

8-1-2009

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Recommended Citation

Peruto, MD, Christina M.; Ciccotti, MD, Michael G.; and Cohen, MD, Steven B., "Shoulder arthroscopy positioning: lateral decubitus versus beach chair." (2009). *Department of Orthopaedic Surgery Faculty Papers*. Paper 19.

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As submitted to:
*Arthroscopy The Journal of Arthroscopic and related
Surgery*

and later published as:

*Arthroscopy - Journal of Arthroscopic and Related
Surgery*
Volume 25, Issue 8, August 2009, Pages 891-896

Doi: 10.1016/j.arthro.2008.10.003

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

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Supported by outside funding or grant(s) from _N/A_

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43 **Abstract:**

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

48

49 **Introduction:**

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

59 **Positioning:**

60 **Lateral Decubitus**

61 To achieve the lateral decubitus position (Figure 1) for shoulder arthroscopy, the
62 patient is placed laterally on a standard operating table with the operative shoulder
63 exposed vertically. A beanbag and/or other stabilizing devices, such as straps or braces
64 are used for support. The head is maintained in neutral position with a foam pad, and the
65 eyes and downside ear are protected. An axillary roll is placed for optimal ventilation and

66 protection of neurovascular structures. Pressure points are padded on both legs. The non-
67 operative arm is placed on an arm board. The operative arm is placed into a foam traction
68 sleeve, which is connected to a traction device. Weight is applied to the traction device,
69 and the amount of abduction and forward flexion of the shoulder is adjusted based on
70 surgeon preference. Gross and Fitzgibbons modified the lateral decubitus position by
71 tilting the table 20 to 30 degrees, which tilts the patient posteriorly, to position the
72 glenoid parallel to the floor. (1,2,3,4) This modification has become standard for the
73 lateral decubitus position in shoulder arthroscopy.

74 *Beach Chair*

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

86 **Ease of Set Up:**

87 Proponents of the lateral decubitus and the beach chair positions each claim that
88 the position they defend is the easiest and fastest to employ, including the number of

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

104 **Conversion:**

105 Ease of conversion to an open procedure without the need for repositioning and
106 redraping is a point made by proponents of the beach chair. (1,2,3,5) Some go as far as
107 saying that the ease of conversion to an open procedure can affect surgical decision
108 making. (3) Supporters of the lateral decubitus position argue that the rare need for
109 conversion from an arthroscopic to an open procedure makes this argument less
110 important. (6) However, when the need for conversion from an arthroscopic to an open

111 procedure arises, the beach chair position allows greater flexibility and no repositioning
112 or redraping is necessary.

113 **Anesthesia:**

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

122 **Cost of Set Up:**

123 The equipment used in the setup of each position varies based on surgeon
124 preference. A cost comparison of this equipment is listed in Table 1. Supporters of the
125 lateral decubitus position argue that costly equipment is a disadvantage of the beach chair
126 position. Many surgeons now use beach chair attachments for the operating table. They
127 secure the head and torso, and a portion can be removed to expose the posterior shoulder.
128 However, in their original paper describing the beach chair position, Skyhar et al. used a
129 standard operating table. (5) In addition, Terry and Altchek have also described the use of
130 a standard operating table for the beach chair position. (3) Based on this, one may argue
131 that the cost of the beach chair attachments is not a reason to refute operating in the beach
132 chair position. The expensive, specialized arm positioners that can be used to assist in

133 stabilizing the arm for a beach chair procedure add to the ease of the procedure, but they
134 are not an absolute necessity to perform the surgery.

135 **Orientation, Visualization, and Accessibility:**

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

144 Surgeons that favor the beach chair position report no difficulty visualizing and
145 working in all portions of the glenohumeral joint and subacromial space while using all
146 of the various portals. (3,5) Ease of stabilizing the scapula makes exam under anesthesia
147 easier in the beach chair position compared to the lateral decubitus position. (3) However,
148 the most accurate method of exam under anesthesia is in the supine position prior to
149 positioning the patient. Beach chair is also said to enable better palpation of external
150 anatomy to guide portal placement. (5) It has been argued that beach chair is the best
151 position for anterior stabilization, releases, and rotator cuff repairs. (3) Access to the
152 anterior shoulder is said to be easier without the arm hanging in the operative field, and
153 the anterior portal allows for insertion of anchors into the glenoid neck below the 4
154 o'clock position. (3,5) Lateral translation of the humerus while in beach chair gives
155 excellent access to the anterior inferior capsule and axillary region. (3) Proponents of the

156 beach chair feel that the superior mobility of the arm in that position gives them a better
157 dynamic view of the cuff and enables them to pick up subtle pathology such as
158 subluxation and both internal and subacromial impingement. (1,3,5,6) Finally, it can be
159 argued that the capsular anatomy is not stretched, which is important for capsular
160 reattachment, assessment of ligamentous laxity, and reapproximation of tissues under
161 minimal tension. (5)

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

176 **Risks:**

177 There are neurovascular as well as cardiovascular risks associated with the lateral
178 decubitus and the beach chair positions. The traction used in lateral decubitus can cause

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

190 Sudden, profound hypotensive and bradycardic events have been reported in over
191 20% of patients undergoing shoulder arthroscopy in the beach chair position. (3,13) Brain
192 and spinal cord ischemia, transient visual loss, and ophthalmoplegia due to hypotension
193 have been documented in patients who have undergone shoulder surgery in the upright
194 position. (7,14) Patients with abdominal obesity are at greater risk for hypotension in the
195 upright position because compression of the vena cava decreases venous return. (4) In the
196 beach chair position, hyperextension and rotation or tilt of the head can decrease vertebral
197 artery blood flow causing infarcts of the posterior cerebral circulation. (14) In addition,
198 an ischemic event due to air embolus is of greater theoretical risk to patients in the
199 upright position. (6,14)

200 There are ways to minimize the risk of each of the aforementioned complications.
201 Klein et al. studied the strain on the brachial plexus in the lateral decubitus position and

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

216 **Summary:**

217 Overall, the evidence regarding the efficiency, efficacy, and risks of the lateral
218 decubitus and the beach chair position for shoulder arthroscopy does not demonstrate one
219 position to be superior. (Table 2) However, there is a significant difference in cost of
220 equipment for the beach chair position if the surgeon chooses to use the beach chair
221 attachments and/or a mechanical arm positioner. The complications associated with each
222 position are rare and, for the most part, avoidable, and they should be considered when
223 choosing a patient position. The lateral decubitus position puts neurovascular structures at
224 greater risk, especially when using an anteroinferior portal. The risk of cardiovascular

225 complications is greater for patients in the beach chair position, and hypertension and
226 obesity further increase those risks. There is no objective, empirical evidence to support
227 claims that either position is easier to set up or provides better surgical access. Therefore,
228 after considering the costs and risks, there is no argument that can be made against a
229 surgeon choosing a position based on their experience and comfort. Surgeons should
230 choose a position that they are most comfortable with in order to perform the anticipated
231 arthroscopic shoulder procedures.

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

275

Beach Chair Position	Beach Chair Mechanical Arm Holder	\$4,000 - \$8,500 \$8,000 - \$12,000
Lateral Decubitus Position	Bean Bag Side Braces Traction Bar	\$600 \$1,000 \$2,000 - \$4,500
* Costs are approximate and based upon a survey of various manufacturers published retail prices		

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Table 2. Lateral Decubitus vs. Beach Chair: Advantages and Disadvantages

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	Lateral Decubitus	Beach Chair
Advantages	<ol style="list-style-type: none"> 1. Traction increases space in joint and subacromial space 2. Traction accentuates labral tears 3. OR table/patients head not in the way of posterior and superior shoulder 4. Cautery bubbles move laterally out of view 5. No increased risk of hypotension/bradycardia; better cerebral perfusion 	<ol style="list-style-type: none"> 1. Upright, anatomical position 2. Ease of exam under anesthesia 3. Arm not hanging in the way of anterior portal 4. No need to reposition or redrape to convert to open procedure 5. Can use regional anesthesia 6. Mobility of operative arm
Disadvantages	<ol style="list-style-type: none"> 1. Non-anatomic orientation 2. Must reach around arm for anterior portal 3. Must reposition and redrape to convert to open procedure 4. Patients don't tolerate regional anesthesia 5. Traction can cause neurovascular and soft tissue injury 6. Increased risk of injury to axillary and musculocutaneous nerves when placing anteroinferior portal 	<ol style="list-style-type: none"> 1. Potential mechanical blocks to use of scope in posterior or superior portals 2. Increased risk of hypotension/bradycardia causing cardiovascular complications 3. Cautery bubbles obscure view in subacromial space 4. Fluid can fog camera 5. Theoretically increased risk of air embolus 6. Expensive equipment if using beach chair attachment +/- mechanical arm holder

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287 Figure 1. Lateral decubitus position with traction bar

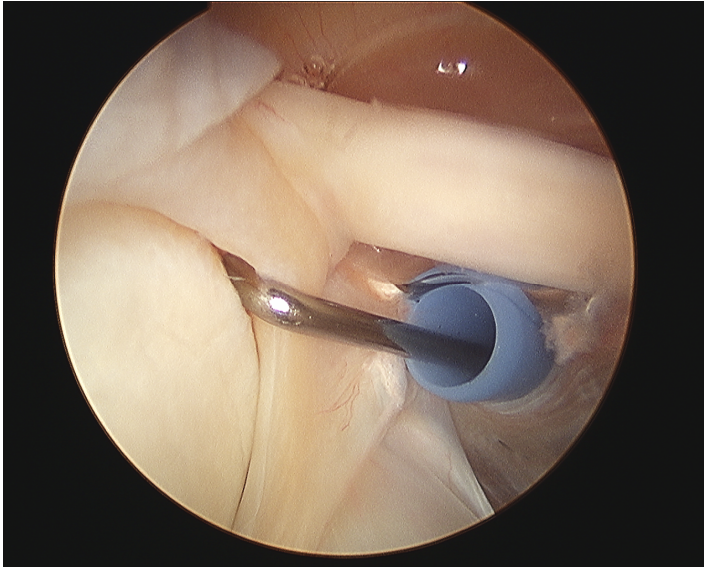
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289 Figure2. Beach chair position shown with mechanical arm positioner

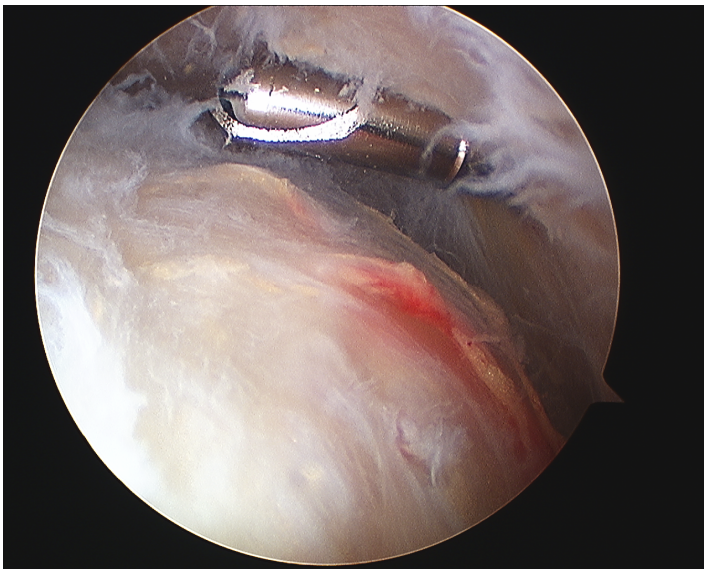
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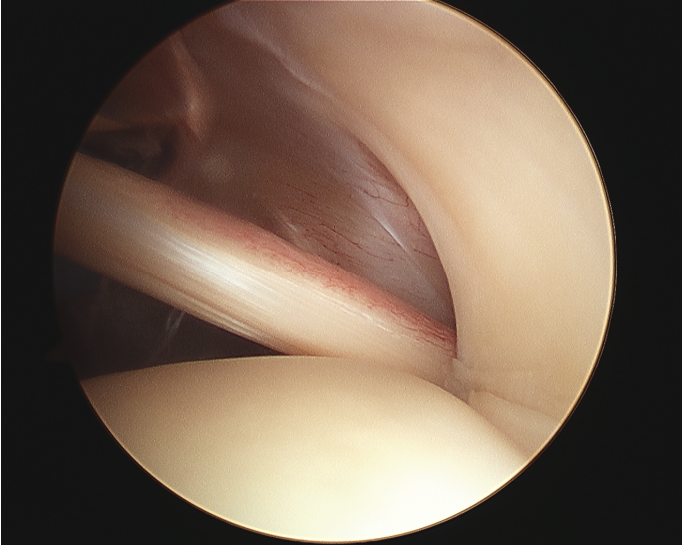
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293 Figure 3



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295 Figure 4

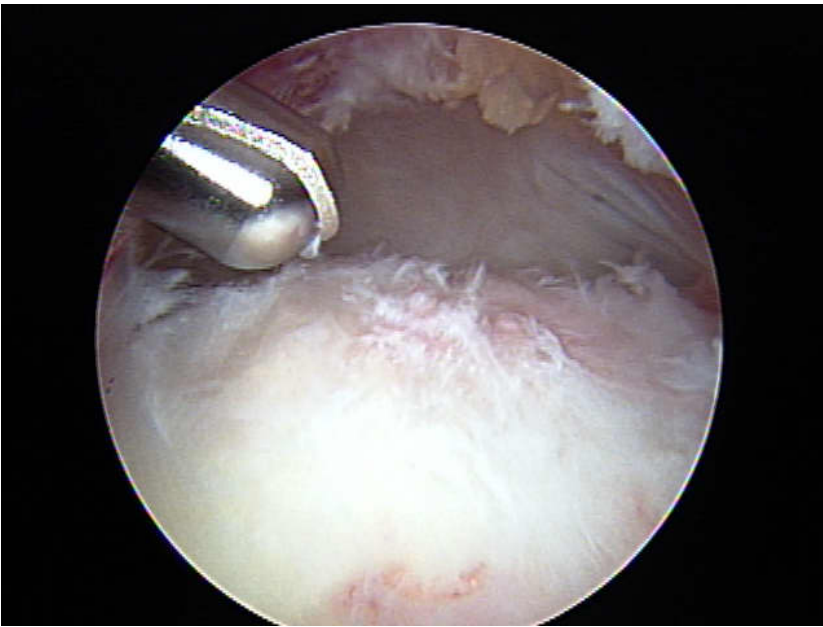


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297 Figure 5

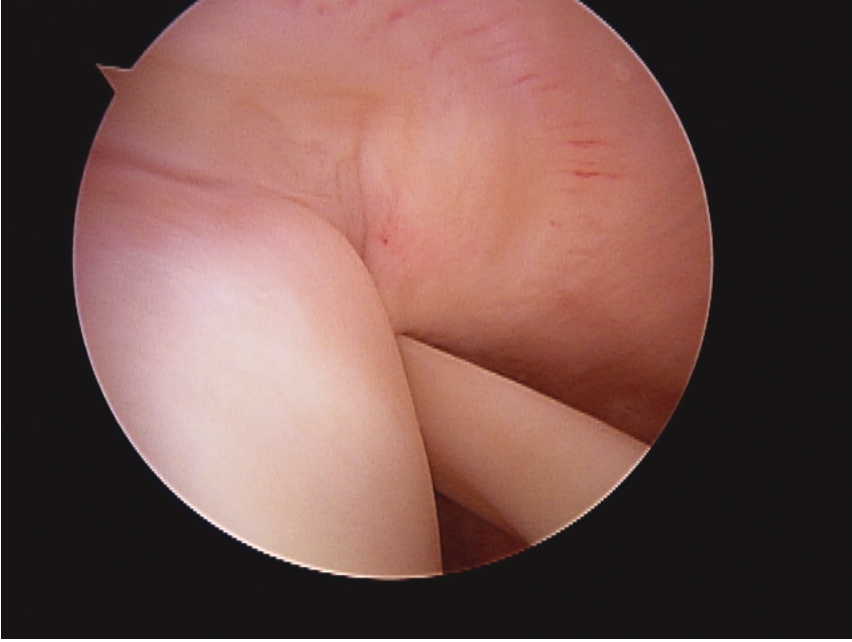
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301 Figure 6



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303 Figure 7

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