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Continuous education in procedural sedation:
life-threatening airway obstruction and contributing perioperative patient factors

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JA Roelofse[1], C Lapere[2]

ABSTRACT

More complex surgical procedures are increasingly offered to older patients with pre-existing disease. Perioperative patient care is at the cornerstone of the current trend in anaesthesia research. Sedation practitioners also have a role to play as intra-operative events can have an impact on long-term morbidity and mortality. A common respiratory emergency encountered during sedation is airway obstruction. Identifying the patient at risk of obstruction will greatly improve the levels of safety and care.

Keywords: perioperative care, airway obstruction, respiratory depression, laryngospasm, anaphylaxis

INTRODUCTION

Detailed statistics of the global and national outcomes following surgery remain limited.[1] Estimates from "high-income", first world countries estimate that postoperative complications occur in up to 20% of patients undergoing surgical procedures.[1] Little is known about the specifics of this subgroup of patients who do present with post-operative complications. Deaths are more common in the surgical population who present as mostly older patients with comorbidities.[2] More complex surgical options exist and are increasingly offered to more patients than in the past. This group of patients often include the older individuals with chronic disease.

The purpose of this article is to highlight the global movement towards better peri-operative care and to focus on the challenges and management of potentially life-threatening airway obstruction that could occur during procedural sedation.

1. **James A Roelofse:** *MB.ChB, MMed, PhD, Dip NDBA (USA).* Professor, University of the Western Cape, Visiting Professor, University College London.
2. **Cherese Lapere:** *MB.ChB, DipPEC, DA(SA), PDD.* Sedation Practitioner.

Corresponding author
James A Roelofse:
Private Bag X1, Tygerberg 7505. Tel: 021 937 3085,
Cell: 083 458 2427. E-mail: jar@sun.ac.za

ACRONYMS

OSA: obstructive sleep apnoea
OR: odds-ratio

DISCUSSION

In standard international practice, surgery should not be undertaken for a patient with an American Society of Anesthesiologists' (ASA) classification of 3 or 4 in a remote setting depending on out-of-theatre procedural sedation.[3] Should any complication occur, the patient with comorbidities might fail to cope and need escalation of care in the immediate postoperative period. Identifying the "high-risk" patient is not an easy task and is currently seen as a major aspect of future research in peri-operative care. Many different triage tools exist that have been validated to predict whether a patient would do well in the post-operative period. However, it remains the considered judgement of the clinician to decide on the day of surgery whether it is in the best interests to continue with the case or not.

Currently, large data collection is being undertaken for the evaluation of perioperative anesthesia outcomes in a very large cohort of hospitals in South Africa inwhich pediatric surgery is undertaken. As we seek to ensure safe surgical treatment for our patients, we need to understand the severity of harm that can develop following complications during the surgery.

The Enhances Recovery After Surgery (ERAS) approach is a "bundle" or group of interventions aimed at enhancing early recovery following surgery. With more complex and longer cases being conducted under sedation, practitioners should be acquainted with these principles.[4] This approach is aimed at reducing the need for postoperative hospital admissions.

The second concept to be discussed in this article is the importance of identifying the patient who may be at risk of airway obstruction during procedural sedation.

Structured sedation protocols exist to provide for the incorporation of safety principles to reduce morbidity.[5]

Regardless of the intended level of sedation, procedural sedation is a continuum and patients may develop respiratory complications at any time. Life-threatening respiratory complications include airway obstruction, respiratory depression, laryngospasm, bronchospasm and unintended loss of the patient's protective airway reflexes.[5]

The framework of the upper airway consists of bone and cartilage attached to soft tissue structures; starting at the nose and lips, and extending to the larynx.[6] Where the upper airway is unsupported by bone or cartilage it has the tendency to collapse when the muscular framework relaxes during sleep.[6] The pharyngeal section is a collapsible area between two rigid structures: the nasal and tracheal sections.[6] During sedation or anesthesia, the decrease in muscle tone is further compounded by drug-induced upper airway neural and muscular activity.[6] This increases the risk of airway obstruction and intervention might be necessary to overcome the problem.

Airway collapse typically occurs at points of narrowing and/or flaccidity. In the case of children with tonsillar hypertrophy a higher chance of obstruction exists. The area of the upper airway most commonly prone to collapse is the velopharynx, as may be shown radiologically with enflurane anaesthesia and under propofol total intravenous anaesthesia.[7] Interestingly, in the study described here, the principal site of collapse was not affected by the depth of anaesthesia.[7] This is important for the sedation practitioner who might be challenged to attempt a "quick, uncomplicated case" on a patient with potentially undiagnosed obstructive sleep apnoea – remember that even a short case could have complications if the patient selection was not done carefully and if the setting were not safe for the "more complex, high-risk patient". These patients should preferably be looked after at a facility with a theatre and having help available. Table 1 is an adapted summary of patients predisposed to developing obstructive sleep apnoea.[6]

Table 1: Predisposing conditions for obstructive sleep apnoea: Adapted from Hillman et al.[6]

Diagnosis / Condition → Example
• Obesity → Acquired, or Prader-Willi syndrome
• Genetic predisposition
• Age
• Male gender
• Alcohol, sedatives
• Smoking
• Nasal obstruction → Septal deviation, chronic nasal congestion
• Pharyngeal obstruction → Tonsillar and adenoidal hypertrophy
• Craniofacial abnormality → Down's, Pierre-Robin, Treacher-Collin's Syndromes, achondroplasia, acromegaly, fragile-X syndrome
• Laryngeal obstruction → Laryngomalacia
• Endocrine/ metabolic disorders → Hypothyroidism, androgen therapy, Cushing's syndrome
• Neuromuscular disorders → Stroke, cerebral palsy, head injury, muscular dystrophies, myotonic dystrophy
• Connective tissue disorders → Marfan's syndrome
• Chronic renal failure
• Storage diseases → Mucopolysaccharidoses

Other features predisposing to airway obstruction, especially in paediatric patients involve: a relatively large occiput, a large tongue and operator-induced obstruction, ie: the surgeon or dentist depressing the mandible while operating.

The STOP-BANG questionnaire consists of eight-items and has been validated for the screening of patients for obstructive sleep apnoea (OSA).[8] Chung et al concluded that a STOP-BANG score of 5-8 increases the incidence of OSA in the surgical population.[9] OSA is a condition characterised by functional airway collapse during sleep causing reduced or complete cessation of airflow despite ongoing breathing efforts. In a 2012 meta-analysis, the authors found an odds-ratio (OR) of 2.4 of OSA associated with acute respiratory failure and OR of 2.3 for post-operative oxygen desaturation.[10] Patients with OSA should be classified in the ASA 3 group. However, the sedation practitioner should always be aware of the undiagnosed patient at risk.

An important distinction should be made between patients with airway obstruction and those with respiratory depression, which is a reduction in the patient's central drive to breathe/ventilate.[11] A cause of central respiratory depression is opioid administration. Sedation guidelines point to the use of short-acting opioids when necessary. Patients at risk are the elderly, patients with renal impairment and the paediatric population. In the UK, the incidence of post-operative opioids-induced respiratory depression is approximated at 1%.[11] Identifying The patient who obstructs is identified as one who "cannot breathe" in contrast with the respiratory depression of "won't breathe".[6] Foreign material in the upper airway can also be a reason for obstruction: secretions, "throat/ pharyngeal packs" or a poorly positioned tongue are all possible culprits.

Prompt identification of upper airway obstruction forms the mainstay of treatment. The next step in the management of an obstructed patient involves correct positioning: "sniffing the morning air" position is achieved by elevating the shoulders slightly, causing flexion of the neck and extension of the head. This keeps the plane of the mid face parallel to the bed. Simple airway manœuvers like lifting the chin or a slight jaw thrust usually solve the problem. When these don't work, and the practitioner is sure that the patient is not suffering from central respiratory depression, other causes of upper airway obstruction should come to mind, namely laryngospasm or laryngeal oedema which is highly suggestive of anaphylaxis. Detail on the management of the latter two conditions has been discussed in a previous communication on Continuous Education. (SADJ volume 71, February and September 2016).

Should the above manœuvers fail to provide a patent airway, more advanced management, including positive pressure ventilation with a bag-mask device and endotracheal intubation or supraglottic airway support may be indicated. Prompt referral to a hospital facility is imperative.

What can sedation providers do to best prepare for managing airway obstruction?

Patient selection, careful review of current and underlying medical conditions, and a detailed pre-operative assessment are fundamental.[5] See Table 2 for more factors which govern our actions in protecting our patients from adverse events. Staff training and practitioner skills have been shown in the literature to improve rescue attempts when a patient develops a complication or inadvertently slips down the continuum to a deeper level of sedation than that intended.[5]

Table 2: Summary of factors that could reduce the risk of complications during sedation

Factors that should be employed to minimize risk:
Practitioner • Skills • Training • Guidelines • Pharmaceutical knowledge • Vigilance; patient monitoring
Patient • Patient selection • Procedure suitable for out-of-office sedation
Environment and staff: • Accreditation • Training • Checklists • Equipment: checked, tested, available • Awareness: posters • Emergency plan

CONCLUSION

Complications arise mostly while providing any level of sedation or general anesthesia for patients who have significant medical compromise. Sentinel events can be prevented as far as possible by ensuring optimal pre-sedation assessment, optimal patient selection as well as attentive intra-operative monitoring and rescue support when indicated.[12]

Perioperative procedural sedation outcomes should be further explored in the South African milieu.

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