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Review Article

Positioning in Shoulder Arthroscopy -

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ABSTRACT

Arthroscopy of the shoulder has become a routine surgical procedure for the diagnosis and treatment of different shoulder disorders. Intraoperative patient positioning is a major determinant in the successful outcome of shoulder arthroscopy procedures. Two positioning methods are commonly described, the lateral decubitus and the beach chair position. Each has its advantages and disadvantages. There is no consensus on the best position. The optimal position should improve visualization, enhance accessibility and minimize complications. In this review we aim to describe the advantages and disadvantages of each position and provide tips to avoid them.

Keywords: Shoulder; Arthroscopy; Beach chair; Lateral decubitus

ABBREVIATIONS

LD: Lateral Decubitus; BC: Beach Chair; SLAP: Superior Labrum From Anterior to Posterior; SBP: Systolic Blood Pressure; MAP: Mean Arterial Pressure

INTRODUCTION

Arthroscopy of the shoulder has become a routine surgical procedure for the diagnosis and treatment of different shoulder disorders. Intraoperative patient positioning is a major determinant in the successful outcome of shoulder arthroscopy procedures. It basically reduces technical difficulties. Two positioning methods are commonly described for shoulder arthroscopy, the lateral decubitus and the beach chair position. Surgeon's preference for patient positioning has been largely based on training. Each has its own advantages and disadvantages [1].

PATIENT POSITIONING

Setup should allow sufficient space for the surgeon to move freely, with one or two assistants, the scrub nurse and all equipment to be approachable. A mayo table is usually positioned near the patient's shoulder. The arthroscopy stack needs to be in a position that is easily viewed while operating, the anesthetist and his equipment must not interfere with the surgeon. Blinds on windows should be drawn and room lights dimmed to facilitate viewing on the display. The patient is positioned, depending on surgeon preference. Anesthesia is usually prior to positioning.

Lateral Decubitus (LD)

The patient is placed on supine, on standard operating table and anaesthetized. Following examination, the patient is turned onto the contralateral side and held in position with pelvic supports or bean bags. The torso is supported by side supports at the level of the thoracic outlet and pelvis. An axillary roll is placed under the upper trunk for protection of neurovascular structures. Pressure points are padded on both legs. Pillows are placed between the legs and bony prominences. Special attention must be paid to the cervical spine to avoid excessive lateral flexion. The position requires a special shoulder traction system that permits adjustments in abduction and distraction. The arm is positioned in approximately 45^0 abduction and 15 ante- version with traction weight of 4-5 kg. More than 45^0 abduction could lead to brachial plexus injury.

For arthroscopy in the LD position, the patient should be covered with a water-resistant drape prior to skin preparation to protect the patient from antiseptic solution running off the skin. The arm is wrapped in a sterile drape and secured to the traction device. The shoulder area is covered with two sterile aperture drapes, one placed from the axillary side and the other from the cranial side (Figure 1).

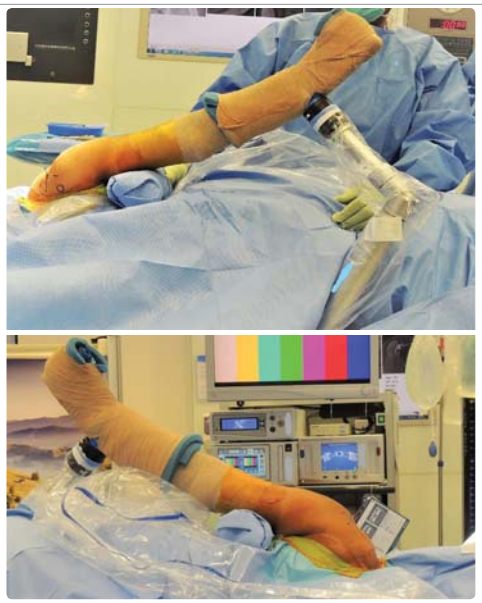

Figure 1: Intraoperative photograph of the Lateral Decubitus position (bolster under axilla, arm handle used).

Complications Related to LD Position

Nerve Injuries and cardiac complications related to positioning in shoulder arthroscopy has been reported in literatures [2]. Complete airway obstruction during arthroscopic surgeries have been reported due to extra articular spread of arthroscopic fluid [3]. The use of LD position may lead to the accumulation of fluid in soft tissue of the neck by gravity.

Peripheral nerves and brachial plexus injuries have been reported due to traction used in LD position [4]. Reported incidence of paresthesia and nerve palsy range from 10 to 30 percent .These injuries are due to excessive strain placed on the brachial plexus during arm positioning and the use of traction intra operatively. Musculocutaneous and Axillary nerves are at risk when establishing the antero inferior portal [5].

Traction has been shown to cause decreased limb perfusion, especially with the use of both vertical and longitudinal traction [6].

Tips to avoid complications:

- Proper padding of bony prominence with special care to the peroneal nerve.
- Avoiding the use of excessive traction. No more than 15 to 20 pounds of traction should be applied in order to minimize strain on the brachial plexus [7]. Klein et al. concluded that combination of shoulder positions either 45^0 of forward

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flexion with 90^0 of abduction or 45^0 of forward flexion with 0^0 of abduction helped to maximize visibility and minimize strain placed on the brachial plexus [8].

- Placement of antero inferior portal with the limb in traction may cause injury to the musculocutaneous nerve. To avoid this, a low anterior portal should be established with the extremity out of traction [9].
- Neutral neck positioning with proper padding prevents injury to the neck and periauricular area.
- Tilting of the table by 20^0 to 30^0 posteriorly, to position the glenoid parallel to the floor helps in better orientation of the glenohumeral joint [4].

BEACH CHAIR (BC) POSITION

Was described by Skyhar et al in 1988. It was developed in an effort to avoid the neuropathies seen with the lateral decubitus position. In contrast to lateral decubitus position neuropathies are rarely reported in beach chair position [10].

The patient is anaesthetized supine then moved on to the operating table. The table is equipped with a headrest on a moveable back and a foot section, placed in Trendelenburg position with the patient's feet elevated at 15^0. The knees are flexed to 30^0 with a pillow underneath, then the table is adjusted to bring the trunk upright with 60^0 of hip flexion. Flexed position of the hip and knees prevents the patient slipping down the table (Figure 2). This position helps an interscalene block as well as examination of the joint. The head is kept in neutral position in the holder. Care should be taken to prevent pressure over eyes while restraining the head (Figure 3). The non-surgical arm is placed in the arm rest.

For BC arthroscopy, the arm is abducted at the shoulder during skin preparation: a towel protects the patient's body from solution running off the skin. The patient is covered till the chest and oppositely from the cranial side with waterproof adhesive aperture sheet then smaller adhesive drape is placed from the axillary side. The arm is wrapped with the adhesive tape and most of the time left free or held by the assistant if traction is required. A variety of arm holder devices are available, with pneumatic holders becoming increasingly popular as they alleviate the need for an assistant to apply traction to the arm (Table 1and 2).

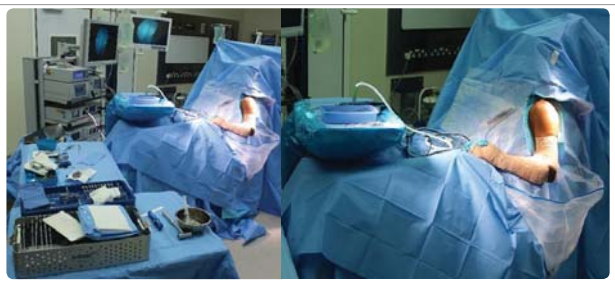

Figure 2: Intraoperative photograph of the beach chair position.

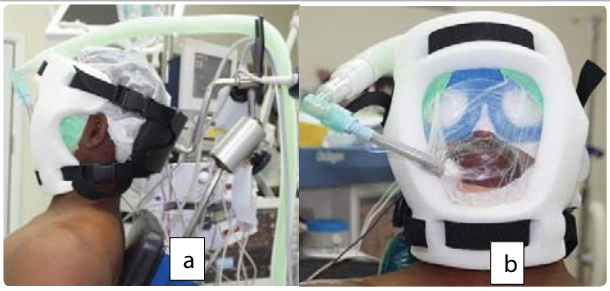

Figure 3: Intraoperative photograph of the beach chair position.
a) Head should be placed in a neutral position to decrease the possibility of complications.
b) Care should be taken for proper positioning of the tube.

Table 1: Advantages and disadvantages of LD.

Advantages	Disadvantages
Allows gravity to work in favour of the surgeon making the procedure less physically demanding	Non anatomic orientation to the joint makes it difficult to train the residents
Good for repair of instability lesions, SLAP tear and biceps work	The patient usually requires general anaesthesia
Excellent visualization of the subacromial space, posterior and postero-inferior aspect of the gleno humeral joint	Difficulty in conversion to an open procedure
Facilitates application of controlled amount of traction to the limb	During anterior labral repair an assistant needs to hold the humerus pulled back for better visualization of the anteroinferior corner
Set up takes less time	The traction system may lead to post-operative complications

Table 2: Advantages and disadvantages of BC.

Advantages	Disadvantages
Normal vertical orientation of shoulder joint anatomy, allows ease of arm movement which will not obstruct the way of anterior portal	Increased risk of cerebral hypoperfusion, hypoxia, hypotension and bradycardic
Surgery can be done under regional anesthesia and allows free movement of the operating limb	Fogging of the camera due to the irrigation solution running down the scope onto the camera
Allows traction to be applied in multiple planes	An assistant is required throughout the procedure to give traction and rotation
Excellent visualization of the anterior, inferior and superior glenohumeral structures as well as the sub acromial space	less visualization of the posterior and postero inferior aspect of glenohumeral joint
Rapid conversion to an open procedure	Set up requires longer time
Good for trainees because of better orientation of the glenohumeral anatomy.	

Complications related to BC position

BC position is the most commonly used position in shoulder arthroscopy, the safety of which has been established [10]. Several complications have been described such as stroke, spinal injuries, blindness, coma and even death with the patient in this position [11].

Nerve injury due to use of interscalene block in beach chair position has been reported. Brachial plexus neuropraxia, seizures, cardiac arrest and inadvertent block of adjacent nerves including phrenic, laryngeal nerve and sympathetic chain were reported [12].

Cerebral hypoperfusion is related to several factors as described by Pohl and Collen [5]. Improper autoregulation and effect of anesthetic agents lead to peripheral vasodilatation. The most common proposed

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mechanism of hypotensive episodes is activation of "Bezold Zarich" reflex [12].The combined effect of venous pooling and increased vagal tone results in sudden profound bradycardia and hypotension. The incidence of hypotensive episodes are 20 percent more in obese patients.

Reported complications attributed to incorrect head position during shoulder arthroscopy have ranged from cutaneous neuropraxia to mid cervical quadriplegia [2]. Unilateral vision loss and Ophthalmoplegia after shoulder arthroscopy has also been reported in the literature, but are rare [13].

Tips to avoid complications:

- Avoid using anaesthetics containing epinephrine to prevent hypotensive bradycardic episodes and treat fluid deficits, blood loss and known causes of venous pooling when using beach chair position.
- Cranial ultrasound pads can be used to measure oxygen saturation perioperatively, and are very useful to prevent ischaemic events. These along with BIS (Bi-Spectral Index) monitors the depth of anaesthesia [14]. The use of cerebral oximetry in high risk patient during shoulder arthroscopy in BC position has been recommended in the recognition and management of decreased cerebral perfusion during surgery.
- Doing the procedure under interscalene block maintains the normal sympathetic response to increase mean arterial pressure and cardiac output. The use of ultrasound guided block reduces the risk of its complications.
- Placement of the blood pressure cuff at the level of the heart instead of the calf and / or using invasive methods of blood pressure monitoring like an arterial line can avoid iatrogenic cerebral hypo perfusion [15].
- Place the non-operating arm properly on arm holder with appropriate padding.
- Positioning the head in a neutral position at all times in both coronal and sagittal planes will prevent complications because extension and rotation can reduce vertebral artery blood flow resulting posterior brain infarcts and flexion of the head can block venous drainage causing the obstruction of the internal jugular vein [16].
- Proper padding of the bony prominence to prevent pressure injuries with specific care to avoid injury to peroneal nerve.
- Current anaesthesia literature recommends to keep SBP > 90 mmHg and the maximum reduction of both the SBP and MAP to < 20% of baseline measurements to prevent cerebral hypoperfusion [17].

CONCLUSION

Both LD and BC positions are widely regarded to be safe, but can lead to complications if due diligence is not observed in proper positioning. Being aware of the potential complications in each position helps to take necessary precautions to avoid them. There is no evidence to show that one position is superior to the other. Complications associated with each position are very rare and mostly avoidable. Neuro vascular structures are at greater risk with LD whereas risk of cardio vascular complications are more in BC position with hypertension and obesity increasing these risks. Great care and precautions must be taken to properly position the patient to avoid these complications. The optimal position depends upon the surgeon's training and experience.

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