Shoulder arthroscopy positioning: lateral decubitus versus beach chair.

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Shoulder Arthroscopy Positioning: Lateral Decubitus vs. Beach Chair
A Concise Review

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Abstract:
Most surgeons use the same patient position to perform all of their arthroscopic shoulder procedures: either the lateral decubitus or the beach chair position. Each position has its advantages and disadvantages. This review presents a comparison of these positions with regard to set up, surgical visualization, access, and patient risk.

Introduction:
Shoulder arthroscopy can be performed with the patient in either the lateral decubitus or the beach chair position. Since the introduction of the beach chair position in the 1980’s, orthopaedic surgeons have debated which patient position is superior. The main topics of controversy include: the ease, efficiency, and economics of setup; the visualization of and access to the surgical site; and the risks to the patient. Historically, a surgeon’s preference for patient positioning has been based largely on training. The purpose of this review is to provide a comprehensive comparison of these positions to enable surgeons to make an educated decision about patient positioning for shoulder arthroscopy.

Positioning:

Lateral Decubitus
To achieve the lateral decubitus position (Figure 1) for shoulder arthroscopy, the patient is placed laterally on a standard operating table with the operative shoulder exposed vertically. A beanbag and/or other stabilizing devices, such as straps or braces are used for support. The head is maintained in neutral position with a foam pad, and the eyes and downside ear are protected. An axillary roll is placed for optimal ventilation and
protection of neurovascular structures. Pressure points are padded on both legs. The non-
operative arm is placed on an arm board. The operative arm is placed into a foam traction
sleeve, which is connected to a traction device. Weight is applied to the traction device,
and the amount of abduction and forward flexion of the shoulder is adjusted based on
surgeon preference. Gross and Fitzgibbons modified the lateral decubitus position by
tilting the table 20 to 30 degrees, which tilts the patient posteriorly, to position the
glenoid parallel to the floor. (1,2,3,4) This modification has become standard for the
lateral decubitus position in shoulder arthroscopy.

*Beach Chair*

To put the patient into the beach chair position (Figure 2), the patient is placed on
the operating table, a standard or “beach-chair” table, in the supine position. The head,
neck, and torso are supported in a neutral position by special straps and attachments. The
patient is placed into 10 to 15 degrees of Trendelenberg; flexed at the hips to 45 to 60
degrees; and the patient’s knees are flexed to 30 degrees. Pressure points are padded, and
the eyes and various aspects of the head are protected. The non-operative arm is tucked,
placed on an arm board, or placed in a sling. If a “beach chair” operating table is used, a
portion of the back of the table can be removed for access to the posterior shoulder. In
addition, an optional sterile arm positioning device as seen in figure 2 (SPIDER Limb
Positioner, Tenet Medical Engineering, Inc; Calgary, Canada) may be attached to the
operative arm. (1,2,3,4)

*Ease of Set Up:*

Proponents of the lateral decubitus and the beach chair positions each claim that
the position they defend is the easiest and fastest to employ, including the number of
steps, amount of equipment, and assistance required to set-up and perform the arthroscopy. (1,2,3,5,6) Regardless of which position a surgeon prefers, both require assistance, and both positions may require adjustments to be made during surgery that can add to surgical time. For the lateral decubitus position, assistance is required to turn and secure the patient after they have been anesthetized. Assistance is required for the addition of the traction and any adjustments that are made to the traction. In the lateral decubitus position, a scrubbed assistant may be required to hold the humerus in internal or external rotation during the surgery. Achieving the proper beach chair position takes time to secure the head, neck, and torso. To prevent harm to the patient, repositioning during the case may be necessary and may require assistance. In addition, a scrubbed assistant is needed to position the arm if a mechanical arm holder is not used in the beach chair position. Despite the use of a mechanical arm holder, an assistant may still be required to pull traction on the arm in the beach chair position. To date there is no objective, empirical evidence to support either group’s claims of speed of set-up or need for assistance.

**Conversion:**

Ease of conversion to an open procedure without the need for repositioning and redraping is a point made by proponents of the beach chair. (1,2,3,5) Some go as far as saying that the ease of conversion to an open procedure can affect surgical decision making. (3) Supporters of the lateral decubitus position argue that the rare need for conversion from an arthroscopic to an open procedure makes this argument less important. (6) However, when the need for conversion from an arthroscopic to an open
procedure arises, the beach chair position allows greater flexibility and no repositioning or redraping is necessary.

**Anesthesia:**

Positioning during shoulder arthroscopy may affect the type of anesthesia used. Surgeons that prefer beach chair position cite the ability to use general or regional anesthesia as an advantage. (1,3) Regional anesthesia is possible for the patient in beach chair; whereas, it is poorly tolerated in lateral decubitus. The lack of muscle paralysis of patients under regional anesthesia allows for patient head control (1); however, it can allow for an undesirable effect if the patient shifts their body during the surgery. Finally, the airway access provided by the beach chair position (6,7) enables rapid conversion to general anesthesia if necessary.

**Cost of Set Up:**

The equipment used in the setup of each position varies based on surgeon preference. A cost comparison of this equipment is listed in Table 1. Supporters of the lateral decubitus position argue that costly equipment is a disadvantage of the beach chair position. Many surgeons now use beach chair attachments for the operating table. They secure the head and torso, and a portion can be removed to expose the posterior shoulder. However, in their original paper describing the beach chair position, Skyhar et al. used a standard operating table. (5) In addition, Terry and Altchek have also described the use of a standard operating table for the beach chair position. (3) Based on this, one may argue that the cost of the beach chair attachments is not a reason to refute operating in the beach chair position. The expensive, specialized arm positioners that can be used to assist in
stabilizing the arm for a beach chair procedure add to the ease of the procedure, but they are not an absolute necessity to perform the surgery.

**Orientation, Visualization, and Accessibility:**

Orientation, visualization, accessibility, and mobility of the shoulder anatomy are all topics of debate when comparing beach chair to lateral decubitus. Proponents of the beach chair position report that the upright, anatomic position makes orientation and teaching easier. (3,5) Those who favor lateral decubitus counter that argument by saying that positioning the glenoid parallel to the floor creates a standard reference point and turning the camera 90 degrees aids in the conceptualization of the anatomy in the natural sitting position. Furthermore, conceptualization of anatomy has been argued to be a function of surgeon experience rather than the actual position of the patient. (2,6)

Surgeons that favor the beach chair position report no difficulty visualizing and working in all portions of the glenohumeral joint and subacromial space while using all of the various portals. (3,5) Ease of stabilizing the scapula makes exam under anesthesia easier in the beach chair position compared to the lateral decubitus position. (3) However, the most accurate method of exam under anesthesia is in the supine position prior to positioning the patient. Beach chair is also said to enable better palpation of external anatomy to guide portal placement. (5) It has been argued that beach chair is the best position for anterior stabilization, releases, and rotator cuff repairs. (3) Access to the anterior shoulder is said to be easier without the arm hanging in the operative field, and the anterior portal allows for insertion of anchors into the glenoid neck below the 4 o’clock position. (3,5) Lateral translation of the humerus while in beach chair gives excellent access to the anterior inferior capsule and axillary region. (3) Proponents of the
beach chair feel that the superior mobility of the arm in that position gives them a better
dynamic view of the cuff and enables them to pick up subtle pathology such as
subluxation and both internal and subacromial impingement. (1,3,5,6) Finally, it can be
argued that the capsular anatomy is not stretched, which is important for capsular
reattachment, assessment of ligamentous laxity, and reapproximation of tissues under
minimal tension. (5)

Conversely, those who favor the lateral decubitus position feel it allows for better
visualization and workspace, both in and around the shoulder. (1,2,6) They also state that
in the beach chair, the table and the head act as mechanical blocks limiting workspace for
the posterior and superior portals. The beach chair position has also been criticized for
causing decreased visibility due to fogging of the camera and the collection of bubbles in
the subacromial space. (5,6) In lateral decubitus, traction is said to accentuate labral tears
and improve access to the labrum, subacromial space, inferior capsule, and underside of
the rotator cuff. (1,6) For example, visualization of the posteroinferior glenoid has been
reported to be insufficient using an anterosuperior portal in the beach chair position
unless sufficient abduction and traction are applied to the arm. Although recently
Costouros et al. have reported the use of a trans-rotator cuff portal to successfully
perform posterior capsulorrhaphy in the beach chair position, historically arthroscopic
posterior Bankart repair and capsulorrhaphy have been more easily performed in the
lateral decubitus position. (8)

**Risks:**

There are neurovascular as well as cardiovascular risks associated with the lateral
decubitus and the beach chair positions. The traction used in lateral decubitus can cause
damage to peripheral nerves and the brachial plexus; as paresthesias and palsies have a reported 10 to 30 percent incidence. (1,5) Soft tissue injuries and compression of digital nerves have been seen at the site of traction (3), and compression of the peroneal nerve can also occur in the lateral decubitus position. Traction has been demonstrated to cause decreased limb perfusion, especially with the use of both vertical and longitudinal traction. (1,9) In addition, a cadaveric study has shown an increased risk of neurovascular injury when establishing an anteroinferior portal in the lateral decubitus position, with the musculocutaneous and axillary nerves being at greatest risk. (10) Neurovascular injuries are extremely rare in both positions; however, it is less common in the beach chair position. Compression and rotation of the head in the beach chair position have been associated with three superficial nerve palsies and one hypoglossal nerve palsy. (11,12)

Sudden, profound hypotensive and bradycardic events have been reported in over 20% of patients undergoing shoulder arthroscopy in the beach chair position. (3,13) Brain and spinal cord ischemia, transient visual loss, and ophthalmoplegia due to hypotension have been documented in patients who have undergone shoulder surgery in the upright position. (7,14) Patients with abdominal obesity are at greater risk for hypotension in the upright position because compression of the vena cava decreases venous return. (4) In the beach chair position, hyperextension and rotation or tilt of the head can decrease vertebral artery blood flow causing infarcts of the posterior cerebral circulation. (14) In addition, an ischemic event due to air embolus is of greater theoretical risk to patients in the upright position. (6,14)

There are ways to minimize the risk of each of the aforementioned complications. Klein et al. studied the strain on the brachial plexus in the lateral decubitus position and
found that 45 degrees of forward flexion combined with either 90 or 0 degrees of abduction maximized visibility and minimized strain. (15) Today, although a variety of arm positions are used, no more than 15 to 20 pounds of traction is applied in order to minimize strain on the brachial plexus. It is also recommended that internal rotation of the humerus is increased along with forward flexion to decrease brachial plexus strain. (2) For the beach chair position, studies have shown that the administration of metoprolol can decrease the incidence of hypotensive and bradycardic events. (13) Furthermore, many of the ischemic events that have been reported for the beach chair position are thought to be due to errors in interpretation of blood pressure values. (7,14) Because hypotensive anesthesia is used to minimize bleeding, it is imperative that the blood pressure is measured appropriately. Placing the blood pressure cuff at the level of the heart rather than the calf and aggressively treating perioperative blood pressure values lower than 80% of preoperative resting values are ways to avoid cardiovascular complications of shoulder surgery in the beach chair position. (7)

**Summary:**

Overall, the evidence regarding the efficiency, efficacy, and risks of the lateral decubitus and the beach chair position for shoulder arthroscopy does not demonstrate one position to be superior. (Table 2) However, there is a significant difference in cost of equipment for the beach chair position if the surgeon chooses to use the beach chair attachments and/or a mechanical arm positioner. The complications associated with each position are rare and, for the most part, avoidable, and they should be considered when choosing a patient position. The lateral decubitus position puts neurovascular structures at greater risk, especially when using an anteroinferior portal. The risk of cardiovascular
complications is greater for patients in the beach chair position, and hypertension and obesity further increase those risks. There is no objective, empirical evidence to support claims that either position is easier to set up or provides better surgical access. Therefore, after considering the costs and risks, there is no argument that can be made against a surgeon choosing a position based on their experience and comfort. Surgeons should choose a position that they are most comfortable with in order to perform the anticipated arthroscopic shoulder procedures.
References:


Table 1. Cost Comparison for Setup of Beach Chair vs. Lateral Decubitus Positions

<table>
<thead>
<tr>
<th></th>
<th>Beach Chair Position</th>
<th>Lateral Decubitus Position</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beach Chair</td>
<td>Bean Bag</td>
</tr>
<tr>
<td></td>
<td>Mechanical Arm Holder</td>
<td>Side Braces</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Traction Bar</td>
</tr>
<tr>
<td></td>
<td>$4,000 - $8,500</td>
<td>$600</td>
</tr>
<tr>
<td></td>
<td>$8,000 - $12,000</td>
<td>$1,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$2,000 - $4,500</td>
</tr>
</tbody>
</table>

* Costs are approximate and based upon a survey of various manufacturers published retail prices
Table 2. Lateral Decubitus vs. Beach Chair: Advantages and Disadvantages

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Lateral Decubitus</th>
<th>Beach Chair</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Traction increases space in joint and subacromial space</td>
<td>1. Upright, anatomical position</td>
</tr>
<tr>
<td></td>
<td>2. Traction accentuates labral tears</td>
<td>2. Ease of exam under anesthesia</td>
</tr>
<tr>
<td></td>
<td>3. OR table/patients head not in the way of posterior and superior shoulder</td>
<td>3. Arm not hanging in the way of anterior portal</td>
</tr>
<tr>
<td></td>
<td>4. Cautery bubbles move laterally out of view</td>
<td>4. No need to reposition or redrape to convert to open procedure</td>
</tr>
<tr>
<td></td>
<td>5. No increased risk of hypotension/bradycardia; better cerebral perfusion</td>
<td>5. Can use regional anesthesia</td>
</tr>
<tr>
<td></td>
<td>6. Mobility of operative arm</td>
<td>6. Mobility of operative arm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disadvantages</th>
<th>Lateral Decubitus</th>
<th>Beach Chair</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Non-anatomic orientation</td>
<td>1. Potential mechanical blocks to use of scope in posterior or superior portals</td>
</tr>
<tr>
<td></td>
<td>2. Must reach around arm for anterior portal</td>
<td>2. Increased risk of hypotension/bradycardia causing cardiovascular complications</td>
</tr>
<tr>
<td></td>
<td>3. Must reposition and redrape to convert to open procedure</td>
<td>3. Cautery bubbles obscure view in subacromial space</td>
</tr>
<tr>
<td></td>
<td>4. Patients don’t tolerate regional anesthesia</td>
<td>4. Fluid can fog camera</td>
</tr>
<tr>
<td></td>
<td>5. Traction can cause neurovascular and soft tissue injury</td>
<td>5. Theoretically increased risk of air embolus</td>
</tr>
<tr>
<td></td>
<td>6. Increased risk of injury to axillary and musculocutaneous nerves when placing anteroinferior portal</td>
<td>6. Expensive equipment if using beach chair attachment +/- mechanical arm holder</td>
</tr>
</tbody>
</table>
Figure 1. Lateral decubitus position with traction bar
Figure 2. Beach chair position shown with mechanical arm positioner

Figure 3

Figure 4
Figure 5

Figure 6