Severe Spinal Cord Insult after Reverse Shoulder Arthroplasty

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Abstract

We present a case of a cervical spine cord ischemia with hemorrhage in a patient with a proximal humeral fracture treated with reverse shoulder arthroplasty (RSA), a rare complication, non-well described in the current literature. The aim of this study is to review immediate neurological post-operative complications of RSA that can be related to surgery or anesthetic technique. Thus, we describe a severe, rare central system neurological complication after RSA.

Keywords
Reverse shoulder arthroplasty, Complications, Cervical spine cord injury, Beach chair position, Interscalene block anesthesia

Introduction

Proximal humeral fractures (PHFs) in patients over 65-years-old are very frequent fractures. Conservative treatment, consisting in sling immobilization and early rehabilitation, stands as “gold standard”. Besides, treatment of three and four-part PHF in elderly patients is not well protocolized due to the lack of clear evidence showing better results with surgical treatment [1].

Reverse shoulder arthroplasty (RSA) was initially developed to treat massive rotator-cuff tear osteoarthritis. Further indications to RSA are: PHFs in patients over 75-years-old with functional demands, osteopenia and rotator cuff insufficiency, so as younger patients with complex PHF and rotator-cuff insufficiency where hemiarthroplasty has obtained poor functional results and a high percentage of revision surgery [2].

Due to the increase number of indications, RSA procedures have been increasing exponentially in the last years [3] and associated complications have increased too [2-4].

Case Report

In 2018, an independent for daily activities 83-yea-old female with clinical history of breast cancer, ischemic heart disease and RSA in her right shoulder done 5 years before because of a PHF, was diagnosed at the emergency room with a four-part left PHF (Figure 1).

Surgical treatment was proposed to treat her fracture. In a beach chair position, RSA with tuberosity repair through a transdeltoid approach was performed. Anesthetic technique was: Interscalene block plus general anesthesia consisting in endotracheal intubation (ETI). The parameters monitoring during surgery was blood pressure, oxygen saturation, bispectral index (BIS), electrocardiogram and hydric balance. During anesthetic induction, we highlight an episode of hypotension requiring administration of a single bolus of ephedrine. Neither further action nor other vasoactive drugs were needed. We do not report any outstanding facts surgery-related. Surgery was therefore performed uneventfully.

Patient’s physical exam (PE) in the first postoperative day, showed plegia and arreflexia (0/5) in the whole left upper limb. Solely, she was able to initiate finger and fist abduction-adduction. Gait disorder, right neck deviation and ptosis without myosis were as well described during PE. She also complained about global hypoesthesia, especially in the C5 dermatomal region.
An urgent magnetic resonance imaging (MRI) of the cervical spine and an urgent evaluation by a neurologist were requested.

MRI images showed: Ischemic tissue damage, with a hemorrhage component between C1 and C7 limited to left medulla (Figure 2).

There was no evidence of brachial plexus or vertebral artery injuries. As Neurology team recommenda-
ned global hypoesthesia in the whole left upper limb. DASH score: 75.8.

Despite of our patient’s severe cervical cord injury, she did not hopefully develop any other systemic complications such as cardiovascular or respiratory. She has shown progressive improvement during clinical follow-up due to rehabilitation. Otherwise, we do not expect any further improvement.

**Discussion**

Complications rates of RSA vary between authors and surgery type: primary or revision procedures, ranging from 13% to 68% [2,3]. The most frequent complications are: instability (16.7%), infection (6.7%), intra-operative periprosthetic fracture (3%) and neurological injuries, with its incidence varies from 1 to 4% [4].

On one hand, among neurological insults, neurapraxia are more frequent than complete nerve injuries (axonotmesis), affecting especially axillary nerve and the brachial plexus. These injuries could happened as a result of surgical approaches, prosthetic components implantation, direct nerve damage during surgical dissection, excessive traction of the upper limb during exposure or reduction, compression secondary to retractors and postoperative hematoma [5-7]. It is known that the glenoid exposure is the most decisive step preventing nerve insults, especially when we have the arm positioned in abduction, external rotation and extension [6,8]. In our case, the radial nerve injury could

A clinical review was taken monthly during the first six months. Progressive, gradual slow but good recovery was observed whereas the patient kept on rehabilitation program. Follow-up MRI at 2 months (Figure 3) showed improvement compared to the previous. Follow-up EMG at one year reported C5 and C6 proximal muscle reinnervation.

Final clinical review at 20 months postoperatively, the patient shows passive elbow, wrist and fingers mobility. Shoulder active range of motion of: 45° of flexion achieving 90° passive, active abduction of 45° and passive abduction 80° with severe limitation of external and internal rotation.

Motor examination according to muscle strength Oxford score, showed deltoid 2/5, triceps 4/5, wrist extensors 3/5, volar flexors 3/5, fingers flexors 3/5, extensor pollicis longus 3/5. Sensitive examination: Maintained global hypoesthesia in the whole left upper limb. DASH score: 75.8.

**Figure 3:** 2 months postoperative MRI. Longitudinal injury between C2 and C7. Hiperintense in T2 (A) and STIR (B) sequences.
occur during the surgery because of an unaware, unre-
ported incident.

Once a nerve injury is detected at the immediate po-
stopervative period, an EMG should be performed at six
weeks from the onset of symptoms to determine the
type of neurological injury. It must be repeated for an
interval of six months to one year. These injuries may
be potentially reversible during the first three postope-
ратive months [8].

On the other hand, spinal cord and brain injuries are
not described frequently in the literature. They may oc-
cur as a consequence of patient positioning during sur-
urgery or as a result of anesthetic techniques and drugs.

The beach chair position (BCP) is worldwide com-
monly used in shoulder surgery (open, percutaneous or
arthroscopy) having more benefits than lateral decubi-
tus position due to lower incidence of peripheral neu-
rapraxia secondary to traction than in lateral decubitus
position. Other described advantages are shorter ope-
rate time or easier, potential possibility to switch into
open surgery an arthroscopic procedure if needed. Ne-
evertheless, this position has been associated with brain
and spinal cord stroke, midcervical quadriplegia, optic
nerve lesions and higher risk of venous and arterial air
embolism [9]. The etiology of these severe complica-
tions could be head and neck malpositioning accompa-
nied by a cerebral hypoperfusion emphasized by hypo-
tensive anesthesia used to reduce bleeding.

Interscalene block anesthesia is an alternative to
general anesthesia in patients undergoing shoulder
surgery. Their benefits are lower concentrations of ane-
sthetics drugs, lower postoperative analgesic demand
and lower incidence of postoperative nausea. However,
it has been related to hypotensive and bradycardic heart
events after its administration. Complications rates related
to this anesthetic technique vary between 1.4
and 2.3%, and they include brachial plexus neurapraxia,
mis-induction of spinal or epidural anesthesia, sei-
zuers, cardiac arrest and potential block of phrenic nerve,
laryngeal nerve and sympathetic chain [9,10].

Back to our case, our patient suffered a spinal cord
ischemia with-hemorrhage, without a clear explana-
tion. According to the related published evidence, this
severe and rare complication could be explained by the
BCP, the interscalene block anesthesia, outstanding in
our patient an isolated episode of hypotension during
induction of anesthesia.

Conclusion

Despite of the increasing number of RSA performed
in elderly patients with three and four-part PHFs, there
is no clear consensus about obtaining better functional
results or a quicker recovery than with conservative ma-
agement, moreover, considering a higher rate of comp-
lications.

Despite its low incidence, it is important when de-
ciding PHF management to take into account potential
severe complications related to RSA like neurological
injuries, which are increasing in the last years, especially
with RSA due to its nonanatomical design [6].

Therefore, it remains necessary to develop more
prospective, control-trials comparative studies to deter-
mine which is the best option of treatment in this type
of fractures in elderly patients so that we could improve
our results minimizing complications.

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