Editorial

The importance of obstructive sleep apnoea management in peri-operative medicine

Obstructive sleep apnoea (OSA) is associated with increased adverse peri-operative outcomes [1–8]. Studies of several large population-based databases, including millions of patients and two meta-analyses, have shown that patients with OSA have an increased risk of postoperative complications [1–7]. Many adverse postoperative events will be resolved by a longer stay in recovery, but some can be profound and result in mortality (dead-in-bed), as well as life-threatening situations requiring admission to a high dependency (HDU) or intensive care unit (ICU) [9].

The anaesthetist's role is to identify potential risks, where possible to initiate treatment to minimise those risks, and to plan for post-operative care in a safe environment where any residual risks can be dealt with. Anaesthetists who are concerned that patients with OSA are at higher risk often request the patient be monitored in HDU, a limited and expensive resource. If an HDU bed is not available, surgery may be cancelled, causing distress for the patient and wasting funded operating time. Using the HDU bed for the OSA patient may deprive other patients of that resource.

So, are we 'crying wolf'? A review of the medicolegal and closed claims literature would suggest not [10–15]. Morbidity and mortality in adult and paediatric patients with OSA is well-documented and poor postoperative surveillance features in many of these tragic cases. A failure to recognise the potential problems means that anaesthetic and postoperative management is not adjusted to take account of the increased risk from OSA.

Is this the tip of the iceberg?

The prevalence of OSA is about one in every four men and one in every ten women [16]. The incidence of OSA increases with obesity [17], and a large number of surgical patients may have unrecognised OSA. Besides the overweight patient, a leaner patient with significant craniofacial deformities, such as retrognathia or mid-facial hypoplasia, may also have OSA [18]. Patients identified by anaesthetists to have difficult mask ventilation, laryngoscopy and tracheal intubation may have undiagnosed OSA [19]. Sixty-six percent of patients with unexpected difficult tracheal intubation were later found to have OSA [19]. Particular attention should be paid to these patients in the recovery area, especially if opiates are required.

Worldwide, 234 million major surgical procedures are undertaken every year [20]. In view of the increased peri-operative complications, surgical safety for patients with OSA could be a substantial global concern.[20]

Pre-optimisation

The American Society of Anesthesiologists recently published a practice guideline recommending pre-operative screening to identify undiagnosed OSA, pre-operative initiation of continuous positive airways pressure (CPAP), if possible, and enhanced postoperative monitoring [21, 22].

What is the evidence for pre-operative CPAP therapy? A recent meta-analysis of six studies of 904 patients, with low to moderate level of evidence, examined the effectiveness of CPAP therapy on postoperative outcomes and length of stay in surgical patients with OSA [22]. There was no significant difference in postoperative complications between patients who did and did not receive CPAP, but there was a trend towards significance for reduction in the length of hospital stay of 0.4 days favouring CPAP [22].

In surgical patients with newly diagnosed OSA, Liao et al. started auto-titrated positive airways

pressure treatment three days pre-operatively and continued in the postoperative period for five days, resulting in a significant decrease in the postoperative apnoea-hypopnoea index [23]. Two recent large retrospective studies provide preliminary evidence of the benefits of CPAP in patients with diagnosed and undiagnosed OSA [24, 25]. Mutter et al. found that diagnosed OSA patients had a significantly reduced risk of cardiovascular adverse events versus undiagnosed OSA patients [24]. Patients with a pre-operative diagnosis of OSA and prescription for CPAP were less than half as likely to experience cardiovascular complications as those diagnosed after surgery. Abdelsattar et al. found that documented OSA without therapy or suspicion of OSA was associated with higher cardiopulmonary complications than OSA patients on CPAP therapy [25]. These two large retrospective database studies provide early evidence of the merit of CPAP therapy in pre-operative patients.

In the last few years, the Royal College of Anaesthetists has embraced peri-operative medicine with the aim to deliver the best possible care for patients before, during and after major surgery [26]. The time between the decision to perform surgery and the date of the surgery allows optimisation of patients' health. With the concept of peri-operative surgical home, optimising a patient's health status such as coronary heart disease, congestive heart failure, chronic obstructive pulmonary disease or diabetes in preparation for surgery has become the new reality [27]. Why not OSA?

One reason is that access to diagnosis and treatment is limited. Sleep clinics are under increasing pressure and waiting times have increased. This discourages anaesthetists from looking too hard for OSA. A significant delay in the patient's surgical treatment may occur if OSA is suspected and surgery is postponed for further investigation.

Management

At present, the optimal clinical pathway for surgical patients with newly diagnosed OSA has not been determined [21, 22, 28–31]. Should we diagnose and treat OSA before surgery? Or, should we refer these suspected OSA patients only after surgery, and, in the meantime, manage these patients conservatively, with additional postoperative monitoring?

The ideal service would start in the anaesthetic pre-assessment clinic. Different screening questionnaires have been used, but most are subjective and the answers are influenced by the individual's motivation. The STOP-Bang questionnaire aims to reduce the subjectivity of patient responses and is gaining popularity [32–34]. It is a self-administered screening tool and includes four 'yes/no' questions with a mnemonic (S- snoring, T – tiredness, O- observed you stop breathing, P- blood pressure) in addition to demographic data including body mass index (> 35 kg.m^{-2}), age (> 50 years), neck circumference (> 40 cm) and gender (male) (see www.stopbang.ca). This gives anaesthetists and nurses in pre-assessment clinics a tool to identify patients with suspected OSA. Whilst this is an important step forward, it introduces an entirely different practical problem. How do we manage patients with suspected OSA?

A high STOP-Bang score could trigger a home sleep study instead of in-patient polysomnography. Technology has improved, so that home sleep tests provide good quality data [35]. As anaesthetists, we are familiar with monitoring various physiological data continuously as part of contemporary practice in the operating room or the ICU. With proper training in sleep medicine, anaesthetists can diagnose and treat OSA in the peri-operative setting [36, 37]. Those without OSA can be treated as normal. Severe OSA and obesity hypoventilation syndrome should be treated with positive airway pressure therapy.

For some patients, CPAP is not an easy therapy. In others, it transforms their lives almost instantly. In hospitals that do not have a sleep medicine service or if there is a long waiting list, there are alternatives. Under supervision of qualified specialists, third-party companies can take over the management of these patients, and data from the CPAP devices can confirm effectiveness and treatment adherence. Newer devices can automatically upload data to a secure web portal and to patient's own devices so that they can review their CPAP use. There are economies of scale for these companies, but there is no reason why the NHS could not

replicate this across geographical boundaries.

For patients with mild to moderate OSA, we are left with a problem. Some will react adversely to anaesthesia, but we are not able to identify the higher-risk patients. Further research is needed to determine the OSA phenotype that may develop postoperative complications. The Society of Anesthesia and Sleep Medicine and the Anesthesia Closed Claims Project have established a registry in North America in order to accurately record adverse anaesthetic events related to OSA [38]. Accumulation of these data will help to identify the predisposing risk factors of OSA resulting in postoperative complications.

In clinical practice, patients with mild to moderate sleep apnoea are often prescribed intra-oral devices. The mandibular advancement device protrudes the lower jaw in the same way that anaesthetists advance the mandible in order to maintain a patent airway. If there is mild to moderate sleep apnoea and the dentition is adequate, a mandibular device could be provided to be used in the peri-operative period. However, this needs to be tested in a randomised controlled trial in the peri-operative setting.

Anaesthetists deal with all patients individually, taking into account comorbidities and the type of surgery planned. Oropharyngeal tumours are one of the causes of OSA, so every patient should have an examination of the upper airway. Patients seen on the day or within a few days before surgery might not be able to have their treatment initiated in time for surgery. In this situation, peri-operative precautions and risk minimisation should be practiced, with short-acting anaesthetics, multimodal analgesic therapy and postoperative monitoring to ensure safety [21, 37].

Paediatric OSA is commonly associated with tonsillar hypertrophy and it is often wrongly assumed that tonsillectomy results in an immediate resolution of OSA. Any child with a major degree of OSA needs to be managed post-operatively in a facility where they can be closely observed and where staff are capable of intervening to resolve an airway problem.

Analgesia

There is evidence that patients with untreated OSA are more sensitive to opiates. Intermittent hypoxia at night may potentiate analgesic effects of opioids. Children with a nocturnal nadir oxyhemoglobin saturation (SpO_2) < 85% required half of the total dose of morphine for post-adenotonsilectomy pain relief [39]. Opiates need to be used sparingly if at all [10, 11]. Similarly, in adult volunteers suffering from OSA, nocturnal nadir SpO_2 and insulin growth factor binding protein-1, a serum marker of hypoxia, were significantly associated with increased sensitivity to the analgesic effect of remifentanil infusion [40]. In a recent retrospective analysis of 218 obese adults with OSA undergoing bariatric surgery, the percentage of total sleep time spent at SpO_2 < 90% was inversely associated with total postoperative opioid consumption [41]. It may be plausible that some patients with OSA require reduced doses of opiates.

The severity of postoperative sleep-disordered breathing in patients with OSA was significantly associated with the total opioid dose administered for postoperative analgesia [42]. In OSA patients, preoperative apnoea hypopnoea index, patient age, and 72-h opioid dose were all significant predictors of increased postoperative apnoea and hypopnoea on the first three postoperative nights [42]. Surgical patients suffering from moderate to severe OSA and the elderly might be more vulnerable to opiate-induced ventilatory depression.

Opiates worsen postoperative sleep-disordered breathing in OSA patients. However, there is an observed inconsistency between the high prevalence of OSA in surgical populations and the very low incidence of opiate-related critical respiratory events in postoperative patients [43]. This may be due to the hypothesis that only a small subset of OSA patients is at increased risk for opiate-induced ventilatory compromise. This subset of OSA patients, characterised by decreased chemoreflex responsiveness and high arousal thresholds, might be at higher risk for opiate-induced ventilatory depression [43]. More research is needed to identify the phenotype of OSA patients who are at potentially higher risk for opiate-induced ventilatory depression [44].

Is HDU or ICU the only alternative for these patients? In the UK, there is a lack of level-one monitored beds. The concern is to monitor patients to ensure that they are not obstructing their airway and becoming hypoxic. In the ward,

patient surveillance monitoring based on pulse oximetry with nursing notification of violation of alarm limits via wireless pager is available [27]. This monitoring has resulted in a reduced need for rescues and ICU transfers [27].

Summary

There is an opportunity for anaesthetists to play a major role in public health [45, 46]. In 2014, the British Lung Foundation completed a national campaign to raise awareness of OSA [47]. It is estimated that only 20% of individuals with OSA are identified. Whilst sleep physicians are keen to identify and treat OSA patients, the prospect of a five-fold increase in workload is daunting. As anaesthetists, we are already looking after a significant number of undiagnosed OSA patients [48]. We could make a major contribution to the health care system in the diagnosis and treatment of this condition as well as improving peri-operative safety.

The initial reaction of Clinical Commissioning Groups might be one of concern. Additional sleep studies and treatment will add to costs in the short term, but in the long term treating sleep apnoea will reduce the overall costs of health care [45, 46] Expenditure and the number of hospital admissions has been shown to be lower in OSA patients on CPAP versus no therapy [45]. Because of comorbidities associated with untreated OSA, these patients are already consuming healthcare resources. Large transport companies who have screened employees for OSA were able to identify significant overall savings in healthcare costs once their employees were treated [49]. If this is planned and managed by enthusiastic clinical teams, there are benefits for the hospital, Clinical Commissioning Groups, and, most importantly, for patients.

Sleep medicine is not typically perceived as an anaesthetic subspeciality. Anaesthetists and ear, nose and throat surgeons specialise in the management of the upper airway and OSA is a condition of the upper airway. Training in sleep medicine is available and should, we believe, be part of core training in both anaesthesia and otorhinolaryngology. In 2016, the British Sleep Society is hosting the International Sleep Medicine Course and this would be a useful starting point for our trainees (see www.sleepsociety.org.uk).

Sleep medicine is a truly multi-disciplinary speciality encompassing respiratory physicians, neurologists, otolaryngologists, psychologists, dentists, orthodontists, maxillofacial surgeons, and anaesthetists. These different subspecialties have contributed their expertise to diagnosis and treatment and have evolved together. We have witnessed the benefits of radiology expanding its scope of practice into interventional therapy. Anaesthesia has the opportunity to develop a critical role in peri-operative medicine. We have the knowledge in upper airway anatomy and physiology, and administer medications daily that impact the modulation of sleep-wake cycle, upper airway collapse, as well as control of breathing. Specialists with dual training in sleep medicine and anaesthesia with skills geared to optimally manage patients with sleep apnoea in the peri-operative setting are needed. This should enhance patient safety whilst simultaneously improving the well being of patients dramatically and reducing overall healthcare costs. What are we waiting for?

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