International Journal of Pediatric Otorhinolaryngology 78 (2014) 119–123

Contents lists available at ScienceDirect

International Journal of Pediatric Otorhinolaryngology

journal homepage: www.elsevier.com/locate/ijporl

An audit of the use of an opiate sparing, multimodal analgesic regime in children with Sleep Disordered Breathing/Obstructive Sleep Apnoea undergoing adenotonsillectomy☆

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ARTICLE INFO

Article history:
Received 28 August 2013
Received in revised form 25 October 2013
Accepted 29 October 2013
Available online 14 November 2013

Keywords:
Adenotonsillectomy
Analgesia
Obstructive Sleep Apnoea
Opiates
Respiratory complications

ABSTRACT

Objectives: Children with Sleep Disordered Breathing/Obstructive Sleep Apnoea have an increased incidence of respiratory complications following adenotonsillectomy. This may be partly related to an increase in sensitivity to opiates.

An audit of such cases undergoing adenotonsillectomy was performed with the following aims:

1. To measure and compare the incidence of postoperative respiratory complications following an already locally established opiate sparing, multimodal analgesic regime, with published reports.
2. To measure local compliance with these guidelines.
3. To consider which risk factor(s) best predicted the chances of a respiratory complication occurring, perhaps enabling a more efficient use of post operative resources in the future.
4. To measure the incidence of postoperative haemorrhage and post operative nausea and vomiting.

Methods: All patients had Sleep Disordered Breathing/Obstructive Sleep Apnoea confirmed preoperatively by Overnight Oximtery Studies. Oximetry data was expressed as the lowest recorded saturation ($SpO_{2\ Low}$ %) and number of significant desaturations (see text) per hour (ODI4%). Case notes and oximetry studies were scrutinized for relevant perioperative anaesthetic and analgesic data, risk factors and complications.

Results: The overall incidence of major and minor respiratory complications was low (1.6% and 27% respectively). Children who suffered any complication were more likely to be younger ($p = 0.0078$), have a lower $SpO_{2\ Low}$ ($p = 0.004$) and higher ODI4% ($p = <0.0001$). Multiple logistic regression showed ODI4% to be the best predictor of a potential respiratory complication ($p = 0.0032$). An ODI4% of >8 may be the best cut off point in predicting complications (AUC = 0.78, sensitivity = 0.90) but it showed a poor specificity (0.57). Primary/secondary haemorrhage occurred in 0.4%/1.2% respectively and postoperative nausea and vomiting in 4.4%.

Conclusions: A low dose opiate-based, multi modal analgesic regime appears to be effective and safe in children with Sleep Disordered Breathing/Obstructive Sleep Apnoea undergoing adenotonsillectomy.

1. Background

Obstructive Sleep Apnoea (OSA)/Sleep Disordered Breathing (SDB) in children is usually treated by adenotonsillectomy, albeit at an increased risk of postoperative respiratory complications [1–4]. The exact risk is difficult to ascertain because of differences in definitions, patient groups studied and differing anaesthetic and analgesic techniques used [5–11]. Perioperative risk appears to be associated with the severity of OSA and/or associated significant comorbidity [1–15]. Following a previous audit [15] in our institution local practice established that all children with suspected OSA/SDB should have preoperative Overnight Oximetry (OOX) to confirm the diagnosis and guide perioperative care. In addition a low dose opiate, multimodal analgesic (paracetamol and NSAID's) regime was recommended following the finding of a low incidence of post operative respiratory complications and recently published national guidelines [15,23,24]. This planned audit of local management of children with OSA undergoing adenotonsillectomy was performed to:

1. Compare the incidence of respiratory complications in patients receiving the recommended analgesic regime with other published studies.

☆ Some of the data published here was presented at the European Society of Paediatric Anaesthetists ASM, Stresa, Italy, September 2012.

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http://dx.doi.org/10.1016/j.ijporl.2013.10.067

2. Investigate whether such complications could be predicted using the data currently supplied by preoperative Overnight Oximetry and/or the presence of significant pre existing comorbidity [1,3] in order to improve service delivery.
3. Measure and compare the incidence of other significant perioperative complications (haemorrhage, postoperative nausea and vomiting) that may be influenced by the analgesic or anaesthetic techniques used.
4. Measure the local compliance with the local anaesthetic and analgesic recommendations.

2. Methods

The medical and nursing records of children who underwent adenotonsillectomy or tonsillectomy for the treatment of OSA/SDB, previously confirmed by Overnight Oximetry Studies (see below) between 2007 and 2011 were scrutinized by the author. Permission for the study was granted by the Hospital Clinical Audit Committee. Data collected included demographic data, results from Overnight Oximetry studies (see below), presence of significant pre existing comorbidity [1,3], perioperative anaesthetic and analgesic technique and the incidence and type of post operative complications.

Local guidelines recommended the use of balanced general anaesthesia employing an oxygen, nitrous oxide and sevoflurane mixture. Choice of induction agent (intravenous propofol or sevoflurane) and definitive airway (endotracheal tube (ETT) or Laryngeal mask airway (LMA)) was at the discretion of the supervising anaesthetist, having consulted the operating surgeon. The recommended peroperative analgesic regime [15,23,24] was a combination of paracetamol (15 mg kg^{-1} IV), a Non Steroidal Anti Inflammatory Drug (NSAID) (Ibuprofen 5 mg kg^{-1} PO or Diclofenac 1 mg kg^{-1} PO/PR) and morphine (50–100 mg kg^{-1} IV, *further reduced in more severe cases*). In practice the total dose of intraoperative morphine given would have been at the supervising anaesthetist's discretion based upon their preoperative evaluation and the patient's intraoperative clinical response to surgery. Recommended prophylactic antiemesis was provided by a combination of Ondansetron and Dexamethasone [15,24]. Recommended post operative analgesia was with a combination of regular paracetamol 20 mg kg^{-1} PO and Ibuprofen 5 mg kg^{-1} PO [15,23]. Rescue analgesia was available with oral morphine 100–200 mg kg^{-1}.

Since the choice of intraoperative opiate varied between anaesthetists all recorded doses were converted to a Morphine Equivalent (ME mcg kg^{-1}) in manner previously reported [22,25]. Total Operative ME dose (TOME) was taken as the intraoperative dose plus any additional opiate required postoperatively in the recovery unit (PACU), to achieve adequate analgesia, before discharge back to the ward. This allowed comparison with previously published series utilizing a similar method [22,25]. All patients left the recovery (PACU) with a pain score <3 (0–10 visual/facial pain score).

To enter the audit, patients must have had a preoperative Overnight Oximetry Study (Nellcor N295 Oximeter/Score Analysis Software™, Nellcor, USA.). The lowest recorded oxygen saturation ($SpO_{2\ Low}$) and Oxygen Desaturation Index (ODI4%) (average number of significant desaturations per hour of sleep, defined as the number of desaturations ≥4% below baseline or <89% for at least 10 s) were recorded. Studies were inspected by the author to exclude artefactual or erroneous measurements. Patients were considered to have SDB/OSA if Studies showed a $SpO_{2\ Low}$ <90% or ODI4% >1.5 [4,5,9,12]. The age and presence of significant comorbidity [1,3] were also noted.

Respiratory complications were based upon the need for intervention and defined as None, Minor (simple desaturation requiring supplementary oxygen only to keep $SpO_2 \geq 95\%$ at any time in the first post op 24 h) or Major (active airway intervention such as Adrenaline nebulizer, Nasopharyngeal Airway, CPAP and/or endotracheal intubation required). The choice of $SpO_2 \leq 94\%$ as the trigger for supplementary oxygen was based upon established practice in our hospital.

All patients had surgery by "cold steel dissection" with spot diathermy and/or surgical ties for haemostasis (technique at the discretion of the operating surgeon).

The primary audited outcome was the incidence of respiratory complications and need for intervention. Secondary outcomes included the adherence to guidelines regarding use of multimodal analgesics, total dose of operative morphine used (TOME), incidence of PONV and post operative haemorrhage. Outcomes were then compared to local and national guidelines and previously published reports.

Since this was a retrospective audit, sample size was determined by the number of cases found that fitted the inclusion criteria, in particular available results of a preoperative Overnight Oximetry study. Simple descriptive statistics, Mann Whitney test, Multiple Logistic regression and ROC Analysis for comparison of data were used where appropriate. StatsDirect V2.7.2 software was employed for data analysis and statistical significance set at $p \leq 0.05$.

3. Results

A total of 252 patients were included in the audit (preoperative patient characteristics Table 1). A Laryngeal mask airway (LMA) was initially chosen in 146 of patients. In 8 cases (7 due to obstruction from the Boyle Davis gag, 1 due to an inadequate anaesthetic airway at induction) the LMA was exchanged for an endotracheal tube (ETT) before surgery commenced. Thus 124 patients were intubated with an ETT for surgery.

The incidence of postoperative respiratory events is listed in Table 2. Only four patients (1.6%) had major complications: two patients needed reintubation and a period of postoperative ventilation and two needed Mask CPAP post operatively (Table 3).

The recommended, maximum operative opiate dosage was exceeded in 26(10.3%) patients (high dose TOME >100 mcg kg^{-1}). When compared to the Low dose TOME group these patients were no different in respect to preoperative characteristics (age ($p = 0.354$), gender ($p = 0.926$), weight ($p = 0.714$), $SpO_{2\ Low}$ ($p = 0.679$) or ODI4% ($p = 0.968$)). Predictably the TOME dose (mcg kg^{-1}) used was significantly higher in the High dose group (Median [IQR]) = 50(40–75) v 200(150–200), $p = <0.0001$). The incidence of any respiratory complication (Major and Minor combined) was significantly higher in the High TOME group ($p = 0.0003$, OR = 4.7).

Since one of the main aims of the audit was to measure the complication rate associated with a Low dose opiate technique, further statistical analysis was applied to the Low Dose group only. Additionally, the overall incidence of major respiratory complications was so low that minor and major groups were combined to allow further meaningful analysis.

Table 1
Patient preoperative characteristics, $n = 252$.

Characteristic	Median (IQR [Range])
Age (years)	3 (2–5 [1–18])
Weight (kg)	16 (13–20 [5–127])
$SpO_{2\ Low}$ (%)	78 (71–82 [45–93])
ODI 4% (desats min^{-1})	9 (5–15 [1.5–53])
M/F (%)	64/36
High risk comorbidity *n* (%)	56(22)