Ultrasound (US) guided injection of corticosteroids and hyaluronic acid in subacromial bursa (SAB) for shoulder impingement syndrome (stage II Neer) treatment

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Purpose

Our purpose was to assess the effectiveness of Ultrasound (US) guided injection of corticosteroids and hyaluronic acid in in subacromial bursa (SAB) in shoulder impingement syndrome stage II Neer for treating inflammation and restore the mechanical function of the bursal buffer.

Impingement syndrome represents the most common cause (about 80%) of chronic painful shoulder. This term was firstly used by Neer in 1972, who introduced the concept of rotator cuff impingement to the literature, stating that it results from mechanical impingement of the rotator cuff tendons and SAB beneath the antero-inferior portion of the acromion. The impingement syndrome described by Neer is triggered and maintained by mechanical rubbing of soft tissues (tendons and bursa) against bony structures and it is based on a continuous series of pathologic changes in the supraspinatous tendon and SAB ranging from hemorrhage, edema and inflammation, to tendonitis, fibrosis, tendon degeneration, and lastly to bony changes and tendon rupture. This sequence alone can't be considered exhaustive and cofactors are invoked in many cases. However Neer's theory and classification remains a milestone and a valid reference in the wide scenario of the chronic shoulder pain. The most common symptoms in impingement syndrome are pain, weakness and a loss of movement at the affected shoulder. The pain is often worsened by shoulder overhead movement and may occur at night. The onset of symptoms may be acute, following an injury, or insidious, particularly in older patients, where no specific injury occurs.

Neer's classification includes:

- Stage 1 Neer, commonly affecting patients younger than 25 years, is depicted by acute inflammation, edema, and hemorrhage in the rotator cuff. This stage usually is reversible with nonoperative treatment.
- Stage 2 Neer, usually affects patients aged 25-40 years, resulting as a continuum of stage 1. The rotator cuff tendon progresses to fibrosis and tendonitis, which commonly does not respond to conservative treatment.
- Stage 3 Neer, commonly affects patients older than 40 years. As this condition progresses, it may lead to mechanical disruption of the rotator cuff tendon and to changes in the coracoacromial arch with osteophytosis along the anterior acromion. Surgical anterior acromioplasty and rotator cuff repair is commonly required.

Stimulated by the great number of patients complaining shoulder pain referable to impingement, we have tried to approach the treatment of painful shoulder by interrupting, at least in part, the mechanisms (biochemicals and mechanicals) that support the perpetration of damage and pain, acting in the phases in which irreversible lesions have not still realized. The concept of a US guided selective infiltration of the SAB using
corticosteroids and hyaluronic acid, stems by the idea of achieving a double effect anti-
inflammatory and mechanical respectively. The well known anti-inflammatory properties 
of corticosteroids are associated to those of the low molecular weight hyaluronic acid.
The low weight hyaluronic acid, differently from the high molecular weight analogous,
shows also mechanical lubricating properties and stimulates the endogenous secretion
of hyaluronic acid by the synovial cell of the SAB; but its therapeutic role can be shown
only when a selective intrabursal injection is achieved. The restoration of the mechanical
function of the bursal buffer can be completed by the mechanical rupture of intrabursal
fibrous septa and adhesions that are usually present at the level of the SAB in the case of
impingement syndrome. These causes the rigidity and the limited slippery function of the
SAB and can be disrupted with the selective puncture and detachment of the SAB walls.

Methods and Materials

During 2010 we have selected and treated with injection of corticosteroids and hyaluronic
acid in SAB 86 patients with painful shoulder. These patients where classified as affected
by shoulder impingement syndrome, stage II Neer, after radiological and US evaluation
Fig. 1 on page 3; patients with other possible causes of shoulder pain such as
calcifications or irreversible changes at the level of the rotator cuff structures were
ruled out Fig. 2 on page 4. The procedure was performed percutaneously by 3
interventional radiologists with US guidance and local anesthesia puncturing selectively
the SAB with a 16G needle, respectively and alternatively for the mechanical rupture of
intrabursal adhesions when present, and for the selective injection of corticosteroids and
low molecular weight (750 kDa) hyaluronic acid. The procedure was performed using
a sterile technique, with the patient lying supine with the arm in neutral position. US
transverse scan (10 MHz linear transducer) depict the correct positioning of the needle
tip inside the SAB. US constant monitoring shows the progressive fluid distension of the
SAB Fig. 3 on page 4 associated to the operators feelings of detachment.

Clinical improvement after treatment (both in terms of pain and function) was evaluated
using a standard ten points visual analogic scale (VAS), comparing post procedural
score, assessed at 3 and 6 months after treatment, with the pre procedural value.

Images for this section:
**Fig 1**
Stage II Neer. No radiological bony changes are observed in (a); in (b) at US is appreciable the thickening of the SAB (arrow) without effusion or irreversible lesions such as tendon tears.

**Fig. 1**

**Fig 2**
Stage III Neer. Radiological changes in the coracoacromial arch with osteophytosis along the anterior acromion and greater tuberosity sclerosis are observed.

**Fig. 2**
Fig. 3

US monitoring during the procedure. (a) the needle tip is inserted into the thickened SAB (arrow). During the injection a progressive bursal distension (arrowhead) and detachment (b-c) of intrabursal adhesions can be appreciated.
Results

3 months after treatment a clinical improvement was observed (VAS score reduced up to 80% in 59 patients, and 50% in 24 patients) while 3 cases resulted unresponsive (Table 1 on page 6, Table 2 on page 6). The cases unresponsive to the treatment were reevaluated and ascribed to an incorrect enrolment. At 6 months the same results where confirmed in 73 patients with the exception of 10 cases in whom shoulder pain recurred (Table 3 on page 7). The explanation of recurrence is the persistence of more factors underlying chronic impingement.

Images for this section:

Tab 1

Preprocedural VAS score in our study population

Table 1
Tab 2
Three months follow up; evaluation of clinical outcome

Table 2
Table 3  Six months follow up; evaluation of clinical outcome

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>pts unresponsive</td>
<td></td>
</tr>
<tr>
<td>pts with VAS score reduced up to 80%</td>
<td></td>
</tr>
<tr>
<td>pts with VAS score reduced up to 50%</td>
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<td>pts with recurrence</td>
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Conclusion

Our preliminary data suggest how the selective injection of both corticosteroids and hyaluronic acid in SAB, achieved by US guidance, provides a significative improvement of pain in patients affected by shoulder impingement syndrome interfering at least with mechanical factors responsible of the onset and maintenance of symptoms.

References


**Personal Information**