Minimally Invasive versus Standard Open Deltopectoral approach in management of Proximal Humeral fractures

A Systematic Review and Meta-Analysis

Submitted for Partial Fulfillment of Master degree in Orthopedic Surgery

By

Mina Reda Roshdy Gadalla
M.B.B.C.H

Directed by

Professor/ Mohamed Kamal Asal
Professor of Orthopedic Surgery - Faculty of Medicine - Ain Shams University

Dr/ Mohamed El-Sayed Awad
Lecturer of Orthopedic Surgery – Faculty of Medicine – Ain Shams University

Faculty of Medicine
Ain Shams University
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Mina Reda Roshdy Gadalla

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List of Abbreviations

Abb.	Full term
3D	*Three dimensional.*
ADL	*Activity of daily living.*
AO	*Association for Osteosynthesis.*
AP	*Antero-posterior.*
ATLS	*Advanced trauma life support.*
AVN	*Avascular necrosis.*
CCT	*Comparative controlled trial.*
CI	*Confidence interval.*
CMS	*Constant Murely shoulder score.*
CT	*Computed tomography.*
DF	*Degree of freedom.*
EMG	*Electromyogram.*
FEM	*Fixed effect method.*
I^2	*I-squared index.*
IMN	*Intramedullary nail.*
IV	*Intra-venous.*
LOS	*Length of hospital stay*
MIPO	*Minimally invasive percutaneous osteosynthesis.*
MRI	*Magnetic resonance imaging.*
n	*Number.*
NCT	*Nerve conduction test.*
OR	*Odds ratio.*
ORIF	*Open reduction and internal fixation.*
OTA	*Orthopedic trauma association.*
PCP	*Percutaneous pinning.*
PHILOS	*Proximal humeral internal locking system.*
Q	*Cochran Q statistic.*
RCT	*Randomized controlled trial.*

List of Abbreviations (Cont…)

Abb.	Full term

REM**.....** *Random effect method.*
ROM**.....** *Range of motion.*
RSA**.....** *Reverse shoulder arthroplasty.*
SD**.....** *Standard deviation.*
SE**.....** *Standard error.*
SMD**.....** *Standard mean difference.*
VAS**.....** *Visual analogue scale.*

ABSTRACT

Introduction: Proximal humeral fractures is common in old osteoporotic women. Surgical management of the fracture is according to displacement of fracture fragment more than 1 cm or angulation more than 45 degree. Advantage of PHILOS plate is that it is not in contact with bone and forces transmitted between plate and bone through head of locked screws so gives better stability and less complication. PHILOS plate can be applied by open reduction technique or minimally invasive techniques.

Aim of the Work: To compare between minimally invasive approaches versus standard open delto-pectoral approach in management of proximal humeral fractures outcomes.

Materials and Methods: A systematic review and meta-analysis in which search strategy done from 2000 to 2017. This study is done on 11 articles with total number of participants 855. The outcome of interest are operative outcome, functional outcome measured by constant score, time to healing outcome, complication rates outcome.

Results: Minimally invasive techniques is superior to open reduction technique in operative outcome, functional outcome. Regarding time to healing and complication rates, minimally invasive techniques and open reduction technique are comparable with no statistically significant difference.

Conclusion: Fixation of proximal humeral fracture by PHILOS plate with minimally invasive techniques is better than open reduction technique.

Keywords: *Proximal Humeral Fractures – Deltoid Splitting - Deltopectoral*

INTRODUCTION

Proximal humeral fractures contribute to 4 – 5 % of all fractures and accounts for 45 % of all humeral fractures. This type of fracture are considered the third most common fracture associated with osteoporosis after intertrochanteric fractures and distal radius fractures [1]. Proximal humeral fractures is expected to increase approximately by 3 folds next 20 years due to increase life expectancy of elderly osteoporotic women [2]. Most of proximal humeral fractures occurs due to low energy trauma like fall down stairs and fall to the ground either by direct trauma by falling on the shoulder or indirect trauma by falling on an outstretched hand [3].

Proximal humeral fractures may be stable or unstable fracture. Unstable fracture is identified by angulation of more than 45 degrees or displacement of more than 1 cm. Also unstable fracture is identified by Neer as displacement or angulation of two-part, three-part and four-part fractures [4].

The usual clinical picture of proximal humeral fracture patients is pain, swelling, ecchymosis and restricted range of motion of the affected shoulder. This type of fracture is always evaluated by plain x-ray antero-posterior view, lateral axillary and lateral scapular view, but CT scan is better in describing fracture morphology, knowing if the fracture is stable or

unstable, knowing degree of comminution and proper pre-operative planning to know the best surgical technique including surgical equipment, implants and surgical approach.

In previous decades, many surgeons managed unstable, displaced and comminuted fractures by different methods. Some surgeons managed them conservatively by broad arm sling, arm to chest bandage or above elbow hanging arm cast, but rate of complications are high with non-union rates up to 23% [4]. Also, there are different surgical techniques used to manage this type of fracture like fixation by tension band, percutaneous pinning using K-wire fixation or compression screws, intramedullary nails, conventional T-plate and joint replacement by either hemiarthroplasty or reverse shoulder arthroplasty. But patients' satisfactory rates still law and complication rates still high especially screw cut out, avascular necrosis of humeral head due to disruption of blood supply by extensive dissection, high non-union rates, high mal-union rates, and axillary nerve damage [5].

Now, many surgeons prefer to use humeral head preserving technique by using locked compressive low contact PHILOS plate. The anatomical design of this plate provides angular stability as it has many holes and surgeons are able to lock the screw in various directions in the head of the humerus [6]. So this plate is better in providing more stability especially in osteoporotic bone, ensure less bone de-vascularization and

less soft tissue damage. Many patients experience less pain and more shoulder range of motion, but there is conflict in its outcome as there is still some complications [7].

There is a debate between surgeons about the best surgical technique to proximal humeral fractures. Some use standard open delto-pectoral approach technique, others prefer minimally invasive techniques. Standard delto-pectoral approach is known to have better look on fracture morphology by naked eye, fracture is easily reduced with manual manipulation especially comminuted fractures [8] and if there is intra-articular extension of fracture or acceptable reduction can't be achieved, it is easily to covert decision to joint replacement either by hemi-arthroplasty or total shoulder arthroplasty. Minimally invasive deltoid splitting approach is known to have good access to postero-lateral surface so there is no extensive soft tissue dissection to visualize postero-lateral fragment in proximal humeral fractures. Also this approach may have less operative time, less blood loss, early discharge from hospital, early better patient satisfaction and less complication [9].

In delto-pectoral approach, there is extensive soft tissue dissection, more blood loss and operative time, increased risk of avascular necrosis in humeral head due to more damage to blood supply and there is difficulty to access postero-lateral fragment of proximal humeral fractures. While in Minimally invasive approach reduction is more difficult as reduction is

usually indirect [8], so accepted fracture alignment is needed before doing approach by doing longitudinal traction of fracture and then correct varus\valgus angulation at surgical neck [7]. Also, in minimally invasive delto-pectoral approach there is high risk of axillary nerve injury [9].

AIM OF THE STUDY

A systematic review and meta-analysis was done To compare between minimally invasive approaches versus standard open deltopectoral approach in management of proximal humeral fractures regarding operative outcomes, functional outcomes, time to healing and complications rate.