For arthroscopic shoulder surgery, access to the glenohumeral joint and subacromial space are required. In addition, shoulder arthroscopy necessitates a relatively bloodless operating field within these confines.

Access to the shoulder demands one of two positions for shoulder arthroscopy: either the beach chair or the lateral decubitus positions are acceptable. A bloodless field during surgery is only possible with a team approach involving the anaesthetist and the surgeon, who controls the clear visual field during arthroscopy.

The surgeon uses an arthroscopic pump, kept at pressures between 30-50 mmHg, as well as bipolar devices to achieve haemostasis. In addition, the use of 1 ml of adrenaline 1:1000, in a 3-litre bag of irrigant solution, helps control some bleeding in the subacromial space.

In shoulder surgery, the anaesthetist’s role is to help maintain a bloodless field by manipulation of the blood pressure and to provide adequate perioperative analgesia.

Theatre problems for the anaesthetist and the surgeon

The positions required by a shoulder surgeon to achieve adequate visualisation at arthroscopy are the beach chair and the lateral decubitus.

The tubing, airway and drip access have to be positioned so the surgeon can access the shoulder from the head end of the operating table. In addition, two stacks around the table, in addition to traction devices, make it a challenging task for the anaesthetist to adequately monitor a shoulder patient.

Both positions have their complications. Nerve injuries are more common in the lateral decubitus position. Most nerve injuries are transient neuro-praxias, but some may be true nerve palsies. Traction injuries resulting from the lateral decubitus position must be prevented by ensuring there is no stretch on the brachial plexus. Adequate padding of the arm holder, under the chest, and around the peroneal nerve must be ensured by both specialists.

Head position can cause nerve injuries. Direct pressure can lead to neuropraxia of the cutaneous branches of the cervical plexus. The lesser occipital and greater auricular nerves have been affected by pressure from the headrest, which needs to be adequately padded.

Rhee et al reported on hypoglossal nerve palsy resulting from the patient having to change in position from sitting to supine during the operation. It was believed that compression of the hypoglossal nerve had occurred beneath the angle of the mandible.

Luckily, the catastrophic complication of spinal cord infarction and midcervical quadriplegia has not yet been reported in shoulder surgery, but it has in neurosurgery.

It has been postulated that extremes of neck flexion led to the adverse outcome as this can impair autoregulation of the spinal cord blood flow. Adjust the neck if it appears to be too flexed in either the beach chair or lateral decubitus positions.

Anaesthesia-related complications primarily pertain to use of interscalene block anaesthesia, deliberate hypotensive anaesthesia, and hypotensive brady-cardic episodes (HBE).

The risk: benefit ratio of interscalene block anaesthesia can be summarised below:

**Benefits**
- Decreased anesthetic concentrations;
- Less postoperative nausea;
- Decreased postoperative analgesic
Refresher Course: Shoulder surgery - what a surgeon needs?

requirements;
- Decreased hospital admission rates;
- Shortened post-anaesthesia stays.

Risks
- Brachial plexus neuropraxia/transient neuropathy;
- Inadvertent spinal/epidural anesthesia;
- Seizure;
- Cardiac arrest;
- HBE;
- Adjacent nerve blockade – phrenic, laryngeal and sympathetic chain.

In a review in the Journal of Arthroscopic and Related Surgery, Rains et al concluded the following with respect to interscalene blocks and shoulder surgery: “Despite some reported concerns, the majority of publications argue for the safe use of an interscalene block anesthesia for surgery on the shoulder”. They note that: “The least complications with interscalene blocks derive from large-volume, single-operator centres that perform regional blocks on a routine basis”.

Deliberate hypotensive anaesthesia has the advantage of decreased blood loss, while helping to maintain a clear surgical field and reduce operative time. The potential for ischaemic brain and spinal cord injury, after both arthroscopic and open shoulder surgery in an upright position, as well as hypotensive anaesthesia, has been reported in the literature.

Papadonikolakis et al emphasised the need to measure blood pressure at the level of the heart, as taking measurements from the calf in a beach chair position will almost certainly lead to cerebral hypo perfusion.

Blood pressure mmHg

<table>
<thead>
<tr>
<th>Position</th>
<th>Cuff at brachium</th>
<th>Cuff at calf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supine</td>
<td>111/72</td>
<td>110/70</td>
</tr>
<tr>
<td>Beach chair</td>
<td>116/82</td>
<td>168/87</td>
</tr>
<tr>
<td>Standing</td>
<td>114/78</td>
<td>209/139</td>
</tr>
</tbody>
</table>

In the beach chair position, the distance from the heart to the calf can be 58 cm, which is equivalent to a change in 43 mmHg.

To prevention complications of cerebral ischaemia, it is recommended that the blood pressure cuff be placed at the level of the brachium, or to have an arterial line and transducer set at the level of heart. To treat perioperative blood pressure, values lower than 80% of preoperative resting blood pressure are recommended. Be careful with known hypertensive patients and make sure the head and neck are well positioned and not too flexed.

Hypotensive bradycardic episodes (HBE) are relatively more common and may lead to devastating complications. An incidence approaching 30% has been reported for using epinephrine containing interscalene blocks in the beach chair position. The definition of an HBE is described as any decrease in the heart rate of less than 30 beats/minute within a five-minute interval, any heart rate of less than 50 beats minute, a decrease in systolic blood pressure of more than 30mmHg within a five-minute interval, or any systolic blood pressure of less than 90 mmHg.

The aetiology of HBE is unknown, but it is postulated to be an activation of the Bezold-Jarisch reflex. Recommendations for treatment are aggressive treatment of fluid deficit, blood loss, or known causes of venous pooling (upright position); and to use a local anaesthetic without epinephrine for block or local skin injection. Beta-adrenergic blockade may be beneficial.

Irrigant-related complications

Cho et al reported two cases of ventricular tachycardia resulting in cardiogenic shock after infusion of epinephrine containing arthroscopic irrigation solution.

They introduced a dye into a 3-litre bag and showed that it stayed near the outlet to the pump. A preventative measure is to teach staff to mix the bag thoroughly.

Airway obstruction has been noted in the lateral decubitus position. Irrigant fluid accumulates in the soft tissues of the neck due to gravity. Three cases are noted in literature. The recommendation is endotracheal intubation in the lateral decubitus position.

Lee et al described spontaneous pneumo-thorax with shoulder arthroscopy. They witnessed three cases of extensive subcutaneous emphysema, pneumomediastinum and tension pneumothorax after shoulder arthroscopy, and subacromial decompression in the beach chair position. They were unsure of the cause, but postulated about negative pressure in the subacromial space following wall suction.

Understanding the common causes of position- and anaesthesia-related complications during shoulder arthroscopy is essential to both the anaesthetist and the surgeon, and generally, most can easily be avoided.