Minimal Access Surgeries for Posterior Pelvic Injuries and Sacral Fractures

Systematic Review/Meta Analysis

Thesis

Submitted for Partial Fulfillment for

Master Degree in ***Orthopaedic Surgery***

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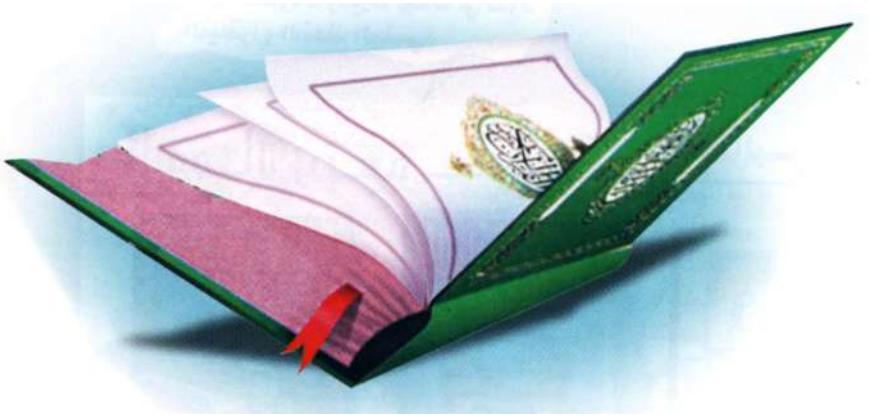
2019

بسم الله الرحمن الرحيم

وَقُلِ اعْمَلُوا فَسَيَرَى اللَّهُ
عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ



صدق الله العظيم

[سورة: التوبة - الآية: ١٠٥]

Acknowledgments

Really I can hardly find the words to express my gratitude to ***Prof. Dr. Abdelfattah M.F. Saoud*** *vice president of Ain shams university, Professor of orthopaedics, faculty of medicine, Ain Shams University, for his supervision, continuous help, and encouragement throughout this work.*

I would like also to express my sincere appreciation and gratitude to ***Dr. Ahmed Mohamed Sallam*** *Lecturer of Orthopaedic Surgery, faculty of medicine, Ain Shams University, for his continuous directions and support throughout the whole work, and tremendous effort he has done in the meticulous revision of the whole work. It is a great honor to work under his guidance and supervision.*

Last but not least, I dedicate this work to my family, whom without their sincere emotional support, pushing me forward this work would not have ever been completed.

Alaa Rafat Ramzy Abdalla

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List of Abbreviations

Abb.	Full term
A.P	*Anteroposterior*
CI	*Confidence interval*
DF	*Degree of freedom*
MIS	*Minimal invasive surgeries*
N	*Number*
P.C	*Percutaneous*
Q	*Cochran Q,*
R.C.T	*Randomized controlled trial*
R.E.M	*Random effect method*
SI	*Sacroiliac*

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Abstract

Background : Percutaneous fixation of pelvic injuries was first described by Routt in 1993 and minimal invasive ilioilial screws for sacral fractures was also first described by Saoud A.M.F and Reda M.A. 2011.

Material and methods : We searched databases: Medline/PubMed, Cochrane library from 1998 to 2018 for the studies that deal with posterior pelvic and sacral fractures using p.c iliosacral or ilioilial screws and after application of our inclusion and exclusion criteria we identified Nine studies . Data from these studies were extracted and Statistical analysed using MedCalc© version 18.9.1 (MedCalc© Software, Ostend, Belgium).

Results : Our selected studies included 327 patients who were treated by minimal invasive iliosacral and ilioilial screws for posterior pelvic ring injuries and/or sacral fractures. Our extracted data were about clinical and radiological outcome of this method of treatment and it's complications including hardware failure, neurovascular injuries, non union, infection and need for re-operation . Our results were as follow: The rate to achieve satisfactory reduction(displacement less than 10 mm) is 92.6% , The rate to achieve excellent and good functional scores (according to Majeed score and Pohleman score) is 90%, Rate of hard ware failure and screws miss-displacement is 3.3 %, Rate of neurovascular complication is 2.8%, Rate of superficial infection is 3.5%, Rate of re-operation is 3.4%, Rate of non union is 0.0%.

Conclusion : From this study we concluded that percutaneous screw fixation for posterior pelvic and sacral fractures is a sound method of fixation and has low complication rate with good long term functional outcome.

Keywords: Iliosacral and ilioilial screws, Management of posterior pelvic fractures, Complications follow p.c. iliosacral and ilioilial screws

INTRODUCTION

Unstable pelvic fractures are the most serious orthopedic injury, however controversy exists in the recommended treatment and outcome. [17,19] Anatomic reduction and stabilization is an important factor that determine the outcome of these fractures.[17,18]

Open reduction and internal fixation of pelvic ring disruptions usually disrupt the pelvic hematoma and lead to additional hemorrhage so it is usually delayed.

Closed reduction and percutaneous fixation of unstable posterior pelvic and sacral fracture can be used for early stabilization and provide stable internal fixation without causing disruption of pelvic hematoma and avoid large surgical exposure and major complications associated with these surgeries . [16,19] And that what we will survey and discuss in our study.

Mode of trauma

In young patient, the most common cause of injury is motor vehicle accident which represent 60% of cases, the second most common cause is fall from height which represent 30% of cases, crush injuries represent 10% of cases. [20]

High energy trauma usually lead to Displaced pelvic fractures which often associated with other life threatening injuries. [21,39]

Also low energy trauma can cause pelvic fracture in elderly patients but usually these fractures are non displaced or minimally displaced and not in need for surgical intervention. [39]

Relevant Anatomy and Biomechanics of the Pelvis

Understanding of the anatomy and biomechanics of pelvic bones and its ligaments is important for dealing with pelvic fractures . The pelvis is composed of two innominate bones and the sacrum.The innominate bones are joined anteriorly at the pubic symphysis, and are joined with the sacrum posteriorly through the SI joint . [31] Each innominate bone is formed of three bone fused together at the triradiate cartilage these three bones are the ilium ,ischium and pubis (Fig 1). [21] The pelvic ring consists of two arches: the posterior arch, a stronger arch that extends behind the acetabular surfaces and includes the sacrum, SI joints, and posterior ilium, and the anterior arch, a weaker arch made of the pubic rami bones and symphysis (Fig 2).

Stability is defined as the ability of the osseoligamentous pelvic structures to withstand the physiologic load without abnormal deformation . [13] The interosseous SI ligaments are the strongest ligaments and may be further subdivided into thin anterior and thick posterior fibers. The anterior SI ligaments resist external rotation of the ilium relative to the sacrum, whereas the stronger posterior ligaments resist both internal rotation and vertical displacement. The sacrospinous ligament extends inferolaterally from the posterior sacrum and attaches to the ischial spine. It is just posterior and inferior to the SI joint and provides rotational stability. The sacrotuberous ligament is superficial to the sacrospinous ligament and extends vertically from the posterolateral sacrum to the ischial tuberosity. It resists vertical shear and flexion forces. The iliolumbar ligaments extend from the posterior iliac crest to the transverse processes of L4 or L5 and secure the pelvis to the lumbar spine. [29,31,32]

The posterior SI ligament is the main vertical stabilizer, maintaining the position of the sacrum in the pelvic ring[14]. The posterior pelvis and sacrum are the keystone elements of the pelvis because they provide structural support and stabilization of the entire pelvic ring.

The posterior pelvic ring and its stabilizing structures act as a suspension bridge , with the strong posterior ligaments maintaining tension at the posterior margin of the SI joint and

suspending the posterior superior iliac spines to maintain an open pelvic configuration (Fig 3).

The pubic symphysis and its stabilizing structures serves as a strut to improve anterior ring stability during ambulation. However, the pubic symphysis is the weakest link in the pelvic ring, contributing only 15% of intrinsic pelvic stability. [24,30]

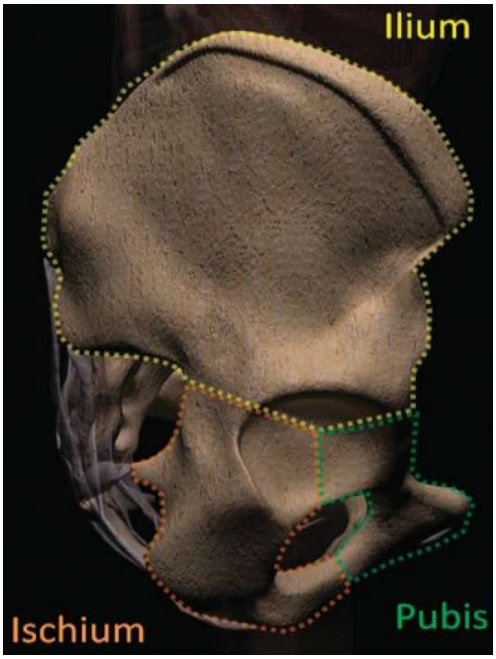

Figure 1: Computer generated lateral view of the pelvis shows the structure of the innominate bone which composed of : ilium (yellow), ischium (orange), and pubis (green). The borders between the three bones are the site of the triradiate cartilage which is fully fused by adulthood. [39]

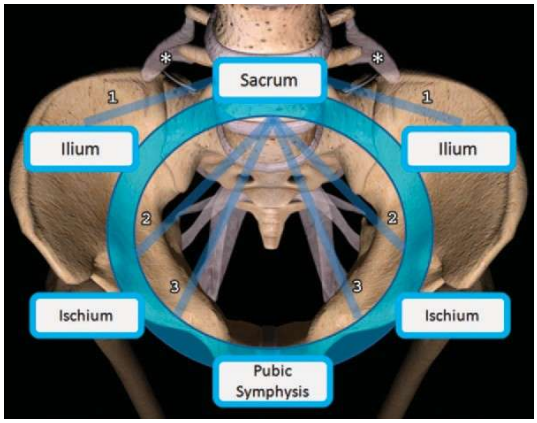

Figure 2: Computer-generated image shows the stabilizing structures of the pelvic ring. The bony pelvic ring (blue circle) is made up of the sacrum and bilateral innominate bones and stabilized by the SI *(1)*, sacrospinous *(2)*, and sacrotuberous *(3)* ligaments. Secondary stabilization is provided by the iliolumbar ligaments (*). Clinical instability is most severe in patients with injury to the posterior pelvic ring [39].

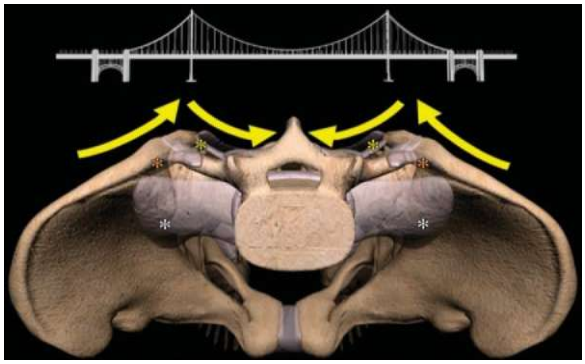

Figure 3: Computer-generated image shows the stabilizing structures of the posterior pelvic ring, which may be compared with the functional structure of a suspension bridge, with the strong posterior ligaments maintaining tension (yellow arrows) at the posterior margin of the SI joint and "suspending" the posterior superior iliac spines to maintain an open pelvic configuration. Orange * = iliolumbar ligaments connecting to the L5 transverse processes, white * = anterior SI ligaments, yellow * = posterior SI ligament [39]

Imaging Evaluation

As the pelvis is a ring like structure , affection of one portion raise the suspicion for disruption in another part . In evaluating pelvic images we must follow a systematic manner to avoid missing subtle findings.

Anterior ring fractures usually usually diagnosed by AP pelvic view which is part of the initial trauma series (Fig 4), but posterior pelvic injuries ,such as sacral fracture, are often occult and need careful examination of the sacral arcs and may need further imaging . [34]

Additional radiographic views include pelvic inlet and outlet views may be helpful and can be done without moving the patient . The pelvic outlet view is an AP view obtained with the x-ray tube angled 25– 45 cephalad. It best depicts the SI joints, vertical fractures of the sacrum, extension of fractures into the neural foramina, and cranial or caudal displacement of fracture fragments. The pelvic inlet view is an AP view obtained with 30–60 caudal tube angulation that allows evaluation of the sacral arcuate lines, AP displacement or internal rotation of fracture fragments, and alignment of the pubic symphysis (Fig 5). [35-37]

Judet views are the best view to diagnose acetabular fractures, also it can be easily done in the operating room for surgical planning. Computed tomography (CT) has become a