesia or showing developmental retardation were excluded. After providing general information to parents and children, all cases were induced with sevoflurane without any premedication. First the anxiety (T0) of the accompanying parent was quantified using the Amsterdam Preoperative Anxiety and Information Scale (APAIS) [2] and then that of the child by means of the Modified-Yale Preoperative Anxiety Scale (m-YPAS) [3]. After the children and their accompanying parent were transferred to a children-friendly holding area of the theatre for approximately 20 minutes, they were either exposed to AVA or not, according to the randomization. Shortly after theatre admission, a second m-YPAS (T1) assessment was done and a final m-YPAS (T2) was performed at induction, while on the operating table. To prevent inter-observer variability all assessments were performed by the same independent and blinded researcher. Correlation was sought between parental anxiety (fraction APAIS score) and children's anxiety of AVA viewer and non-viewer control groups.

**Results and discussion.** Clinical and demographic data were comparable in both groups. At T1 anxiety of the parents (APAIS-anxiety subscale) and of the children (m-YPAS) correlate significantly ( $r = 0.4555$ ;  $p = 0.0006$ ) in the non-viewer group ( $n=53$ ). However, no correlation ( $r = -0.0280$ ;  $p = 0.84$ ) was found in the viewer group ( $n=54$ ) as shown in figure 1. Correlation coefficients differed



significantly ( $Z = 2.611$ ;  $p = 0.009$ ).

**Figure 1.** Correlation and regression analysis of parent's versus children's anxiety revealed a significant correlation at T1 in the non-viewer

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group (panel A) and not in the viewer group (panel B).

**Conclusion** At T1 when entering the theatre, the relationship between parents' and children's anxiety only disappears in cases exposed to AVA. However, during the very induction of anaesthesia no beneficial influence of AVA could be demonstrated.

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## Change of Paradigm in Ventilation. Experiences with NAVA-Ventilation in Phrenic Nerve Injury

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**Background.** Phrenic nerve injury has a high incidence in pediatric cardiac surgery, some centers report even a 30% occurrence. Younger age, cold cardioplegic infusions predispose to this complication. The paresis of the diaphragm lengthens ICU stay, results in prolonged weaning. The recovery of the phrenic nerve might take several weeks. In Neurally Adjusted Ventilatory Assist (NAVA) Ventilation the patient's electric diaphragmal impulse (the EDI-signal) triggers the ventilator, which is a very early signal in the breathing cycle. We hypothesized that patients with phrenic nerve injury could be weaned off easier with NAVA ventilation, then with conventional ventilatory modes.

**Materials and methods.** Yearly ca. 300 children receive heart surgery in the Linz Heart Center. In 2008 4 children (1.3%) showed after heart surgery signs of phrenic nerve injury (decreased movement of the diaphragm detected by ultrasound). Two of these children could be ventilated with NAVA in September and October 2008, in a period where we had the opportunity to try out the NAVA modus of the Maquet Servo-i Ventilator.

**Results and discussion.** In both of our patients NAVA Ventilation was started after several previous extubation attempts. Our first patient, a newborn boy with TGA after arterial switch operation could be successfully extubated after 6 days of NAVA ventilation on the 66.postoperative day. Our second NAVA ventilated patient was a baby girl with totally anomalous pulmonary venous return (TAPVR) of the supracardiac type. After correction surgery at age 9 days she developed bilateral phrenic nerve paresis and became ventilator dependent. NAVA ventilation was started on postoperative day 18. After a course of NAVA Ventilation for 13 days she could be finally extubated. The detection of the Edi signal in both patients was possible which spoke for a partial recovery of the phrenic nerve.

While conventional mechanical ventilation modes use pneumatic triggers (pressure, volume, or flow changes) to achieve patient-ventilator synchrony NAVA detects the electric impulses of the phrenic nerve. This Edi signal takes place at the very beginning of the breathing cycle and the triggers of conventional ventilator modes all derive from a later phase of the breathing cycle. Therefore, one expects to achieve a much better patient-ventilator synchronization with NAVA. We can not prove to what extent did NAVA ventilation contribute to the successful weaning of our patients, however, we were satisfied with the results and impressed by the clinically obvious better patient-ventilator synchronization in both cases.

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## ANESTHESIA FOR INFANTS WITH ACQUIRED SUBGLOTTIC STENOSIS

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**Background.** Acquired subglottic stenosis (SGS) is a disorder characterized by narrowing of the airway below the glottis and is usually due to scar formation secondary to prolonged airway intubation (1). These patients present airway compromise in the region of the larynx, so ventilatory management is a challenge to anesthesiologists (2). The aim of the study is to evaluate the efficacy of spontaneous ventilation and conservative treatment with balloon dilatation in these patients.

**Material and methods.** A descriptive, prospective study was done on infants with bifasic stridor following extubation at NICU, scheduled for endoscopic dilatations of SGS in our hospital from January 2006 to December 2008. After placement of standard non-invasive monitoring and preoxygenation, patients were induced with atropine 0.01 mg/kg and slowly increasing concentrations of sevoflurane up to 1.5-2 MAC. Continuous positive airway pressure of 3-5 cm H<sub>2</sub>O (CPAP) kept up spontaneous ventilation, adjusting the pressure relief valve and a tight facemask (FM) providing oxygen 100%. Lidocaine local anaesthetic spray was used to the vocal cords to avoid airway reflexes. During all the procedure patients maintained spontaneous respiration with a 1-1.5 MAC of sevoflurane and remifentanyl infusion at 0.1 µg/Kg/min. Volatile agent and oxygen were discontinued when patients underwent dilatation with a 10 mm balloon to the recommended burst pressure 6-10 atm in a single procedure without stenting. Each time patients saturation decreased under 80%, the dilatation procedure stopped to administer oxygen 100% to the patient (the whole dilatation procedure took 2 minutes). Adjuvant topical mitomycin C was placed after dilatation of the stenosis at concentrations of 1 mg/ml. Postoperatively, all patients received oral omeprazol 1 mg/kg/24h. The patients were followed up to 12 months after dilatation.

**Results.** We included 20 patients, average age: 4.9 months (range 2-14 months). In all cases spontaneous ventilation was maintained without any anesthetic complications. The dilatation procedure was discontinued to administer oxygen 100% to the patient twice each treatment in average. 15 patients underwent a single procedure and remained symptom free for up to 12 months after balloon dilatation. The rest of the patients, 1 required tracheotomy and 4 re-dilatation (2 of the 4 re-dilatations required eventual tracheotomies).

**Discussion.** Acquired subglottic stenosis (95% of all SGS) is a frequent problem in infants, because the subglottis is the narrowest part of their upper airway and consequently the pressure exerted by an endotracheal tube inflicts the most damage to this area. Discrete immature and isolated SGS can be safely managed by early balloon dilatations with a high rate of success (1). The combination of deep sedation and CPAP allows us to maintain an adequate spontaneous respiration with an efficient ventilation with no turbulent flow distal the stenosis (2,3). Sevoflurane and ketamine are the ideal anesthetic drugs to maintain spontaneous ventilation (2).

**Conclusion.** Balloon dilatation is a safe and effective method to manage discrete immature and isolated SGS in post-intubated infants. The anesthetic management with sevoflurane allows the maintenance of spontaneous breathing, which is a good option for patients with airway obstruction and permits an effective ventilation with minimum complications.

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## RECOGNITION OF DIFFICULT AIRWAY PROBLEM IN POLISH NEONATAL UNITS AND PAEDIATRIC INTENSIVE CARE UNITS.

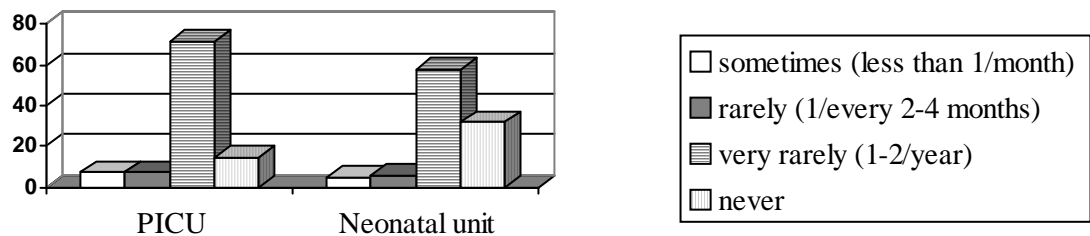
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**Aim of the study.** According to American Society of Anesthesiologists (ASA) a difficult airway is “the clinical situation in which a conventionally trained anaesthesiologist experiences difficulty with face mask ventilation, difficulty with tracheal intubation or both”. Children and especially newborns are patients at high risk of compromised airway. Hypoxemic complications and in result damage of brain or even death are reported. Aim of the study was to assess existing currently in Poland knowledge on difficult airway problem in newborns and children. .

**Methods.** The study was performed as a part of “The National Survey on Practices in Paediatric and Neonatal Intensive Care” edition 2008/2009. The questionnaire referred to difficult airways was sent by mail to all Polish neonatal units (416 centers, reference level from 1<sup>st</sup> to 3<sup>rd</sup>) and pediatric intensive care units (PICUs, 53 centers). The independent centre performed data collection and statistical analysis using SAS programme.

**Results.** The overall response rate was 65% (varied from 51% to 91% respectively in PICUs and 3<sup>rd</sup> level neonatal units). Recognition of difficult airway problem have been reported by 93% of PICUs and only 32% of all neonatal units ( $p=0.0003$ ). Assessment of degree of obstruction and functional impairment in children at risk airway was declared by 79 % PICUs and only 40% neonatal units ( $p=0.001$ ). No significant difference in declared rate of unsuccessful intubations was found between all neonatal units and PICUs (table 1).



**Conclusions.** Results of the survey confirmed need for better education on difficult airway problem especially among medical staff of neonatal units in Poland. Publishing of a written, national guideline on difficult airway management is planned this year.

## Hypercapnea in Congenital Diaphragmatic Hernia Repair. How Permissive Should We be?

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**Introduction.** In congenital diaphragmatic hernia (CDH) thoracic herniation of abdominal contents may cause lung compression, pulmonary hypoplasia and persistent pulmonary hypertension (PPHT). Historically aggressive ventilation strategies to control CO<sub>2</sub> and prevent exacerbation of PPHT in the intensive care setting caused barotrauma. Now permissive hypercapnea is used to minimize iatrogenic injury, but during surgery to correct CDH, concern has been raised over levels of hypercapnea seen, particularly with thoracoscopic repair. (1)

**Methods.** We searched our local database to identify patients who had surgery to correct CDH. Their records were reviewed and demographic, anaesthetic, surgical, and length of stay data recorded.

**Results.** There were 6 open and 9 thoracoscopic procedures to correct CDH between December 2005 and May 2009. Two thoracoscopic procedures were converted to open, one due to surgical difficulty, the other due to difficulties in ventilation and oxygenation. Table 1 summarizes the data collected: Perioperatively, hypercapnea was noted in both groups, with one case in the thoracoscopic group reaching an arterial CO<sub>2</sub> (PaCO<sub>2</sub>) of 22.45 kPa, resulting in a pH of 6.61. This resolved and post-operative PaCO<sub>2</sub> was 6.42 kPa with a pH of 7.24. The maximum end tidal CO<sub>2</sub> (etCO<sub>2</sub>) recorded was only 8.0kPa. The highest PaCO<sub>2</sub> in the open group was 11.6 kPa, with a pH of 7.02 and maximum etCO<sub>2</sub> of 5.5 kPa. No significant hemodynamic compromise was noted in either group.

**Discussion.** Decision for surgical approach was taken jointly between the surgeon, anaesthetist and neonatologist, with heavier, more stable patients generally chosen for thoracoscopic surgery. Perioperatively, the extreme hypercapnea seen on blood gas analysis was not evident on etCO<sub>2</sub>, so regular, routine capillary or arterial blood gas, or trans-cutaneous CO<sub>2</sub> measurement may be appropriate. Also, whilst there were no immediate adverse events as a result of marked respiratory acidosis, the long-term effect this has on the neonatal brain remains unclear. Recent studies have shown widespread brain cell death in newborn rats subjected to hypercarbia (2), and more work is needed to determine if this is evident in human neonates.

**Conclusion.** CDH repair may be safely performed thoracoscopically, but requires careful patient selection as difficulties with ventilation and monitoring resultant hypercapnea can be more marked in this group.

		Thoracoscopic		Open		
		Median	Range	Median	Range	
<b>Patients</b>	Day of Life	7	3 - 654	5.5	3 - 238	
	Post Con. Age (days)	291	274 - 934	284	244 - 518	
	wt (kg)	3.75	2.35 - 13.2	2.83	2 - 7.4	
<b>Operation</b>	Time (mins)	130	70 - 240	93.5	70 - 130	
	MAP Nadir (mmHg)	47.5	30 - 65	32.5	25 - 43	
	SpO <sub>2</sub> Nadir (%)	95.5	87 - 97	97	92 - 98	
	FiO <sub>2</sub> Max (%)	0.52	0.3 - 1.0	0.4	0.38 - 0.5	
	pH	Pre op	7.4	7.35 - 7.46	7.41	7.35 - 7.47
		Nadir Intra op	7.38	6.61 - 7.48	7.34	7.02 - 7.37
		End of op	7.3	7.24 - 7.44	7.4	7.08 - 7.52
	PaCO <sub>2</sub> (kPa)	Pre op	5.71	5.11 - 6.04	5.85	4.88 - 6.56
		Max Intra op	5.86	4.76 - 22.45	7.45	5.61 - 11.6
		End of op	5.62	4.65 - 7.66	5.04	3.56 - 10.67
	etCO <sub>2</sub> (kPa)	Max Intra op	6.15	4.1 - 8.0	4.4	3.6 - 5.5
End of op		5.3	2.0 - 9.3	4	3.2 - 5.4	
<b>Outcome</b>	Time intubated (days)	2	0 - 32	11	1 - 29	
	Hospital stay (days)	10	2 - 43	34	4 - 259	

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1. Arca MJ, Barnhart DC et al. Early experience with minimally invasive repair of congenital diaphragmatic hernias: results and lessons learned. *J Pediatr Surg.* 2003; 38(11): 1563-8.
  - 2 .Stratmann G et al. Effect of Hypercarbia and Isoflurane on Brain Cell Death and Neurocognitive Dysfunction in 7-day-old Rats. *Anesthesiology* 2009; 110: 849–61

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## Early high-frequency oscillatory ventilation versus synchronized intermittent mandatory ventilation in very low birth weight infants with hernia diaphragmatic: a single-center experience of 43 cases.

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**Objective.** To evaluate the feasibility of conducting prospective randomized trial comparing early high-frequency oscillatory ventilation (HFOV) to synchronized intermittent mandatory ventilation (SIMV) in very low birth weight (VLBW) premature infants with hernia diaphragmatic. This pilot study evaluated two ventilator management protocols to determine how well they could be implemented in Vinnitsa Region Clinical Children Hospital. Although this pilot study was not powered to detect differences in outcome, we also collected outcome data.

**Methods.** 43 infants weighing 501 to 1000 g, less than 4 hours of age, who had received one dose of surfactant and required ventilation with mean airway pressure > 4-6 cm H<sub>2</sub>O and FiO<sub>2</sub> >0.25, and had an anticipated duration of ventilation greater than 48 hours. Newborn were stratified by birth weight and prenatal steroid status, then randomized to either HFOV or SIMV with tidal volume monitoring. Ventilator management for patients in both study arms was strictly governed by protocols that included optimizing lung inflation and blood gases, weaning strategies and extubation criteria.

**Results.** Data are presented for 20 HFOV and 23 SIMV infants (two infants, twins, were withdrawn from the study at parent's request). 18 of the 20 HFOV infants and 18 of the 23 SIMV infants survived to 36 weeks corrected age. Age at final extubation for survivors was 10.2 ± 8.3 (mean ± SD) days for HFOV infants and 18.4 ± 9.1 days for SIMV infants. At 36 weeks corrected age, 14 of the 18 HFOV survivors were extubated and in room air, whereas 5 required supplemental oxygen. In comparison, 8 of the 18 SIMV survivors were extubated and in room air, whereas 10 required supplemental oxygen. Grade III/IVIVH and/or periventricular leukomalacia occurred in 1 HFOV and 4 SIMV patients. Overall compliance with the ventilator protocols was 82% for the SIMV protocol, and 90% for the HFOV protocol.

**Conclusions.** The preliminary outcome data supports conducting the large randomized trial, which began in February of 2009. The protocols for the Early HFOV vs. SIMV in VLBW Infants ventilator management of VLBW infants, both with HFOV and with SIMV were easily implemented and consistently followed, and are presented here.

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## PRESSURE CONTROL VENTILATION VERSUS VOLUME CONTROL VENTILATION IN INTUBATED CHILDREN DURING SURGERY

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**Background and goal.** Pressure Control Ventilation is recommended for infants and children<sup>1</sup>. The goal of this prospective study is to assess respiratory mechanics in intubated anesthetised children, ventilated by volume control ventilation (VCV) or by pressure control ventilation (PCV) during surgery.

**Materials and methods.** 20 children were evaluated. Age, weight and ASA status were recorded. Children were ventilated by a Julian-Dräger anesthesia machine.

In group A, 10 children were ventilated primarily by VCV at settings:  $FI_{O_2}=0.5\%$ , tidal volume 6-8 ml/kg, time I:E= 1:2 and PEEP=0.  $ETCO_2$  (mbar), airway pressures: peak and plateau (mbar), tidal volume (ml), end tidal (ET) sevoflurane (%) and pulmonary compliance (ml/mbar), were recorded after intubation(a) and at 20 min of VCV(b). At that moment (b) the machine was switched to PCV, adjusting P max so as to give at the same child the same tidal volume as previously and the same remaining settings. After 20 min of PCV (moment c), the same recordings were obtained.

In group B, 10 children were ventilated using firstly PCV, with similar settings as in Group A, for 20 min and after that VCV was applied for 20 min. Recordings were obtained at the same time intervals as in Group A. Statistical analysis was performed by ANOVA and independent samples T-test using SPSS. Statistically significant difference was regarded when  $p<0,05$ .

**Results and discussion.** Children's mean age: 25.8 (13.5) months in group A and 24.2 (15.4) months in group B, weight: 12.8 (3.1) kg and 12.2 (4) kg in group A and B respectively and ASA status had no statistically significant differences between groups. Recorded measures after intubation and during the first 20 min also had no statistically significant differences between groups. In the next 20 min, respiratory pressures (peak and plateau) during PCV were statistically significant lower (\*) than at VCV between moments b and c, irrespective of the mode of ventilation used initially, as indicated in the following table. The remaining recordings had no statistically significant differences between moments b and c.

	GROUP A			GROUP B		
	20 min VCV(b)	20 min PCV(c)	p	20 min PCV(b)	20 min VCV(c)	p
$ETCO_2$	36.3(6,3)	37.7(5.1)	0.59	35.9(5.5)	36.4(2.7)	0.85
Peak Pressure	18.3(4.9)	14.2(2.3)	0.03*	14.4(2.5)	18.8(1.6)	0.005*
Plateau Pressure	17.8(5)	14.2(2.3)	0.048*	14.4(2.5)	17.8(1.6)	0.02*
VT	98(32.2)	98(32.2)	1,00	100.6(23.5)	111(23)	0.44
ET Sevo	1.8(0.4)	2.53(3)	0.47	2.2(0.7)	1.9(0.6)	0.50
Compliance	6.32(3.1)	7.6(3.41)	0.39	7.8(2.2)	6.5(1.4)	0.26

**Conclusion:** PCV is as efficient as a mode of ventilation during surgery as VCV, respecting pulmonary mechanics, having the advantage of requiring lower respiratory pressures.

**Reference:** 1. Odin I., Nathan N. Ann Fr Anesth Reanim. 2006; 25(4):417-23.

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## ANAESTHETIC MANAGEMENT OF A CHILD WITH TRACHEAL RUPTURE AND FREE FLUID IN THE ABDOMEN

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**Background.** Tracheal injuries are an uncommon but life threatening consequence of chest trauma. Anaesthetic and surgical management is dependent upon the location and severity of the insult. In this case, free fluid in the abdomen precluded use of cardiopulmonary bypass during tracheal repair. This case illustrates how good team work and communication can ensure an excellent outcome despite suboptimal surgical conditions.

**Case report.** A 14 year old boy was a restrained rear seat passenger in a car driven at 60kmph into a telegraph pole. At hospital he complained of shoulder and abdominal pain. Initial chest X ray showed pneumomediastinum. Abdominal CT showed free fluid in the pelvis. Chest CT revealed a tracheal laceration extending from T3 to T4. Over the next 6 hours he developed worsening dyspnoea and massive surgical emphysema.

Prior to induction we discussed the management plan with the cardiothoracic team. Bypass and attendant heparinization was felt to be too risky with known intra-abdominal bleeding.

The surgeon felt he would be better able to perform tracheal closure with a conventional endotracheal tube (ETT) in situ rather than a larger double lumen ETT.

Anaesthesia was induced with 8% sevoflurane in oxygen for 5 minutes. Direct laryngoscopy was performed and with him spontaneously breathing a 6.5 Cuffed Oral ETT was inserted. Using the fiberoptic bronchoscope the ETT was guided into the left main bronchus and secured at 27 cm. The patient was paralysed and ventilated using pressure support ventilation. He was kept on an FiO<sub>2</sub> of 1.0. His saturations remained at 100% throughout the case.

The patient was placed in the left lateral position and surgery was via a right thoracotomy. On opening the chest, the right lung remained inflated, suggesting the COETT had migrated from the left main bronchus. The ETT was at its hilt and so the surgeon proceeded by retracting the lung to reveal a 6 cm tracheal tear. The cuff of the ETT was protruding out of the defect.

The surgeon was able to suture the trachea around the ETT. The ETT was then pulled back, to above the repair and the integrity of the surgery was tested with a valsalva manoeuvre.

Once the thoracotomy was complete the patient was turned supine and a laparotomy performed. A jejunal perforation was resected and repaired by end to end anastomosis.

The patient was extubated 8 hours later. He was discharged from hospital on day 8 and has no residual problems from his injuries.

**Discussion.** Tracheal trauma is rarely seen in hospital, since many victims die at the scene. Management of the multiply injured child relies on close cooperation between medical specialties. In this case close liaison between anaesthetist and cardiothoracic surgeon allowed timely repair of the airway despite less than perfect operating conditions. When attempting endobronchial intubation with a conventional ETT, anaesthetists should be mindful that the tube may be too short, especially in larger children, once the patient is placed in the lateral position.

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## EFFECT OF MANDIBULAR DISTRACTION SURGERY IN AIRWAY MANAGEMENT OF CHILDREN WITH CRANIOFACIAL MALFORMATION.

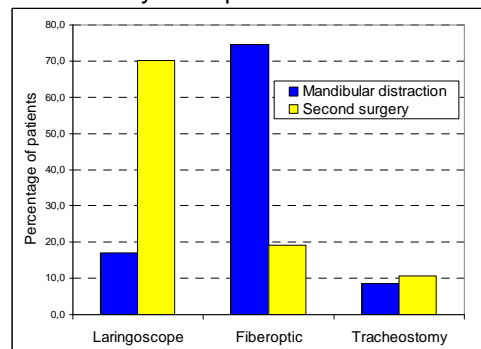
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**Introduction:** The aim of this study is to evaluate the efficiency of distraction mandibular osteogenesis, as surgery treatment of several craniofacial disorders, in what concerns to the modification of the airway management and difficulty of intubation.

**Methods:** A retrospective study of 47 patients suffering from these pathologies (Treachers-Collins 7 patients, Pierre-Robin 13 patients, ankylosis temporomandibular 8 patients, Goldenhar 9 patients and hemifacial microsomia 10 patients) has been carried out, taking into account the cases appeared at Hospital Doce de Octubre de Madrid from January 2000 to December 2007. At first instance they were operated of mandibular distraction osteogenesis and months later, they came back to the operation room for other pathologies (knock-kneed foot, fissure palate, inter-ventricular communication...). The anaesthetic management was identical for all patients: general anaesthesia with face mask using sevoflurane and oxygen but keeping spontaneous ventilation. Intravenous solution glucosade 5% and atropine 0.1 mg/kg was administrated. Then, only one attempt of direct laryngoscope was performed, in order to avoid damage and bleeding. If it failed, nasotracheal fiberoptic intubation was performed. When the tube passed the vocal cords, fentanil and muscle relaxant was administrated, and the patient was connected to mechanic ventilation. At first laryngoscope, it was used, as standard predictor of difficult airway intubation, the Cormack-Lehane's classification of laryngeal view. When the result of direct laryngoscope was grade 3 or 4, which means difficult airway, in most of the cases the fiberoptic intubation was needed. The intubation method, laryngoscope or fiberoptic, was statistically analysed using Pearson's Chi-Square test. Patients with tracheostomy were not included because of the lack of difficult intubation.

**Results:** In the first surgery (mandibular distraction osteogenesis) 35 from the 47 children required nasotracheal fiberoptic intubation, 8 patients were intubated with direct laryngoscope and 4 of them had previous tracheostomy. Months or year later, another surgery came up due to different pathologies. In this situation, 33 patients were intubated with direct laryngoscope, 9 needed fiberoptic intubation and 5 of them had tracheostomy. Comparative results can be seen in the following figure.



**Discussion:** The mandibular distraction osteogenesis improves the difficult intubation in a second surgery with statistical significance ( $p < 0.001$ , Pearson's Chi-Square test).

The airway management is easier after mandibular distraction. This fact is important because patients with this kind of malformations require more surgeries. The availability and correct management of fibrobroncoscope is essential in the anaesthetic management of these patients.

## PREDICTION SEVERITY COMMUNITY-ACQUIRED PNEUMONIA IN CHILDREN

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The problems of diagnostics and treatment children with severe community-acquired pneumonia (CAP), who admitted to intensive care unit (ICU) are still actual. One of perspective methods of estimation severity of pneumonia the method of cells morphometric of peripheral blood, which allows simultaneously to explore sizes and structural components of cells, to expose to conformity to the law between severity of inflammatory process and morphometric changes in neutrophils, monitoring sever of inflammatory process at children with pneumonias, to estimate efficiency of the conducted antibacterial therapy.

**Goal** – morphometric investigation neutrophils of periphery blood in children with CAP.

**Material and methods.** The article represents the results of examination of 130 children in critical state, caused by severs CAP, when admitted to ICU of Kharkov regional children infection hospital. The initial sever state has been assessed upon SOFA scale. We evaluated parameters of central and pulmonary hemodynamics, gas exchange and oxygen transportation system, acid-base state of blood. But the most informative for prognosis severity CAP was morphometric research of cells of peripheral blood (segment-nuclear neutrophils) – has been conducted with the help of of electronic microscope method. The following parameters of cell and nucleus were studied: area of cell ( $\text{pic}^2$ ), perimeter of cell ( $\text{pic}^2$ ), nuclear area ( $\text{pic}^2$ ), nucleus area of segment-nuclear neutrophil correlation (in a norm this parameters are equivalent for the children of different age and adults). The estimation of reliability of the averages quantities between groups as well as control quantities has been carried out according Student criteria and method signs criteria. The patients were divided into two groups. The 1-st group - 67 children with sever CAP, who didn't require respiratory support. The 2-nd - 63 children, who require respiratory support. Evaluation on SOFA in the 1-st group at the receipt into ICU was  $1,04 \pm 0,16$  point, and in the 2-nd group - a  $5,14 \pm 0,3$  point and was authentically higher ( $p < 0,001$ ). The average children age in the 1-rst group –  $14,2 \pm 1,9$  months, in the 2-nd –  $10,5 \pm 1,6$  months. 25 healthy children were included into the control group. The mean age was  $13,4 \pm 1,7$  months. There was no authentic differences in age between researching and control group ( $p > 0,05$ ).

**Results and discussion.** At morphometric investigation of the peripheral blood segment-nuclear neutrophil, significant alterations in cell structure was revealed at examined patients. The most apparent alterations are as follows: increase area and perimeter of segment-nuclear neutrophil, nucleus area of segment-nuclear neutrophil, as well as nuclear cytoplasmic ratio as compared with control group, were observed at the most severity patients.

### The morphometric indexes of segment-nuclear neutrophils peripheral blood at children with a different initial estimation on the SOFA at receipt to ICU ( $M \pm m$ )

Index	I group	II group	Control group
Area of cell ( $\text{pic}^2$ )	$4789 \pm 199,12$ ***	$8630 \pm 200,9$ ***	$2736,7 \pm 529,7$
Perimeter of cell ( $\text{pic}^2$ )	$232 \pm 90$ ***	$284,8 \pm 5,40$ ***	$113,08 \pm 6,60$
Nuclear area ( $\text{pic}^2$ )	$1338,57 \pm 67,9$ **	$2518,1 \pm 96$ ***	$1016,28 \pm 99$
Nucleus area of segment-nuclear neutrophil	$0,39 \pm 0,008$ *	$0,43 \pm 0,009$ ***	$0,37 \pm 0,004$

**Comment:** comparison between I and II groups - \*  $p < 0,05$ , \*\*  $p < 0,01$ , \*\*\*  $p < 0,001$ . Comparison with control group: - \*  $p < 0,05$ , \*\*  $p < 0,01$ , \*\*\*  $p < 0,001$ .

**Conclusion.** Morphometric investigation of the peripheral blood segment-nuclear neutrophil is perspective method for monitoring severity at children with CAP. It allows to control the sever state of a along with other clinical methods to do monitoring severity of condition of child, forecast the flow of disease, and, consequently, to determine strategy of prescription of starting intensive therapy.

On the basis of the obtained results we have developed the diagnostic algorithm of prediction of initial severity of children at receipt to the ICU.

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## INTRATHECAL MORPHINE 5 $\mu\text{G.KG}^{-1}$ VS 10 $\mu\text{G.KG}^{-1}$ IN PAEDIATRIC SURGERY

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**Background.** Intrathecal morphine has been widely used in adults undergoing various surgical procedures. Its reported use in the paediatric surgical population has been limited to spine [1] and cardiac [2] surgery. The doses in these studies ranged from 5 to 30  $\mu\text{g.kg}^{-1}$ . We propose to compare the postoperative analgesic effect of two doses of intrathecal morphine: 5 versus 10  $\mu\text{g.kg}^{-1}$  in sus-mesocolic and thoracic surgery in children.

**Methods.** After ethics committee approval and parental informed consent, we conducted a prospective randomised double blinded study including ASA I-II children, aged between 1 to 10 years, undergoing sus-mesocolic or thoracic surgery. Patients were randomly allocated to receive either 5  $\mu\text{g.kg}^{-1}$  (GA) or 10  $\mu\text{g.kg}^{-1}$  (GB) intrathecal morphine, immediately after induction of standardised general anaesthesia. The injected volume was 0.1  $\text{ml.kg}^{-1}$  for all the patients (Morphine: GA (50  $\mu\text{g.ml}^{-1}$ ) and GB (100  $\mu\text{g.ml}^{-1}$ )). Isoflurane, remifentanyl and cisatracurium were used for maintenance of anaesthesia. Children received paracetamol 15  $\text{mg.kg}^{-1}$  at the end of surgery. Postoperative pain was assessed at regular intervals during the first 24 hours using CHEOPS score. Analgesia was supplemented whenever pain score was  $\geq 7$  (nalbuphine 0.2  $\text{mg.kg}^{-1}$ ). Time to first requirement, the total doses of analgesic given and morphine adverse effects were noted. The number of patients requested in each group was statistically determined. Chi-square and Students t-test were used in statistical analysis;  $p < 0.05$  was considered significant.

**Results.** Sixty two children were included. Three patients in GB developed postoperative respiratory depression requiring naloxone administration and were excluded of the study. Data of 59 patients were analyzed (GA=30; GB=29). There were no differences between groups concerning demographic characteristics, kind and duration of surgery. Mean CHEOPS scores, time to first requirement and total doses of analgesic given were similar in the two groups. Number of patients with Ramsay scores  $> 2$  was significantly higher in GB at the first ( $p = 0.028$ ) and second ( $p = 0.033$ ) postoperative hour. The incidence of nausea-vomiting, pruritus and urinary retention was similar in the two groups.

**Conclusion.** Intrathecal morphine 5  $\mu\text{g.kg}^{-1}$  compared to 10  $\mu\text{g.kg}^{-1}$  provided equivalent postoperative analgesia with less severe respiratory depression and sedation in thoracic and sus-mesocolic surgery in children.

References: 1. *Anesth Analg* 2004; 98:956 –65. 2. *Acta Anaesthesiol Scand* 2004; 48:875-82

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## EFFICACY OF A LOW-DOSE SPINAL MORPHINE WITH BUPIVACAINE FOR POSTOPERATIVE ANALGESIA IN CHILDREN UNDERGOING HYPOSPADIAS REPAIR.

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**Background and aim.** There is a considerable amount of studies on caudal morphine for children undergoing urologic or lower abdominal surgery under general anesthesia; however, the effects of spinal morphine are less studied. We designed this double-blinded, randomized, placebo controlled study to compare the efficacy of a low dose ( $2\mu\text{g.kg}^{-1}$ ) of intrathecal morphine with placebo for postoperative pain control of children undergoing repair of hypospadias surgery with spinal anesthesia.

**Patients and methods.** 54 children were randomly assigned to one of two spinal anesthesia groups. Group M (n=27) received hyperbaric bupivacaine plus  $2\mu\text{g.kg}^{-1}$  of preservative free morphine and group P (n=27) received hyperbaric bupivacaine plus 0.9% NaCl (placebo) under inhalation anesthesia. The dose of bupivacaine was calculated according to age of the child (<5 yr =  $0.5\text{ mg.kg}^{-1}$  and  $\geq 5$  years =  $0.4\text{ mg.kg}^{-1}$ ). General anesthetics were discontinued subsequent to the block. Pain was evaluated by using the Children's Hospital of Eastern Ontario Pain Scale (CHEOPS). The primary outcome was the presence of pain requiring analgesics (CHEOPS>5) during the first 12 hours after the spinal block. Side effects were also recorded.

**Results.** Forty nine patients completed the trial. Fifteen patients (60%) in group P received supplementary analgesics within the first 12 hours compared to only four patients (16.7%) in group M ( $p=0.005$ ). Mean duration of analgesia was  $480\pm 209$  min. and  $720\pm 190$  min. in group P and group M respectively ( $p=0.009$ ). The groups were similar in postoperative side effects.

**Conclusion:** Spinal anesthesia provided by hyperbaric bupivacaine is adequate for distal hypospadias repair in children, while  $2\mu\text{g kg}^{-1}$  intrathecal morphine provides better postoperative pain control when compared to placebo in these children.

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## CAUDAL ANAESTHESIA IN SEDATED, SPONTANEOUSLY BREATHING PRETERM AND TERM INFANTS FOR INGUINAL HERNIA REPAIR: COMPARISON OF TWO WEIGHT GROUPS.

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**Background and goal of study.** Although single shot caudal anaesthesia is frequently used for inguinal hernia repair in the awake or lightly sedated preterm and low weight term infant, this technique seems not to be in regular use for older term infants. In our institution single shot caudal anaesthesia is performed under adequate sedation for hernioraphy in infants up to a weight of 5kg. The aim of this prospective randomised study was to evaluate the effectiveness and safety of this method comparing two weight groups.

**Material and methods.** All included patients were allocated in one of two groups according to their weight at the time of operation. Group A included infants with a weight up to 3500g and group B infants with a weight between 3500 – 5000g. A local anaesthetic cream (EMLA<sup>®</sup>) was placed over the caudal and the i.v. puncture site one hour prior to the procedure. After insertion of an i. v. line sedation was introduced and the spontaneously breathing infant was turned into the lateral decubital position. A single shot caudal block was performed using 1ml/kg ropivacaine 0.375%. Clonidine 1-2µg/kg as an adjuvant was added to the discretion of the anaesthetist. No further sedation was primarily administered during the operation. All patients were breathing spontaneously (30% oxygen in air) with an oropharyngeal airway in place. Heart rate, non invasive arterial blood pressure, pulse oxymetry (SaO<sub>2</sub>) and endtidal CO<sub>2</sub> using a special nasal probe, were monitored throughout the procedure. Adverse effects, pain reactions, the need to administer additional drugs or a change of method were noted.

**Results and discussion.** Forty-seven infants scheduled for unilateral or bilateral inguinal hernia repair were included. Group A consisted of 20 and group B of 27 patients (details see table 1).

n = 47	Group A (n = 20)	Group B (n = 27)
median age (not corrected for preterm infants)	52.5 days (range: 7 – 113 days)	48 days (range: 25 – 96)
median birth weight	1860g (range: 660 – 3250g)	3070g (range: 1860 – 3590g)
median weight at time of operation	2530g (2016g – 3500g)	4400g (range: 3690 – 4980)

In group A one infant (5%) needed intubation due to respiratory distress. Two intubations (7.4%) were performed in group B due to a slow onset of the block in one and severe dyspnoea in another patient. A total of 44 operations were performed successfully in single shot caudal anaesthesia in the spontaneously breathing patient. Additional intraoperative sedation and/or analgesia due to movements or pain reactions were needed in 5 infants (26.3%) in Group A and in 9 patients (33.3%) in Group B. No further adverse effects were noted.

**Conclusion:** According to our findings single shot caudal anaesthesia combined with light sedation is a save and effective method for inguinal hernia repair both in preterm and term infants up to a weight of 5 kg. Whether the more frequent need of intraoperative sedation due to movements in Group B indicates the limits of this method in patients with a weight close to 5 kg needs further investigation.

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## **INFLUENCE OF EPIDURAL CAUDAL BUPIVACAINE ON SEVOFLURANE REQUIREMENT FOR ADEQUATE DEPTH ANESTHESIA USING BIS IN CHILDREN.**

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**Introduction:** Combined regional and general anesthesia with inhalation anesthetics, as well as balanced anaesthesia, are commonly used in children. Regional anaesthesia reduces the inhalation anesthetics requirement needed to suppress somatic movement in response to surgery as well as the cardiovascular response to painful surgical stimulations. We still don't have clear evidence that epidural local anaesthetics have sedative effects. Our hypothesis: Epidural caudal bupivacaine decreases sevoflurane requirement in comparison to i/v analgesia. Adequate depth of anesthesia measured by the Bispectral Index Monitor (BIS) will be maintained because of local anaesthetic's sedative effect.

**Methods:** This study was approved by the local ethics committee and written informed consent was obtained from all parents. Forty boys, aged 1-7 years, up to 20 kg, ASA1, undergoing elective orchidopexy were randomized in two groups A (sevoflurane+laryngeal mask+caudal block with 0,19% bupivacaine 2.5 mg/kg; 16 boys up to 3 years of age) and B (sevoflurane+laryngeal mask+alfentanil loading dose 20 µg/kg and in 10-15 minutes intervals 10-20 µg/kg; 13 boys up to 3 years of age). All children got premedication with 0,04mg/kg midazolam. We measured end-tidal sevoflurane concentration (sevoE) in 5 minute intervals trying to maintain the BIS values between 40-60. Statistical analysis of differences in measured variables among groups was conducted using two way analysis of variance. If significance was detected, t-test (or Mann-Whitney test) was applied for comparison between groups. Logistic binary regression was used to predict higher values of sevoE in the group B (with alfentanil). Pearson test was applied to determine correlation between variables. Probability value level less than 0,05 was considered significant.

**Results:** Lower sevoE values were observed in A group but difference was not statistically important (group A  $2.2 \pm 0,5$ ; group B  $2.3 \pm 0,5$ ;  $p=0.694$ ). Logistic binary regression confirmed our hypothesis that higher values of sevoE are predictive for group B (odds ratio =1.414 ; confidence interval=1.016-1.969 ;  $p= 0.040$ ).

There is a negative correlation between children age and BIS, between children age and sevoE. We did not find any correlation between BIS and sevoE.

**Discussion:** Contrary to our expectation we could not prove that caudal epidural bupivacaine would have sedative effect in our children. It was difficult to maintain the BIS values around 50 because they were changing also in the phase without pain stimuli (waiting for the surgeon) with the same concentration of sevoflurane. We observed paradoxical changes of BIS values from 70-45 at the end of operation (sevoE 0.5-0.2 Vol%) and also paradoxical changes during the operation. As BIS value is based on adult EEG data and may not apply to children, further investigations are necessary(2).

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## COMPARISON BETWEEN ROPIVACAINE AND BUPIVACAINE IN PARASCALENE BRACHIAL PLEXUS BLOCK IN CHILDREN.

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**Introduction.** The aim of this study was to compare ropivacaine (R) 0.2% to bupivacaine (B) 0.25% for parascalene brachial plexus block (PBPB) in children.

**Methods.** The study protocol was approved by the local committee of ethics and all parents gave written informed consent before enrolment. We performed a prospective, randomized, double-blind trial including children aged between 1 and 10 years, scheduled for a shoulder or arm surgery. General anaesthesia was standardized: sevoflurane inhalation induction, maintenance with isoflurane 1 MAC. The PBPB was performed after randomisation in two groups: RG (R 0.2 %: 0.5 ml.kg<sup>-1</sup>) and BG (B 0.25 %: 0.5 ml.kg<sup>-1</sup>). In case of failure of the block, the child was excluded from the study. CHEOPS score was noted on the recovery then 1, 2, 3, 4, 6, 9, 12 and 24 hours after surgery. If CHEOPS score  $\geq$  7, the child received 15 mg.kg<sup>-1</sup> of paracetamol and if insufficient, 0.2 mg.kg<sup>-1</sup> of nalbuphine by intravenous route. The time to first requirement and the total doses of analgesic given were recorded. Heart rate (HR) and mean arterial pressure (MAP) were collected at baseline, after performing PBPB, at skin incision, and then every 10 minutes until the end of surgery. Chi-square and Students t-test were used in statistical analysis;  $p < 0.05$  was considered significant.

**Results.** Forty two patients were included (RG=20, BG=22). Five children were excluded. Data of 37 patients were analyzed (RG=16; BG=21). The two groups were comparable as regards demographic data, kind and duration of surgery. There was no difference between the groups concerning pain scores and time to first analgesic requirement ( $p=0.76$ ). Six children in RG versus 7 in BG required complementary analgesics during the first 24 hours ( $p=0.87$ ). Motor block duration and intraoperative HR and MAP and were comparable between the two groups.

**Discussion.** Ropivacaine 0.2% seems to be as effective as bupivacaine 0.25% for PBPB in children undergoing shoulder and arm surgery.

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## THE USE OF ON-Q PAIN BUSTER FOR POSTOPERATIVE ANALGESIA AFTER RENAL OPERATIONS IN CHILDREN

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**Introduction.** Postoperative pain after renal surgery in children is often controlled with opioids which have unfavourable side-effects like respiratory depression, hypotension, PONV, constipation etc. The ON-Q PainBuster delivers local anaesthetic continuously to the surgical site by elastomeric pump and soaker catheter placed subfascially. The aim of the study was to determine the effectiveness of ON-Q system in children for pain relief after renal surgery. Better pain relief than narcotics alone and significantly less need for narcotics post surgery is to be expected. PONV and other opioids side effects should be minimized.

**Methods.** A retrospective observational study of 40 children who underwent renal surgery and received local anaesthetic by ON-Q pain buster. Variables to be measured during first two postoperative days were the level of pain by visual analogue scale (VAS), amount of additional analgesics needed to control pain and appearance of PONV and constipation. Bupivacaine 0,5% in a dose of 5 mg/kg diluted with saline to 100 ml at flow rate 2 ml/h for up to two days was used. Concentration of bupivacaine was ranging from 0.15% to 0.5% (mostly 0.25%).

**Results.** Demographic characteristics were: 40 children, 25 male, 15 female, aged from 1 year to 17 years (mean 5.4), weight ranged from 11 kg to 65 kg (mean 21.4 kg). Types of renal operations were pyeloplasty sec Anderson-Hynes in 20 patients, heminephrectomy in 5, nephrectomy in 3 patients, ureter modelage and neocystostomy in 6 operations of nephroblastoma in 5 patients and of suprarenal tumor in one. All were ASA physical status 2. Average duration of ON-Q system use was 44.5h, range 38h to 48h. Pain scores by VAS (range 0 to 10) on the first and second postoperative days were 3.4 and 2.1 respectively. Additional analgesia was used in 15% of patients in the form of tramadol infusion. PONV have 4 patients, constipation only one. Complications encountered were catheter leakage of bupivacaine mixture which precluded catheter removal in two patients. No wound healing complications or infections associated with the use of the pump were noted.

**Conclusion.** Subfascial placement of ON-Q postoperative pain relief system for renal operations in children appears effective regarding postoperative low pain scores, decreased need for additional analgesia and less PONV and constipation than with opioids use.

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## THE INFLUENCE OF PROPOFOL AND REMIFENTANIL ON SELECTED HAEMODYNAMIC PARAMETERS IN CHILDREN AND ADOLESCENTS - AN EARLY EXPERIENCE WITH THE NICO MONITOR

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**Introduction.** Deliberate hypotension with propofol is an accepted method of anaesthesia for functional endoscopic sinus surgery (FESS)<sup>1</sup>. Remifentanil may be used for the same purpose. While easy to titrate, remifentanil produces a fall in blood pressure and cardiac index, mainly as a result of a fall in heart rate<sup>2</sup>. We have reporting haemodynamic data obtained using a non-invasive cardiac output monitoring system (NICO<sup>®</sup>, Non-Invasive Cardiac Output Monitor, Novametrics Medical System Inc., Wallingford, CT, U.S.A.) to monitor selected haemodynamic parameters in children and adolescents anaesthetized for functional endoscopic sinus surgery (FESS) or deviated nasal septum repair using our standard anaesthetic regimen (TIVA). The monitor operates based on the partial CO<sub>2</sub> rebreathing technique; it is not only non-invasive, but provides real-time monitoring of the cardiac output<sup>3</sup>.

**Methods.** With the approval from the institutional Ethics Committee, NICO<sup>®</sup> was used in 9 children and adolescents ( $13,2 \pm 4,3$  years old,  $56,8 \pm 16,7$  kg) anaesthetized with continuous infusion of propofol  $3-4 \text{ mg kg}^{-1} \text{ h}^{-1}$  and remifentanil  $0,75 \mu\text{g kg}^{-1} \text{ min}^{-1}$ . The device was connected after the induction of anaesthesia and endotracheal intubation. Heart rate, non-invasive blood pressure, pulse-oxymetry, inspiratory and expiratory gas flow, as well as inhaled and exhaled CO<sub>2</sub> were measured. Cardiac output (CO), cardiac index (CI), as well as stroke volume (SV) and stroke volume index (SVI) were calculated.

**Results.** All children completed the study. No complications were observed. While mean arterial blood pressure was maintained between 50 and 65 mm Hg (as requested), mean heart rate (HR) was  $64 \pm 7$  beats/min. The median value of the minimal HR observed was 51 beats/min [range 42-62]. Cardiac index as well as stroke volume index of each patient varied within quite wide range (Fig.1) without exceeding physiological values. Mean CI was  $4,39 \pm 0,56 \text{ l} \cdot \text{min}^{-1} \cdot \text{m}^{-2}$ , while the median of minimal value of CI observed was  $3,3 \text{ l} \cdot \text{min}^{-1} \cdot \text{m}^{-2}$  [range 2,7 – 3,7]. Mean stroke volume index was within normal range.

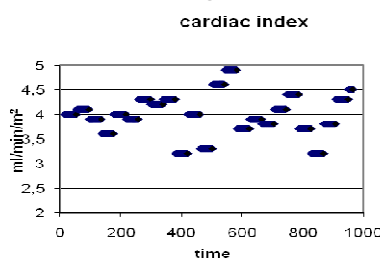


Figure 1. Cardiac index changes during apparently stable intravenous anaesthesia.

**Discussion.** Short episodes of bradycardia observed during FESS or deviated nasal septum repair seemed to have no clinical significance. However, during apparently stable total intravenous anaesthesia cardiac index and stroke volume varied within quite wide range. NICO seems to be a useful monitor which may improve patient's safety during anaesthesia.

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## DEXKETOPROFEN VS. RACEMIC KETOPROFEN FOR THE POSTOPERATIVE ANALGESIA IN PEDIATRIC UROLOGY

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**Introduction.** Postoperative analgesia in paediatrics can be called “pharmacological orphanhood”. As compared the pain researchers spare less attention to children, than to adults. And pharmaceutical companies do not expend a mean for clinical research in the narrow groups of patients. Development of new analgesic drugs and understanding children's pharmacokinetics and dynamics of them can improve therapy of pain. Confronting information that dexketoprofen during short application was at least so effective for adults as the other NSAIDs and paracetamol/opioid combinations, without side effects [1,2]. And knowledge that racemic ketoprofen is effective to relieve children's pain after surgery [3], we applied dexketoprofen off-label for the postoperative analgesia in pediatric urology.

**Patients and methods.** 654 generally healthy boys ASA I average aged  $6,73 \pm 3,6$  [3-15] years (after permission of ethics committee of hospital and informed consent of parents), undergoing urology surgery (orchepexia, hydrocele, varicocele repair) with standardized anaesthesia (induction: intravenously 3 mg/kg propofol, 5 mcg/kg fentanyl, 0,4 mg/kg atracurium, maintenance – 10 mg/kg/h propofol, brief supporting-LMA) were randomly assigned to receive either racemic ketoprofen 2 mg/kg intravenously slowly (RK, 336 patients) or dexketoprofen trometamol 1 mg/kg intravenous bolus (DK, 318 patients) at induction of anaesthesia. All children received repeated doses after an operation on necessity (after reaching 4 points on the Broadman-Hannallah VAS). Monitoring of level of pain (time up to achievement of 4 points by VAS), multiplicity of analgesic injection and complications or side effects (SPONV, brief, haemodynamic depression, gastrointestinal bleeding or cardiovascular events) was performed.

**Results.** In the DK group, median (range) pain scores were lower during activity at 24 h (3 [0-5] vs 4 [0-6];  $p = 0.01$ ). The median ( $\pm$ SD) times to achieve 4 points by VAS after surgery were  $304.00 \pm 44.77$  min after RK and  $342.55 \pm 50.38$  min after DK respectively ( $p < 0.001$ ).

Quantity of analgesic injection were  $1,05 \pm 0,43$  (group RK) vs.  $0.95 \pm 0.53$  (group DK) ( $p = 0.012$ ).

Additional use of rescue analgesics was not required in both groups. No adverse events related to renal, gastrointestinal or cardiovascular function were detected during the study.

**Conclusion.** Dexketoprofen trometamol appeared to show possibility of his application for children; a trend towards a better tolerability profile compared with the racemic ketoprofen and requires a further study.

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## INTRAOPERATIVE SUPRAVENTRICULAR TACHYCARDIA IN A BOY WITH DUCHENNE MUSCULAR DYSTROPHY

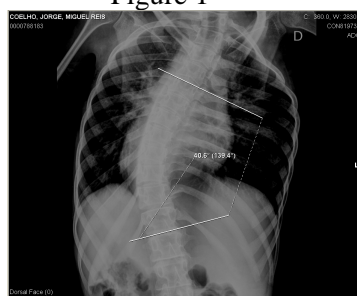
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**Introduction.** Duchenne muscular dystrophy (DMD) is an X-linked genetic disorder accompanied by almost complete loss of the muscular protein dystrophin, leading to a weakened sarcolemma. DMD is characterized by severe proximal muscle weakness, progressive degeneration, and fatty infiltration of the muscles. The symptoms appear at the age of 2-6 yr, and patients are usually wheelchair-bound by 10 yr. The progressive nature of the disorder results in restrictive pulmonary disease, multiple contractures and scoliosis (1). We present a case report which demonstrates that non-specific alterations preoperative electrocardiogram (EKG) and normal transthoracic echocardiography (TTE) cannot exclude the development of heart failure in patients with DMD during anesthesia for major surgery.

**Case report.** A 16-yr-old boy weighing 25 kg, ASA physical status class III, was scheduled for elective thoracolumbar stabilization. His medical history was dominated by DMD diagnosed by histological examination and molecular genetic investigations, at 2-yr-old. Preoperatively, his lung function showed a restrictive pattern with a vital capacity of 1,07 (25,8% of normal), chest x-ray was normal apart from a scoliosis (Figure 1). EKG showed a sinus arrhythmia and TTE showed a normal cardiac anatomy and good ventricular function. He had been treated with perindopril. The results of laboratory tests showed a Von Willebrand disease and a plasma creatine kinase abnormal. Airway evaluation revealed micrognathia and limited mobility of the cervical spine. Anesthesia was induced and maintained with sufentanil and propofol. Vecuronium was used to facilitate orotracheal intubation. Central venous catheter, invasive arterial blood pressure catheter and urine catheter were inserted. After turn the patient to the prone position, suddenly a supraventricular tachycardia with severe hypotension develops. The patient was immediately returned to the supine position, and a one-sided carotid body massage was performed successfully. A consultation with a cardiologist was done and the surgery was postponed. The patient was transferred to the intensive care unit.

Figure 1



**Discussion.** Patients with DMD are considered to be at high risk of perioperative complications related to: administration of trigger agents as the disease is associated with malignant hyperthermia; reduce pulmonary reserve, due to upper respiratory tract infection and pneumonia, especially those in wheelchair group; cardiovascular abnormalities due to dystrophic involvement of myocardium (2). In our patient the tachyarrhythmia with hemodynamic compromise occurred during changing of position which may cause major hemodynamic changes. As described in literature a normal echocardiography may not reflect the intraoperative ability of the diseased myocardium to respond to stress (1). Should we do more exams routinely before major surgery in patients with DMD? All that issues will be discussion.

**Conclusion.** Clinical observations suggest that even a normal echocardiography does not exclude the development of heart failure in patients with DMD during anaesthesia for major surgery.

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