Review Article
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Floating shoulder injuries, what parameters are important and their treatment options

Abstract

Introduction: Floating shoulder is the disruption of the superior shoulder suspensory complex in two or more sites. It is an uncommon injury, accounting 0.1% of all bone fractures, and has a high incidence of associated injuries, which are present in 80-90% of the cases. Currently there is no defined treatment algorithm or classification for floating shoulder. Many parameters have been described regarding the surgical criteria's, but most of them are described unevenly. Thus the instability criteria and surgical indications are unclear.

Material and methods: We made a scoping review using the methodology described by Colquhoun in 2014. We did the review of the literature of the last 10 years in Spanish and English. Then in a narrative form we described the main actual surgical criteria and options for each type of injury in the floating shoulder.

Results: To make a proper Floating Shoulder diagnosis, CT scan is recommended for a better assessment of the displacement, angulations and medialization of the injuries. At this time the decision making is based on the displacement and angulations, inferring the ligament ruptures and instability of a floating shoulder injury. Glenopolar angle of less than 30° and Offset medialization of more than 20 mm are two parameters that can predict a bad outcome.

The displacement is an important measure in decision making. Coracoid and acromium fractures are treated surgically when displaced more than 8 mm. Surgical Fixation of clavicle injuries is extensively recommended.

Conclusion: Floating shoulder diagnosis requires an integral assessment and complete CT workup. The treatment of floating shoulder injuries requires the assessment of each morphological injury individually. Displacement, medialization and the Glenopolar angle are the main criterias in decision making. Nowadays a floating shoulder classification or treatment protocol is needed.

Keywords: Floating Shoulder, Shoulder injury, Polytrauma, Glenoid fractures, Clavicular Fractures, Glenopolar Angle, Treatment High Enery trauma

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Abbreviations

FS, Floating Shoulder; GPA, Gleno-polar Angle; SSSC, superior shoulder suspensory complex; AIS, Abbreviated Injury Scale; ATLS, Advanced Trauma Life Support CST, Constant Score; DASH, Disabilities of the Arm, Shoulder and Hand Score; SST, Simple Shoulder Test; TENS, Neuro-Sensitive Electro Therapy

Introduction

The floating shoulder (FS) is the disruption of the superior shoulder suspensory complex (SSSC) at two or more different points.[1] The SSSC is composed by: the glenoid neck, the clavicle, the coracoid, the acromium and the C4 ligament complex (acromio-clavicular, coracoclavicular and coracoacromial ligaments.[2-6]

Scapular fractures are only 1% of all the fractures.[2] Glenoid neck fractures are 18-33% of the scapular fractures and only 50% of them have a double SSSC disruption. A glenoid neck and clavicle fractures is the most common type of floating shoulder injury pattern.[2] Open injuries are present in 9% of the FS cases.[3]

The FS is often present in polytrauma patients (AIS of more than two in two or more corporal regions).[7] in such cases the FS injury can be easily overlooked.[2] being belatedly diagnosed.[1,2] Associated injuries are present in 80-90% of the FS cases. The most common injuries are: Head Trauma (30%) (CET).[2,3,8] Thoracic trauma (30%) and ipsilateral chest-wall injury (25%) followed by cervical spine fractures 12%.[2,9]

Currently there is no classification or treatment protocol for the floating shoulder.[1-3,8,10] Nowadays displacement is the main criteria of stability,[1,2,6]

The objective of this article is by a Scoping review of the literature, identify the main parameters which define the treatment in the floating shoulder injuries. This article has the objective to help the Trauma surgeon in the FS decision making .[11]

Methodology

Thorough a working team of 6 trauma surgeons, composed by 4 surgeons specialized in shoulder surgery and treatment of the polytrauma patient, we made a narrative scoping review based on the methodology clarified by Colquhoun in 2014.[12-14] The review was made following all the principles of the Helsinski declaration in its last Assemble 64ª in Fortaleza, Brasil, and October 2013.

The literature review was made of the term: Floating Shoulderin the research databases: "PubMed", "Ovid", "Sciencedirect" and "Cochrane". 221 indexed publications were obtained. Inclusion criterias were publications after 2006, written in English or Spanish,

excluding editor letters. Finally 20 publications were reviewed, adding 6 more crossed references in order to obtain the original quote. The time period was arbitrary selected because in 2006 three review articles were published, TP Goss y B D Owens.[1] A Van Noort.[2] and DeFranco.[6]

We did a narrative review. The review responds to 4 main themes: diagnostic protocol, surgical criteria, surgical technique and postoperative and rehabilitation schemes.

Discussion

Diagnostic protocol

Most of the FS injuries are caused by High Energy trauma.[1,3] In the polytrauma patient the diagnosis must follow the ATLS (Advanced Trauma Life Support) guides, searching vascular or brachial plexus injuries, gross shoulder deformity, abnormal shoulder contour, shortening of the hemi thorax, tenderness or crepitus. The patients with high energy trauma and thoracic or head trauma are the most likely to have a FS injury.[1-3,6,15]

Basic X-rays are a AP thorax X-ray.[6] and if a scapular girdle injury is suspected at least two more X-rays projections must be taken.[2] True AP view and scapula-lateral view are the most useful ones.[1,2,6,16] Other useful projection is the Axillary view.[1,6] having the disadvantage of being very painful.[2] To asses coracoid fractures, Stryker view is recommended.[3,6]

The CT scan is recommended for a better assessment of the displacement, angulations and medialization of the scapular fractures.[1-5,8,15,17,18]

The MRI (Magnetic Resonance Imaging) use for preoperative or diagnostic proposes in the FS hasn't being reported yet.[6] Jan Friederichs, says that new instability criteria's could come with the usage of this resource.[8,15] A Van Noort refer that rotator cuff injuries can be diagnosed, but it's not needed for the ligament rupture diagnosis.[2]

Surgical criteria

Due to the low evidence based studies(Level II-IV) and lack of a standardized morphologic classification,[1-3,8]the surgical criteria for the FS aren't clear,[1,2,6,17,18]

All of the open FS injuries need surgical management at least with surgical debridement in all cases.[3,6,19] Izadpanah et al. recommend the clavicle fracture surgical management in all polytrauma patients to improve breathing, helping the inspiratory accessory muscles, making easier the thoracic injuries management and early mobilization.[20]

We divide the FS in the different type of injuries that can be present, discussing specific surgical criteria for each one of it.

Glenoid neck fractures

Glenoid neck fractures are the most common injuries in the FS. The displacement, angulations, rotation, medialization and comminution are the main surgical criteria.

In the anatomic glenoid neck fractures, surgical fixation is always advised, due to the lack of ligamentous attachments in the glenoid fragment.[1,6,8]

A displacement of more than 10mm in Surgical Glenoid neck fractures is considered unstable and surgical management is advised.[1,2,5,8,10] Edwards et al. concluded that good results can be reached with conservative treatment in glenoid neck fractures with less than 5 mm of displacement.[6,21]

The glenopolar angle (GPA) is a well known standardized measurement which normal values oscillate between 30-45°.[10,22] When preserving a GPA above 30° is related with greater Constant Score (CST)[6,10,18,22] and Herscovici Score.[10,20,22] demonstrated by some evidence III and IV studies. Romero et al demonstrated that a GPA of less than 20° will produce persistent malrotation.[4,6,23] Tsung-li Lin in a three group retrospective patient series reported better CST in the group with a mean GPA of 36°.

The glenoid offset is the distance between the clavicle medial border and the tangent line made with the humerus greater tuberosity.[5] The loss of glenoid offset, is related to negative outcomes, low CST, DASH (Disabilities of the Arm, Shoulder and Hand Score) and SST (Simple Shoulder Test).[2-5] DeFranco said that a difference of 30 mm compared to the contra lateral offset, causes: instability, bad functional outcome and pain. Dean E.P Wright said that a medialization of 10-25mm will produce abduction weakness.[4] Romero et al. said that a medialization of more than 25 mm will produce pain and abduction degree loss.[23] For us an offset medialization of more than 20 mm can produce a bad functional outcome.

Clavicle fractures

Surgical criteria for clavicle fractures are: shortening of more than 20mm.[17,18] displacement of more than 10 mm.[6,18] the absence of cortical apposition or comminution; all these indicates the need of a surgical management.[1-6]

Clavicular fixation is extensively recommended in the FS, because the clavicle reduction and fixation may reduce the glenoid neck fracture due to the ligamentous insertions.[17,2,5]

Other structure injuries

Only a few floating shoulders case reports are conformed by other shoulder girdle structure injuries.[2,4,8,16,24,25]

The acromio-clavicular dislocations type III or greater + another SSSC injury is considered a floating shoulder, advisable for surgical fixation.[2] For the AO group, a displacement of 8 mm or more in coracoid or acromial fractures is indicative for surgical fixation.[9] For the intra-articular glenoid fractures a displacement of more than 2 mm.[8] and in scapular body fractures displacement of more than 20 mm will require surgical fixation.[8]

Management

The initial management in all patients with a suspected floating shoulder injury, should be immobilization in a sling.[25] The treatment for associated injuries needs to be done according to ATLS protocol.

Surgical treatment

Surgical fixation decision making should be made individually for each injury of the SSSC. There are two ways to make the surgical fixation as B D Owens and T P Goss referred.[1] First to fix the clavicle in a beach chair position and then reposition the patient to dorsal decubitus for scapular fixation. The other way is by fixing both injuries in lateral decubitus. This decision has to be made according to surgeon preferences and associated injuries.[16]

The most preferred surgical approach for the scapular neck fracture fixation is the posterior deltoid approach.[1,2,9,26] Also Judet and Modified Judet approaches have been described for complex fractures.[5,16]

Angle stable implants are being used in most of the fracture cases, being easier to place and to achieve a stable fixation.[5,16,17] Non locking implants can still be used; being the reconstruction 3.5 mm plates the preferred ones.[1,18]

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Other implants like TENS (Titanium Elastic Nails), have been used. Izadpanah et al in a case-control series with a 36 months of follow up demonstrate that in the AO type B and C clavicle fractures, the TENS group suffered clavicular shortening of 5 mm in contrast with the LCP plate group where shortening wasn't seen.[27]

In cases of severe comminution, threaded k-wires or screws can be use to fix the glenoid fragment to the acromion or distal clavicle.[1,2,5,16,18]

In the Floating shoulder, fixation of other components of the SSSC, have been poorly described in limited case reports.[4,8,16,24,25]

Conservative treatment

The conservative treatment of the selected FS cases should be made through immobilization in a sling during the first 3-4 weeks.[5,6,8,10] Free hand and elbow movement is recommended.[2,3,5,6,10,15]

Postoperative and rehabilitation protocols

Post-operative treatment and follow-up has been only described by type IV studies. The most used scheme is shoulder immobilization with a sling for 2-6 weeks together with shoulder passive movements.[5,8,10,17] At week 2 pendulum movements and passive motion is allowed. Active movements and sling removal is indicated at week 6.[5,15-17] Daily life activities are allowed progressively from week 6-12.[15,17,24] Full reintegration to endurance and sport activities is recommended only after 6 months.[15,24]

Becca Reisch published a detailed rehabilitation scheme in a FS, initiating rehabilitation therapy at week 6 after sling removal. He established a four stages goal based scheme: the protection stage (0-6 weeks), range of motion (6-10 weeks), dynamic strengthening (10-20 weeks) and daily living and sport returning (+20 weeks).[28]

According to Tsung-li Lin observations of 39 FS patients, consolidation in the surgically fixed group was archived after 10 weeks. In the conservative treatment group or fracture consolidation was obtained after 12 weeks.[18]

Follow-up visits protocol varies, with a mean of 3 visits with control X-Rays in the first 12 weeks, (weeks: 1,2,6.[8] or 2,6,12 .[17]). Complete follow-up after 6 months and a year is recommended.[15]

Conclusion

Floating shoulder injuries can be easily misdiagnosed; its diagnosis requires an integral assessment and complete CT workup.

The treatment of floating shoulder injuries requires the assessment of each morphological injury individually. Fixing clavicular fractures and acromio-clavicular dislocations first can reduce the other SSSC injury. Displacement, medialization and the Glenopolar angle are the main criteria in decision making. A floating shoulder classification or treatment protocol is needed.

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Conflicts of interest

All the Authors state they do not have any conflict of interest related to this article and have not receive any financial support.

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