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Pre-Operative Optimisation of Respiratory Disease

Before completing this tutorial please answer the following MCQs T/F:

1) Regarding asthma
    - Variable symptoms are in keeping with a diagnosis
    - PEFR values of >70% of the patients normal indicate good control
    - CXR is routinely indicated in perioperative workup
    - Spirometry is likely to be be useful in assessing patients disease control
    - In patients with suboptimal control a short course of oral steroids may be indicated perioperatively

2) Regarding COPD
    - Many patients with COPD remain undiagnosed
    - Do not normally require an ECG pre operatively
    - The FEV(1)/FVC ratio is used to grade severity of COPD
    - The diffusing capacity of carbon monoxide (DLCO/KCO) is commonly useful in the assessment of COPD
    - Raised PaCO2 is not associated with increased perioperative complications

3) Regarding OSA
    - Prevalence of OSA is increasing and incidence may be as high as 70% in select surgical cohorts
    - The STOP BANG score is the most validated screening tool for identifying patients at high risk of OSA
    - Sleep studies are always required if patients are at high risk of OSA
    - The apnoea/hypopnoea index (AHI) refers to the number of apnoea's/hypopnea's recorded per hour
    - An AHI value of 8 is consistent with moderate OSA

4) Regarding OSA
    - If full sleep studies are not available overnight peripheral oximetry recording can be used to detect significant OSA
    - The oxygen desaturation index is the number of desaturation >3%

from baseline per hour
- Obesity hypoventilation syndrome is a triad of BMI >35, sleep disordered breathing and baseline PaCO2 >6Kpa
- It confers an increased risk of stroke
- ECG is indicated pre operatively

Key points:

- Respiratory disease is common and confers an increased risk of post operative pulmonary complications (PPC'S) (1)
- The risk of PPC's can be reduced by optimisation of respiratory disease which requires; accurate diagnosis, assessment of impact on functional status and identification of any deterioration from baseline to guide interventions
- Peak expiratory flow rate is a useful test perioperatively in asthma and values <80% of normal should prompt consideration of additional treatment (2)
- Spirometry can be used to both diagnose and quantify severity of COPD aiding planning of perioperative care (3)
- OSA is often undiagnosed and its prevalence is increasing. Recent SOBA guidelines provide a useful framework to guide perioperative workup. (4)

Answers 1. TFFFT, 2. TFFFF, 3. TTFTF, 4. TFTTT

Introduction

Anaesthetists in the UK are faced with an increasing elderly and co morbid population. Several recent papers have examined the incidence, impact and risk factors for development of postoperative pulmonary complications (PPC's), identifying pre-operative optimisation of respiratory disease as a vital part of strategies to reduce these (1). This tutorial will focus on the diagnosis and pre-operative management of asthma, COPD and OSA.

Optimisation of respiratory disease requires diagnosis, assessment of the diseases impact on baseline functional status and identification of any deterioration in disease

control to guide pre-operative interventions. As ever this is achieved through meticulous history and examination combined with targeted investigations.

Smoking

Whilst a full discussion of the effects of smoking and benefits of smoking cessation is beyond the scope of this tutorial, the importance of smoking cessation as part of respiratory optimisation cannot be overstated.

Many studies have demonstrated a reduction in PPC's and all cause post-operative morbidity on cessation of smoking (5). The pre-operative assessment is recognised as an important and effective time to offer smoking cessation advice and support and this is reflected in the 2013 NICE guidelines (6)

Asthma

Although more the domain of the GP and respiratory physician a working knowledge of the diagnosis and management of asthma is important to allow effective perioperative optimisation of these patients. A history of:

* Recurrent episodes of wheeze, cough, breathlessness or chest tightness

* Symptom variability

* Absence of symptoms of an alternative diagnosis

* Recorded observation of wheeze

* Personal history of atopy

* Historical record of variable PEF/FEV(1)

Should alert the anaesthetist to the possibility of undiagnosed asthma and prompt consideration of referral for further assessment (7).

In patients with known asthma history taking should focus on; establishing the patient's baselines status, exercise tolerance, nature, frequency and severity of attacks (including whether these attacks required hospital treatment, ICU admission) and normal asthma therapy. The enquiry should then move to seeking evidence of any deterioration or active infection; increasing frequency or severity of attacks, decreasing exercise tolerance, fever, purulent sputum and or changes in asthma therapy. In the clinical examination the finding of wheeze or evidence of upper/lower respiratory tract infection are of particular importance.

In the patient with well controlled asthma and no evidence of deterioration or infection there may be no need for any specific investigations other than those required due to the nature of the surgery or other co-morbidities. Otherwise the following investigations should be considered;

Peak expiratory flow rate (PEFR)

The wide normal range (200-600L/min) for this investigation means comparison with the patient's normal value is far more useful than the absolute number. The American lung association propose values >80% of patient normal suggest good control, 50-80% suggest additional treatment may be required and values <50% suggest an acute asthma attack (2).

CXR

Even in patients with poorly controlled asthma a CXR will rarely aid in anaesthetic planning. Instead a CXR should be reserved for patients in whom an alternative or additional pathology is suspected, principally lower respiratory tract infection.

Spirometry

Although recommended in establishing the diagnosis of asthma (2,7) it is unlikely that formal spirometry will confer additional benefit above PEFR in detecting deterioration in patients asthma control. The variability in patient symptoms and time constraints in obtaining spirometry also limit its usefulness in perioperative assessment of asthma.

ABG

Rarely of benefit, but may be useful to establish baseline oxygenation, carbon dioxide retention and acid base status in severe disease

Poorly controlled asthma confers a significantly increased risk or perioperative complications (8). In the emergency setting there may be little that can be done to mitigate this, however, where more time is available every effort to optimise disease should be made prior to surgery. BTS guidelines do not make specific recommendations regarding management in the perioperative period and in most cases the most prudent course of action will be to refer the patient to either their GP or respiratory physician to improve disease control. In situations where this isn't possible, for example urgent surgery the anaesthetist should seek to gain better disease control through escalating

pharmacological therapy. This could be achieved specific stepwise approach to preoperative management proposed by Applegate et al (23)

Alternative options include prescribing a short course of oral steroids for all patients with asthma who's PEFR is not at their predicted value or personal best as per ALA (2) guidance, or escalating to the next step of asthma management in the BTS guidelines. It is vital that anaesthetists are familiar with any drugs they prescribe and communicate with patients GP's to ensure appropriate follow up.

COPD

The prevalence of COPD has increased by 27% in the last decade (10) with 4.5% of the population aged over 40 now diagnosed with the disease. In addition undiagnosed COPD remains common, therefore, as with asthma an understanding of the diagnosis and management of COPD is vital for the anaesthetist. NICE guidelines (3) recommend that a diagnosis of COPD be considered in all patients aged >35 with one or more of the following symptoms

* Exertional breathlessness

* Chronic cough

* Regular sputum production

* Frequent winter bronchitis

* Wheeze

Patients presenting for elective surgery in whom undiagnosed COPD is suspected require referral for formal diagnosis and initiation of therapy. Since Spirometry is a key part of diagnosis is may be expeditious to organise this concurrently.

In patients with a diagnosis of COPD the history should again focus on establishing the patients baseline function, before seeking evidence of active infection and/or deterioration from that baseline. In this more elderly cohort of patients self-reporting of exercise tolerance is less reliable and so seeking objective evidence (relatives assessment, breathlessness during activities of daily living, how many stairs they can climb before stopping) is essential. Co morbid conditions, particularly cardiac are common and evidence of these should be sought.

Clinical examination should seek evidence of decreased breath sounds, rhonchi and wheeze as these have be shown to confer and increased risk of PPC's (11). In addition evidence of active infection and right heart failure should be sought.

In contrast to asthma patient with COPD routinely require pre-operative investigations for their disease as well as those required by the proposed surgery and other co morbidities.

ECG

This is required to identify signs of right heart failure secondary to chronic hypoxia (P pulmonale, RBBB, RVH), it may also identify other common pathologies such as IHD or AF.

Routine pre-operative blood tests

May reveal polycythaemia secondary to chronic hypoxia, or a neutrophilia suggestive of current infection. In addition albumin levels <35mg/litre are associated with an increased risk of PPC's (12) and nutritional supplementation should be considered.

Spirometry

As well as being required to make a diagnosis of COPD spirometry is also used to assess severity of the disease as shown below

Post bronchodilator FEV(1)/FVC	FEV(1)% predicted	GOLD (2017)	NICE (2010)
		Post bronchodilator	Post bronchodilator
<0.7	>80%	Stage 1 - Mild	Stage 1- Mild
<0.7	50-79%	Stage 2 - Moderate	Stage 2 - Moderate
<0.7	30-49%	Stage 3 - Severe	Stage 3 - Severe
<0.7	<30%	Stage 4 – Very Severe	Stage 4 – Very Severe

(3,13)

Increasing severity of disease is associated with increased risk of PPC's (14).Assessment of diffusing capacity of carbon monoxide (KCO, DLCO) is of limited use in assessment of obstructive airway disease and NICE guidelines (3) only recommend its use to investigate symptoms disproportionate to the above described spirometric impairment alongside CT imaging of the thorax.

ABG

This may be useful in patients with severe disease. Reduced PaO2 and raised PaCO2 have both been associated with increased post-operative complications (15) and it may also serve as a useful baseline.

Functional assessment (6 minute walk, CPET)

Functional assessment is not required in pre-operative investigation of COPD specifically. However, patients with COPD often have significant functional impairment and these tests should be considered if major surgery is proposed.

Poorly controlled COPD or active infection places patients at an increased risk of PPC's. When time allows these patients should be referred to their GP or respiratory physician for optimisation of therapy. However, an understanding of COPD management is still useful. NICE guidelines (3) offer detailed recommendations for the escalation of pharmacological therapy. It is important to remember that NICE also recommend encouraging, and offering support with smoking cessation and pulmonary rehabilitation (PR). PR combines a tailored physical exercise programme with education on managing the condition and its symptoms, typically delivered over 6 to 8 weeks. Its effectiveness has been widely established, a recent Cochrane review demonstrated significant improvements in patients HRQoL and exercise capacity (21). It has also been shown to reduce health care utilisation (22).

OSA

Estimates of OSA prevalence vary widely amongst different patient groups. Whilst estimates in the UK general population are around 2-4% (16), this figure is higher in those presenting for surgery and may be as high as 70% (4) in patients undergoing bariatric surgery. In addition OSA is commonly undiagnosed and likely to increase alongside increasing obesity and age, presenting a significant challenge for anaesthetists.

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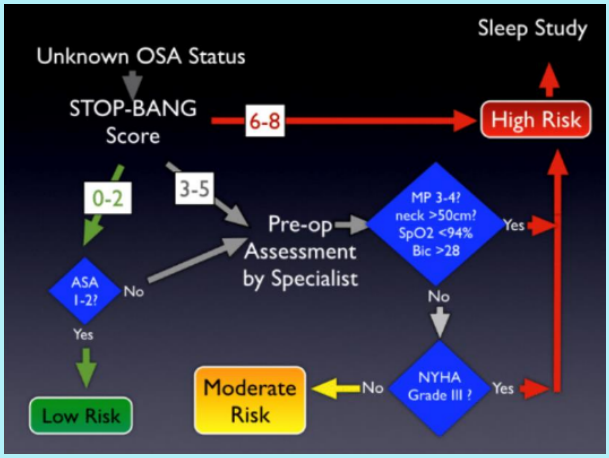
While aimed specifically at obese patients the recent SOBA OSA guideline (17) also has utility in the general population.



(17)

The guidelines recommend classifying patients into low, moderate and high risk for OSA. It is widely accepted the STOP BANG score is the most validated screening tool for OSA (4) and its use in the perioperative setting as a screening tool is recommended by both the AAGBI and ASA. Like most screening tools there is an inverse relationship between sensitivity and specificity with increasing STOP BANG score meaning the exact score used to define a high risk group may differ between organisations faced with different surgical populations. In the 2015 AAGBI guidelines on management of the obese patients (18) a STOP BANG score of > 5 is considered high risk.

Using the above recommendations a large proportion of patients will be identified as high risk through pre operative assessment. As ever a through history and examination is vital in allowing the anaesthetist to identify those at high risk. Features suggestive of OSA can be divided into three groups.

Symptoms

Witnessed apnoea's or chocking noises, excessive daytime sleepiness or impaired concentration, feeling unrefreshed on waking, mood swing, personality change, depression, nocturia (NICE)

Signs

Neck circumference, tongue size, craniofacial abnormalities, adenotonsillar hypertrophy

Co morbidities associated with OSA

BMI >35, hypertension, history of stroke, IHD, diabetes, Down syndrome, acromegaly

Although the SOBA guideline specifically uses Mallampati score, neck circumference, oxygen saturations, bicarbonate levels and NHYA grade to define patients with lower STOP BANG scores as high risk when thinking about OSA in the general rather than obese population that decision remains a clinical one based upon the above described features. It should also be noted that although ASA 3 and 4 patients should be seen pre operatively those with a BMI <35 and a STOP BANG score <2 can be considered low risk for OSA.

Patients with OSA frequently require investigations both to diagnose or quantify severity of OSA and associated co morbidities.

Sleep studies

Where time and resource allow all patients defined as high risk for OSA should be referred for sleep studies prior to surgery (17,18). A formal sleep study will include; polysomnography (ECG, EEG, eye movements, EMG), snoring volume, oro-nasal airflow and peripheral pulse oximetry. This allows calculation of the apnoea/hypopnoea index (AHI), which can be used to define the severity of OSA (15)

AHI >5 = mild

AHI >15 = moderate

AHI > 30 = severe

If full sleep studies are not available then OSA can be defined as significant or non-significant using overnight oximetry. The oxygen desaturation index (ODI) is the number of desaturations >4% per hour. An ODI of .5 is considered significant (15)

ABG

Whilst not specifically used in the diagnosis or assessment of OSA ABG analysis may be useful in the perioperative setting. The presence of hypercapnia ($PaCO_2$ > 6Kpa) alongside sleep disordered breathing and obesity defines obesity hypoventilation syndrome. As with COPD hypercapnia and hypoxia both infer a higher risk of postoperative pulmonary complications (19) and it can serve as a useful baseline

ECG

This is required to identify signs of pulmonary hypertension and or right heart failure. It may also identify other common co morbidities such as IHD and AF.

AAGBI and SOBA guidelines (17,18) both recommend requesting sleep studies in patients deemed to be at high risk for OSA, however, both of these guidelines refer to the obese population. ASA guidelines (20) suggest that in patients whom OSA is suspected either sleep studies should be requested or the patient should be managed as if they have OSA during the perioperative period. The urgency of surgery is crucial in decision making. Perioperatively the rational for requesting sleep studies is to define the severity of OSA, initiate CPAP therapy for those with moderate to severe disease and modify lifestyle factors. Since patients need to receive CPAP for 3 months prior to surgery to see benefit if surgery is required within this time they may serve little purpose.

While a detailed discussion of intraoperative and postoperative management of OSA is beyond the scope of this tutorial, knowledge of the basic principals will aid in preoperative planning. Patients with OSA are particularly susceptible to the central respiratory depressant effects of opiates, benzodiazepines and neuroleptics. If possible these agents should be avoided or minimised. OSA is also associated with difficult intubation; as such it is vital that an airway strategy be in place prior to induction of anaesthesia.

Postoperatively CPAP should be recommended in recovery and oxygen saturations should be measured continuously while patients are immobile. Patients with OSA frequently require higher-level postoperative care.

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