

# Pre-Operative Assessment and Post-Operative Care in Elective Shoulder Surgery

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**Abstract:** Pre-operative assessment is required prior to the majority of elective surgical procedures, primarily to ensure that the patient is fit to undergo surgery, whilst identifying issues that may need to be dealt with by the surgical or anaesthetic teams. The post-operative management of elective surgical patients begins during the peri-operative period and involves several health professionals. Appropriate monitoring and repeated clinical assessments are required in order for the signs of surgical complications to be recognised swiftly and adequately.

This article examines the literature regarding pre-operative assessment in elective orthopaedic surgery and shoulder surgery, whilst also reviewing the essentials of peri- and post-operative care. The need to recognise common post-operative complications early and promptly is also evaluated, along with discussing thromboprophylaxis and post-operative analgesia following shoulder surgery.

**Keywords:** Complications, post-operative care, pre-operative assessment, shoulder surgery.

## INTRODUCTION

Pre-operative assessment is necessary prior to the majority of elective surgical procedures, in order to ensure that the patient is fit to undergo surgery, to highlight issues that the surgical or anaesthetic team need to be aware of during the peri-operative period, and to ensure patients' safety during their journey of care. In addition, unnecessary cancellations or complications due to inappropriate surgery may be avoided, in addition to costs both to the patient and health service [1]. The post-operative management of elective surgical patients begins during the peri-operative period and involves the surgical team, anaesthetic staff, and allied health professionals. Appropriate monitoring and repeated clinical assessment are required, along with support for all major organ systems, including cardiorespiratory function, renal function and fluid and electrolyte balance, and awareness for signs of early surgical complications such as bleeding and infection [2].

This article examines the literature regarding pre-operative assessment in elective orthopaedic surgery and shoulder surgery, whilst also reviewing the essentials of peri- and post-operative care. The need to recognise common post-operative complications early and promptly is also evaluated.

## PRE-OPERATIVE ASSESSMENT

Most patients undergoing elective surgery are subjected to routine history checks and clinical examinations by medical staff at the time that a decision is taken by both clinician and patient to undergo surgery. For most procedures other than those which are very minor, a formal

pre-operative assessment consultation is usually led by a specialist nurse or a member of medical staff, and generally includes a review of the patient's case notes, a detailed history and clinical examination, and additional tests and investigations.

## History

Salient points in the history in patients who are presumed to be healthy is to identify any as-yet undetected illnesses which could have an adverse affect on the forthcoming surgery and peri-operative care. The history should focus on the indication for surgical procedures, allergies, and undesirable side-effects to medications or other agents, known medical problems, surgical history, major trauma, and current medications.

Common conditions which can affect peri-operative care include ischaemic heart disease, congestive cardiac failure, chronic respiratory disease, diabetes mellitus and liver or renal dysfunction [3]. As anaesthetic drugs can have pronounced adverse effects on cardiovascular and respiratory systems, it is worthwhile enquiring about chest pain, dyspnoea, ankle swelling and palpitations. The presence of a cough, sputum production and any indication of airway obstruction will provide invaluable information. An excellent indicator of cardiorespiratory function is tolerance of exercise [4]. A smoking history should also be taken as smokers are difficult to anaesthetise due to their upper airways being sensitive to the dry gases used during anaesthesia, and their risk of hypoxia is greater. Assessment and documentation of alcohol intake is required, as induction of liver enzymes by alcohol may shorten the action of anaesthetic drugs and may identify the risk of potential alcohol withdrawal. The use of recreational drugs such as intravenous opiates should also be recognised, as such patients may have poor venous access, may be at risk of septicaemia, and may pose a risk to the surgical team.

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Patients on long term steroids require adequate cover intra-operatively in order to avoid a hypotensive crisis [4].

In elective shoulder surgery, a detailed history is important not only in arriving at the correct diagnosis, but also in decision-making between the clinician and patient. The history may be considered one of the most valuable yet least effectively used tools in clinical medicine [5]; and poor history taking and physical examination may lead to both inappropriate diagnostic testing and surgery. Patients with shoulder pathology usually present with pain and/or loss of function, which should be explored along with the patient's premorbid status and demands, and the likely functional demands aimed for in the future. A comprehensive interview regarding the patient's pain and functional deficit is required, exploring components such as site, onset, duration, character and radiation of the pain, including features of neural irritation. The degree of dysfunction should also be clarified and how this impacts on the patient and their activities of daily living (ADL), especially as lower pre-operative ADL measurements have been associated with higher post-operative mortality in patients undergoing elective orthopaedic surgery [6]. Table 1 below displays how shoulder function can be assessed [5].

**Table 1. Assessment of Shoulder Dysfunction**

<b>Which movements are limited?</b> This can help isolate the structure
<b>Consider the following if movements are limited by:</b>
<ul style="list-style-type: none"> <li>▪ <b>pain:</b> tendinopathy, impingement, sprain/strain, labral pathology</li> </ul>
<ul style="list-style-type: none"> <li>▪ <b>mechanical block:</b> labral pathology, frozen shoulder</li> </ul>
<ul style="list-style-type: none"> <li>▪ <b>night pain</b> (lying on affected shoulder): rotator cuff pathology, anterior shoulder instability, ACJ injury, neoplasm (particularly unremitting pain)</li> </ul>
<ul style="list-style-type: none"> <li>▪ <b>sensation of 'clicking or clunking':</b> labral pathology, unstable shoulder (either anterior or multidirectional instability)</li> </ul>
<ul style="list-style-type: none"> <li>▪ <b>sensation of stiffness or instability:</b> frozen shoulder, anterior or multidirectional instability</li> </ul>

### Physical Examination

A general systems examination is performed to identify abnormalities of the cardiorespiratory system which would require further assessment. In particular, cardiac murmurs, additional heart sounds, and abnormal chest signs in patients with no previously documented pathology require investigation and/or referral to an appropriate specialist. Review of the gastrointestinal (GI) system identifies any abdominal masses and previous surgical scars. Skeletal malformations such as kyphoscoliosis can be detected on examining the musculoskeletal system. Local skin abnormalities should be documented and any issues should be highlighted to the surgical team.

Observations including heart rate and blood pressure are recorded. Brief examination of the airway provides valuable information regarding the feasibility of intubation. Several factors must be considered when assessing the airway. These include whether the patient is obese, has a short neck and small mouth, or whether or not there is any soft tissue

swelling at the back of the mouth or if there are any constraints to neck flexion or extension. Cervical spine stiffness should be followed up with a plain radiograph to aid the anaesthetic team in decision-making regarding intubation.

Specific examination of the shoulder involves inspection, palpation, movement and special tests which may be able to narrow down the diagnosis. Previous scars, skin abnormalities, erythema, bruising and shoulder symmetry are to be noted on inspection [5]. Palpation of the shoulder should reveal any specific tenderness around the joint, in addition to crepitus, especially with movement. Passive and active range of movement should then be assessed, comparing both sides.

Special tests of shoulder joint function involve Hawkins test for subacromial impingement, with the humerus abducted to 90 degrees and 30 degrees anteriorly in the line of the scapula. The elbow is then flexed to 90 degrees and the glenohumeral joint internally rotated. Pain constitutes a positive test. This test has a sensitivity of 91–92% and specificity of 25–43% [7]. The empty can test can also be used for detecting a torn rotator cuff, specifically for a supraspinatus tear. Pain and/or weakness signify a positive test when the patient resists a downward pressure with the arm in 90 degrees of abduction in the plane of the scapula. Sensitivity for this test is 18.7% with specificity being 100% [7]. The apprehension test can be used to test for anterior shoulder instability, following anterior shoulder dislocation and subluxation, with a sensitivity of 91.9% and specificity of 88.9%. The active compression test (O'Brien's test) for acromioclavicular joint (ACJ) arthritis and labral pathology can also be utilised. With the arm flexed to 90 degrees and the elbow fully extended, the arm is then adducted about 15 degrees medially. The arm is internally rotated so that the thumb points to the floor, the patient then resists the downward force applied by the clinician. The arm is then supinated so the palm is facing upward and resisting another downward force. The test is positive and diagnostic of ACJ pathology if pain is elicited over the ACJ or on top of the shoulder in the thumb down position and reduced or eliminated in the palm up position. Sensitivity for this test is 100% with specificity of 96.6% [7].

### Investigations

Most patients admitted for elective surgery undergo a range of routine pre-operative tests. Some of these tests are guided by the patient's clinical needs, whilst others are done as a matter of routine. The purposes of routine pre-operative tests are to assess whether the patient may have any pre-existing health problems, to identify any medical conditions unknown to the patient, the prediction of post-operative complications and the establishment of a reference for comparisons [8] if tests need to be repeated at a later date.

#### Chest Radiographs

Overuse of pre-operative chest x-rays (CXR) has in the past led to inappropriate wastage of resources [9]. Unexpected abnormalities are rare and seldom lead to changes in further management [10]. In many cases, the radiologist's report of the pre-operative chest radiograph is not available until after surgery [11], and the absence of a

chest radiograph pre-operatively has not been shown to be associated with an increase in post-operative morbidity or mortality [12].

Little evidence exists advocating the use of pre-operative chest X-rays prior to elective orthopaedic surgery. Radiographs should be sought when clinically indicated, or as requested by an anaesthetist. Chest x-rays should, however, be included in routine pre-operative tests for patients with a hip fracture [13]. The National Institute for Clinical Excellence (NICE) does not recommend routine pre-operative chest X-rays for otherwise healthy patients unless cardiac surgery is to be performed, but states that the decision depends upon the clinical history (e.g. chronic obstructive pulmonary disease (COPD), asthma) and the pathology requiring surgery [8, 14].

### **Electrocardiograms (ECGs)**

ECGs can identify, amongst other things, underlying ischaemic heart disease, previous infarction, and abnormalities in heart rhythm. No clear consensus exists whether pre-operative ECGs should be performed. ECGs may provide the major, and perhaps only, indication as to whether the patient has previously suffered an unrecognised myocardial infarction, which within the preceding 6 months is a risk factor for life-threatening cardiac complications in the peri-operative period [15].

Barnard *et al.* [16] recommend pre-operative ECGs in those over 60 years of age undergoing major surgery and in those displaying signs and symptoms of cardiovascular (ischaemic heart disease/hypertension) or respiratory disease. In patients with known or suspected coronary artery disease, ECGs should be performed pre-operatively, immediately post-surgery and on the first two days after surgery. In addition, patients with unstable coronary syndromes, significant arrhythmias or severe valvular heart disease scheduled for elective non-cardiac surgery should have surgery cancelled or delayed until the cardiac issue has been clarified and treated [17]. NICE guidelines for pre-operative tests and investigations in otherwise healthy patients state that pre-operative ECGs should be performed in patients younger than 60 years of age if they are asthmatic or a smoker, and in all those patients above the age of 80 years [14].

### **Full Blood Count**

For those patients in whom anaemia is suspected, a full blood count (FBC) is recommended. Whether or not a patient requires a pre-operative FBC also depends on the complexity of the surgery to be performed. For those patients attending only for minor surgery it can be argued that an FBC is not required [16]. It is required however if the proposed operation is expected to cause anything greater than minor blood loss [4] and also in those patients over the age of sixty who will be undergoing major surgery [14]. Pre-operative FBC also acts as a baseline for comparison with post-operative testing.

### **Biochemistry**

Pre-operative serum biochemistry testing generally includes assessment of urea & creatinine and electrolytes. Abnormalities of serum potassium concentrations should be highlighted to anaesthetic staff pre-operatively and corrected

where possible, due to a risk of cardiac arrest with agents such as suxamethonium [16]. NICE recommends pre-operative renal function in patients older than 40 years undergoing major surgery [14]. In addition to NICE, Barnard [16] recommends a dipstick urine test in those older than 16 years to screen for evidence of diabetes. Pre-operative liver function tests should be performed in those with established cirrhosis or a history of liver disease, or excessive alcohol intake [18].

### **Coagulation Screening**

Coagulation testing is often routinely undertaken in anticoagulated patients or patients to be started on anticoagulants. The activated partial thromboplastin time (APTT) is used to monitor unfractionated heparin, whereas the International Normalised Ratio (INR) is used for the monitoring of coumarin anticoagulants such as warfarin. Rohrer *et al's* study from 1988 suggested that blanket use of routine coagulation testing in the pre-operative setting is unnecessary [19], and may result in needless further testing and perhaps a delay in surgery. This is also the viewpoint of NICE [14]. Thus pre-operative clotting screens should only be performed in selective groups, namely those with a history of a bleeding disorder, liver disease, or malnutrition, or patients on anticoagulants (warfarin, heparin) [18].

Pre-operative care specific to shoulder arthroplasty includes the features mentioned above, but in addition shoulder X-rays are necessary and essential. Such radiographs may include a true anterior/posterior (AP) and an axillary view [20]. These allow for careful consideration regarding which prosthesis is to be used.

## **POST-OPERATIVE CARE WITH RECOGNITION OF COMPLICATIONS**

The mainstays of post-operative care in general are regular assessment, selective monitoring and timely documentation [2]. Further principles of post-operative care involve reviews of the major body systems, namely respiratory, cardiovascular and renal systems. Furthermore, sepsis must be controlled and sufficient pain relief must be provided. Specific post-operative neurovascular assessment following shoulder surgery is also of vital importance. In order for a patient to be discharged from the post-operative recovery room and back to the ward, certain criteria need to be met [21] (see Table 2).

**Table 2. Criteria for Patients to be Discharged from the Post-Operative Recovery Room**

• The patient is fully conscious, responding to voice or light touch, able to maintain a clear airway and has a normal cough reflex
• Respiration and oxygen saturation are satisfactory (10-20 breaths/minute and SpO <sub>2</sub> >92%)
• The cardiovascular system is stable with no unexplained cardiac irregularity or persistent bleeding
• The patient's pulse and blood pressure should compare with normal pre-operative values or should be at a level corresponding to planned post-operative care
• There should be adequate control of pain and vomiting with suitable analgesic and anti-emetic regimens prescribed
• Temperature should be within acceptable limits (>36°C)
• Oxygen and fluid therapy should be prescribed when required

The first post-operative assessment should take place following a patient's return from theatre. This acts as a baseline against which the patient's condition can be assessed at a later date and identifies any problems that may have occurred on transfer from the operating department. This assessment should include the intraoperative history and post-operative instructions, circulatory volume status, respiratory status and cognitive state. Common causes of confusion in the postoperative period include infection, hypoxia, sedatives and other medications such as anticholinergics [22].

### Monitoring

Monitoring of patients allows routine data to be collated and trends established, therefore making it more straightforward to detect any clinical deterioration. It also allows a patient's response to treatment to be evaluated. Common parameters include temperature, pulse rate, blood pressure, respiratory rate, urine output, peripheral oxygen saturation and pain scores [2].

These variables should be measured multiple times during the day, depending on the type of surgery involved. Other examples of monitoring include ECGs, arterial blood gas analysis (ABGs) and central venous pressure (CVP) monitoring [23]. In addition, assessment of drainage and bleeding should also be performed routinely [24].

### Cardiovascular Monitoring

As the main significant post-operative complications in general surgical patients are cardiovascular and respiratory in nature, it is sensible that cardiorespiratory monitoring be made a priority [25]. In general, maintaining a patient's heart rate and blood pressure within normal limits will result in a satisfactory outcome. However, there are no clinical studies to indicate what is normal with respect to heart rate and blood pressure for individual patients in the post-operative period [2].

Hypertension is common post-operatively and can be due to various causes including pain, anxiety and discontinuing antihypertensive medication. Guidelines by The American College of Cardiology/American Heart Association [26] recommend deferring surgery if the diastolic pressure is above 110 mm Hg and systolic is above 180 mm Hg. No such guidelines exist in the UK however.

Hypotension is also common post-operatively and has been defined as a systolic blood pressure below 90 mmHg [27]. Causes include hypovolaemia due to bleeding or dehydration, or drug therapy.

Myocardial ischaemia in the first 48 hours after an operation is the single most important predictor of serious cardiac events, including cardiac death, myocardial infarction, unstable angina, congestive heart failure and serious arrhythmias [2]. High risk procedures with a risk of cardiac event greater than 5% include cardiac and vascular surgery, or major pelvic/GI surgery in the presence of pre-existing vascular disease. The majority of elective orthopaedic surgery is classed as intermediate risk, with a cardiac risk of less than 5% [28].

### Respiratory Monitoring

Pulmonary complications are an important and common cause of post-operative morbidity and mortality and are particularly common after major abdominal and thoracic surgery. Risk factors for the development of post-operative pulmonary complications include high body mass index (BMI), smoking status and the presence of COPD [29]. Others include pre-operative respiratory illnesses, Intensive Care Unit (ICU) stay and mechanical ventilation in the post-operative period [30]. In order to adequately observe respiratory function and to identify post-operative respiratory complications the respiratory rate, heart rate and conscious level should be monitored routinely. Indicators of respiratory complications include respiratory rate  $<10$  or  $>25$  breaths per minute; pulse rate  $>100$  beats per minute and reduced conscious level.

Patients in whom there is a suspicion of post-operative pulmonary complications should have an arterial blood gas analysis, a sputum culture and ECG. A CXR should be performed on suspicion of major collapse, effusions, pneumothorax or haemothorax. Generally accepted diagnostic criteria for respiratory failure, pulmonary infections and acute respiratory distress syndrome (ARDS) are summarised in Table 3 [2].

**Table 3. Diagnostic Criteria for Certain Respiratory Complications**

<p><b>Respiratory failure:</b></p> <ul style="list-style-type: none"> <li>▪ type 1 - PaO<sub>2</sub> &lt; 8kPa (60 mm Hg), PaCO<sub>2</sub> &lt;6.6kPa (50 mm Hg)</li> <li>▪ type 2 - PaO<sub>2</sub> &lt; 8kPa (60 mm Hg), PaCO<sub>2</sub> &gt;6.6kPa (50 mm Hg)</li> </ul>
<p><b>Atelectasis:</b></p> <ul style="list-style-type: none"> <li>▪ pulmonary collapse clinically or on x-ray which may be subsegmental, segmental, lobar or pulmonary, without evidence of respiratory infection</li> </ul>
<p><b>Respiratory infection:</b> Any two of the following on two or more days:</p> <ul style="list-style-type: none"> <li>▪ pyrexia &gt; 38°C</li> <li>▪ positive sputum culture</li> <li>▪ positive clinical findings</li> <li>▪ abnormal chest x-ray - atelectasis/infiltrates</li> </ul>
<p><b>ARDS:</b></p> <ul style="list-style-type: none"> <li>▪ acute onset</li> <li>▪ bilateral infiltrates on chest x-ray</li> <li>▪ if PaO<sub>2</sub> (kPa) / FiO<sub>2</sub> is <math>\leq 26</math></li> </ul>

Post-operative pulmonary complications can therefore be recognised early if vital signs are recorded accurately in the post-operative period. Any deterioration in these values should then necessitate the need for further investigations such as x-rays and ABGs.

### Fluids & Electrolytes

The standard principles of fluid balance in the post-operative patient are to correct any pre-existing deficits, to replace unusual losses (e.g. from surgical drains, pyrexia)

and to use the oral route wherever possible as there is not infrequently a delay in commencing oral intake after surgery. Particular patient groups susceptible to fluid or electrolyte disturbances include the elderly, those with pre-existing cardiovascular/cerebrovascular/renal disease and patients who have suffered a peri-operative myocardial ischaemic event [2].

In order to detect fluid and electrolyte abnormalities, patients must have their vital signs checked regularly. Hypotension, tachycardia, oliguria, confusion and tachypnoea may all be indications of hypovolaemia but also have other causes, including sepsis. Whenever a post-operative patient is hypovolaemic, it is important that haemorrhage be considered and to actively exclude this before attributing hypovolaemia to another cause [31].

Potential causes of hypovolaemia include haemorrhage, diarrhoea and vomiting, polyuria and fluid losses *via* drains. On the other hand, causes of fluid overload include excessive intravenous fluid administration and poor renal or cardiac function [32]. This should be avoided as consequences may include pulmonary oedema. It is thus important to regularly check patients' vital signs when administering intravenous fluids, so that it can be recognised early if the patient is getting too much or too little.

### Sepsis

Sepsis is the systemic inflammatory response to infection and represents a progressive response to infection leading to a generalised inflammatory reaction and eventually end-organ dysfunction and/or failure [2]. The development of systemic sepsis in a post-operative patient marks a serious decline in their condition. Therefore, early identification of patients at risk of developing sepsis and subsequent management is paramount [2] (see Table 4). Matot *et al.* [33] explain that some of the clinical features to look out when identifying sepsis include fever, signs of peripheral vasodilation, altered mental state, leucocytosis/neutropenia and unexplained tachycardia, tachypnoea or hypotension. Early identification and appropriate treatment of sepsis improves outcome [34]. Without prompt intervention, severe sepsis may ensue, which has a mortality rate of 20-50% [35].

**Table 4. Systemic Inflammatory Response Syndrome: SIRS**

<b>The SIRS response is defined by the presence of two or more of the following:</b>
▪ temperature > 38°C or < 36°C
▪ heart rate > 90 beats/min
▪ respiratory rate >20 breaths/min or PaCO <sub>2</sub> <4.3kPa
▪ white cell count >12,000 cells/mm <sup>3</sup> , <4,000 cells/mm <sup>3</sup>
<b>Sepsis</b>
▪ SIRS plus documented site of infection
<b>Severe sepsis</b>
▪ Sepsis associated with organ dysfunction, hypoperfusion or hypotension (septic shock)

### Neurovascular Assessment

Following shoulder surgery, particularly highly invasive procedures such as total shoulder arthroplasty, reverse shoulder arthroplasty, or hemiarthroplasty, a thorough neurovascular assessment should be conducted. Circulation, sensation and movement (CSM) are evaluated by assessing the shoulder, elbow and wrist [20]. Motor and sensory examination findings may be difficult to determine in the immediate post-operative period however, as regional blocks are frequently used. As a result, regular assessments are encouraged to demonstrate return of function. Assessment of all major nerves of the upper limb should be conducted, including the axillary nerve which is the most common nerve to be injured during shoulder surgery [36].

### Pain Control

Post-operative pain can have a significant effect on patient recovery. Since the introduction of Patient-Controlled Analgesia (PCA) in the early 1980s, the daily management of post-operative pain has been enhanced. Patients using PCAs administer and titrate the dose to their own needs using a small microprocessor-controlled pump. Morphine is the most commonly used intravenous drug for PCA, however other opioids have been used. The most frequently observed adverse effects of opioid-based PCA are nausea and vomiting, pruritus, respiratory depression, sedation, confusion and urinary retention [37].

Other options available for post-operative analgesia include intrathecal and epidural analgesia. These may be provided either by using opioids, local anaesthetics or a combination of both. Intrathecal opioids are relatively straightforward to administer and can provide pain relief for twenty four hours or more after a single injection of intrathecal morphine. Epidural analgesia has been shown to be more effective than parenteral opioid administration and intravenous PCA for major surgery [38]. However, this route of administration increases the risk for complications related to the indwelling epidural catheter, including dislodging, kinking or migration within the epidural space.

Opioids are commonly used in the post-operative period. Commonly used agents include morphine, fentanyl and pethidine. Intravenous infusion administration results in a more constant blood level however [39]. Oral opioids can be very effective and can be used to rapidly wean a patient off parenteral therapy, thereby allowing earlier discharge from the hospital. Oxycodone as a controlled-release tablet can provide good pain control for up to 12 hours.

Other methods of providing analgesia also exist. A Cochrane review in 1998 concluded that paracetamol can be used for post-operative pain relief. Several reviews have since supported this, suggesting that paracetamol can provide effective pain relief for up to four hours post-operatively with few adverse side effects [40, 41]. Non-steroidal anti-inflammatory drugs (NSAIDs) can also be added to opioid treatment post-operatively as this can reduce morphine requirements and opioid-related side effects in the early post-operative period [42].

Wound infiltration with a local anaesthetic is a simple, safe, and attractive technique in the control of post-operative pain. Several randomised, controlled studies involving minor surgical procedures have discovered that wound infiltration with local anaesthetic provides superior analgesia, better pain scores, and superior reduction in opioid consumption compared with placebo [43, 44]. Long-acting local anaesthetics such as ropivacaine or bupivacaine are preferred as the analgesic effect is longer.

Interscalene brachial plexus blocks, either alone or combined with a general anaesthetic, are also a useful technique which can be employed to provide excellent post-operative analgesia for patients undergoing shoulder surgery [45]. Fredrickson *et al.* in 2010 [46] discovered during their review that continuous interscalene block incorporating a local anaesthetic infusion combined with PCA is the most effective analgesic technique following both major and minor shoulder surgery.

### Thromboprophylaxis

Thromboprophylaxis after elective shoulder surgery is a debatable issue as venous thromboembolic events (VTE) are so rare. There are no large-scale randomised trials published on rates of VTEs, although these are thought to be very low. The risk of a pulmonary embolism (PE) ranges from 0.2% to 2% in the literature with mortality rates of 1% [47]. Jameson *et al.* [47] discovered that since the introduction of NICE guidelines in 2007 recommending the use of chemical agents in shoulder surgery, rates of VTE events did not change. As such, chemical VTE prophylaxis may not be required in shoulder surgery. Despite this, NICE continues to recommend thromboprophylaxis for high-risk shoulder surgery, extrapolating data from hip and knee replacements.

### SUMMARY

This article has reviewed the pre-operative assessment especially in shoulder surgery. It draws attention to the mainstays of this assessment, which are a detailed history and clinical examination must be conducted, and additional tests and investigations be requested which are specific to the needs of the individual. The evidence behind such tests has been presented.

The fundamentals behind routine post-operative care have also been discussed. Post-operative care begins once the procedure has ended, with the patient being reviewed in the anaesthetic recovery room, then have their vital signs monitored once they are deemed safe enough to be transferred from the recovery room to the ward. Post-operative monitoring, along with a system-based approach, then allows complications to be recognised early and acted upon. Post-operative neurovascular assessments should also be carried out following shoulder arthroplasty in order to recognise any complications promptly. Finally, thromboprophylaxis and post-operative analgesia following shoulder surgery has also been discussed, demonstrating that several options exist to provide post-operative pain relief.

### ABBREVIATIONS

ABG = Arterial blood gas  
ACJ = Acromioclavicular joint

ADL = Activities of daily living  
AP = Anterior/posterior  
APTT = Activated partial thromboplastin time  
ARDS = Acute respiratory distress syndrome  
BMI = Body mass index  
COPD = Chronic obstructive pulmonary disease  
CSM = Circulation, sensation, movement  
CXR = Chest x-ray  
CVP = Central venous pressure  
ECG = Electrocardiogram  
FBC = Full blood count  
GI = Gastrointestinal  
ICU = Intensive care unit  
INR = International normalised ratio  
NICE = National institute for clinical excellence  
NSAID = Non-steroidal anti-inflammatory drug  
PCA = Patient controlled analgesia  
PE = Pulmonary embolism  
VTE = Venous thromboembolic event

### CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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