PERCUTANEOUS FIXATION OF FRACTURES OF ACETABULUM

Essay
Submitted for fulfillment of master degree

In

ORTHOPAEDICS

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2008

Acknowledgement:

First and for most, I am always indebted to **GOD**, the source of all human's knowledge.

No words can fulfill my deepest respect to **Professor Dr. Ahmed Hassan Rezk**, professor of orthopaedics faculty of medicine Cairo university, for his fatherly attitude, valuable guideness, scientific support and kind supervision. I would like to express my deepest gratitude to **Professor Dr. Atef M. Morsy**, professor of orthopaedics faculty of medicine Beni Suef university, for his sincere encouragement, scientific support, the idea and plan of the study in addition to his reliable advice and kind supervision in every step in this work.

Last but not least, I would like to express my deepest gratitude to all my professors, colleagues and my family for their kind support and encouragement.

Abstract:

Pelvic ring and acetabular fractures result from significant trauma. Letournel and Judet classified acetabular fractures into two major groups simple fracture types and more complex associated fracture types. It is hoped that Computer-guided operative procedures will prove useful in open acetabular procedures as well, by allowing accurate blind placement of screws for internal fixation without violating the hip joint. Now, It is possible to obtain internal fixation and to promote osseous healing with a computer assisted percutaneous technique. Virtual three-dimensional reconstruction might be useful in pre-operative planning for percutaneous screw fixation of acetabular fractures. Closed reduction of displaced anterior acetabular fracture is possible using virtual fluoroscopic surgical navigation. Also, an acetabular fracture with a substantial external rotation can be successfully treated by CT-guided closed reduction and percutaneous fixation.

Keywords:

Acetabular fractures – Letournel and Judet classification – 3D CT – Percutaneous fixation.

Contents

Page

LIST OF ABBREVIATIONS

AVN Avascualr necrosis

AP Anteroposterior

CPM Contiuous passive motion

CT Computer tomography

DVT Deep venous thrombosis

2DCT Two dimensional computer tomography

3DCT Three dimensional computer tomograhpy

IGA Inferior gluteal artery

IVC Inferior vena cava

L-J Letournel and Judet classification

LT Ligamentum teres

OBT Obturator artery

ORIF Open reduction and internal fixation

PCL Posterior cruciate ligament

SCDs Sequential compression devices

SGA Superior gluteal artery

LIST OF FIGURES

page

INTRODUCTION

Introduction:

The acetabulum can be dercribed as an incomplete hemispherical socket with an inverted horseshoe-shaped articular surface surrounding the non articular cotyloid fossa. This articular socket is composed of and supported by two columns of bone described by Letournel and Juded as an inverted Y ***(Mears, 1999).***

Pelvic ring and acetabular fractures occur as the result of significant trauma secondary to either a motor vehicle accident or a high-velocity fall. These injuries are correlated with significant morbidity and mortality, both from the complications of pelvic ring fractures and from commonly associated injuries. Letournel and Juded classified acetabular fractures into two major groups simple fracture types and more complex associated fracture types ***(Moed et al., 2003).***

Computer-assisted surgery is a rapidly expanding field with tremendous potential in a variety of surgical subspecialties and Closed reduction of joint fractures remains a fundamental challenge***(Huegli et al., 2004).***

Now, It is possible to obtain internal fixation and to promote osseous healing with a computer assisted percutaneous technique***(Crowl and Kahler, 2002)***

Computer-guided operative procedures may help to decrease the need for formal open operative exposure in the treatment of selected acetabular and pelvic fractures. It is hoped that this technology will prove useful in open acetabular procedures as well, by allowing accurate blind placement of screws for internal fixation without violating the hip joint***(Jacob et al., 2000)***

Virtual three-dimensional reconstruction might be useful in pre-operative planning for percutaneous screw fixation of acetabular fractures***(Huegli et al.,2004).***

Closed reduction of displaced anterior acetabular fracture is possible using virtual fluoroscopic surgical navigation. Also, an acetabular fracture with a substantial external rotation can be successfully treated by CT-guided closed reduction and percutaneous fixation***(Jacob et al., 2000).***

For percutaneous applications, it is currently necessary to place a small external fixator before computed tomography in order to obtain sufficient registration accuracy. It is hoped that this step will be eliminated in the future with the development of noninvasive registration techniques using ultrasound or fluoroscopy ***(Zura and Kahler, 2000).***

CHAPTER 1

ANATOMY

Applied surgical anatomy of the acetabulum

The acetabulum:

It is an approximately hemispherical cavity on the lateral aspect of the hip bone; it is directed laterally downwards and forwards. The acetabulum faces distally at an angle of 40 degrees to the horizontal plane and is directed anteriorly at an angle of 35 degrees to the sagittal plane ***(Harty, 1982*).**

The column concept of the acetabulum:

At first sight the acetabulum appears to be contained within an arch. the limbs of the arch are posterior (or ili-ischial), and anterior (or ilio-pubic). For a better understanding of the pathological anatomy of the acetabular defects we must alter somewhat this basic concept of the architecture. It is better to regard the acetabulum as being contained within the open arms of an inverted Y ***[fig.3 & 4] (letournel, 1993)***

It is formed by a posterior column, ilio-ischial component, and an anterior column which is much longer extends from the anterior end of the iliac crest to the pubic symphsis; the upper end of the posterior column is attached to the posterior aspect of anterior column , a little above its mid-level ***[fig.3 & 4] (Tile, 1996).***

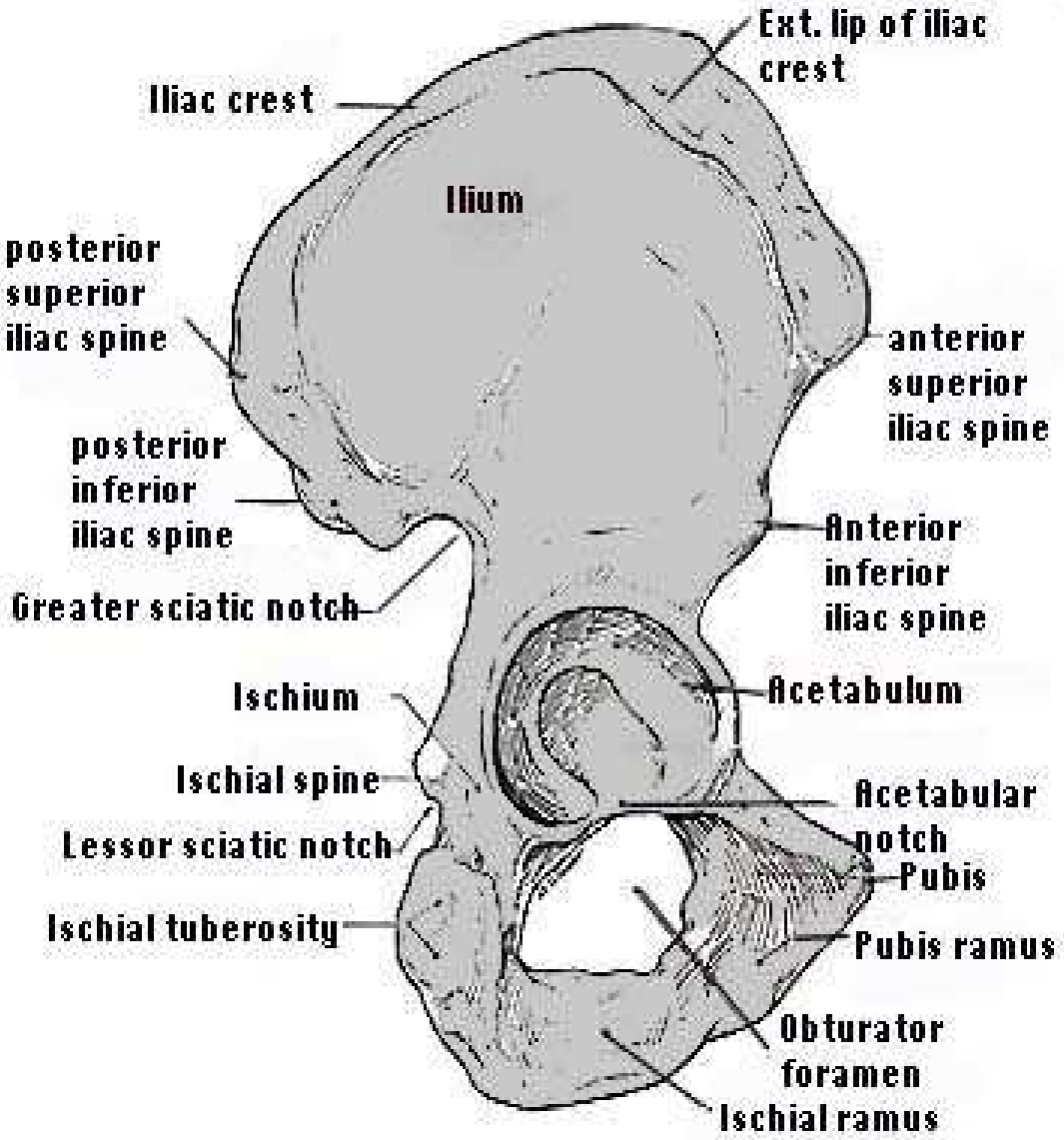

Fig.1: External surface of hip bone **(*MCMinn, 1994*).**

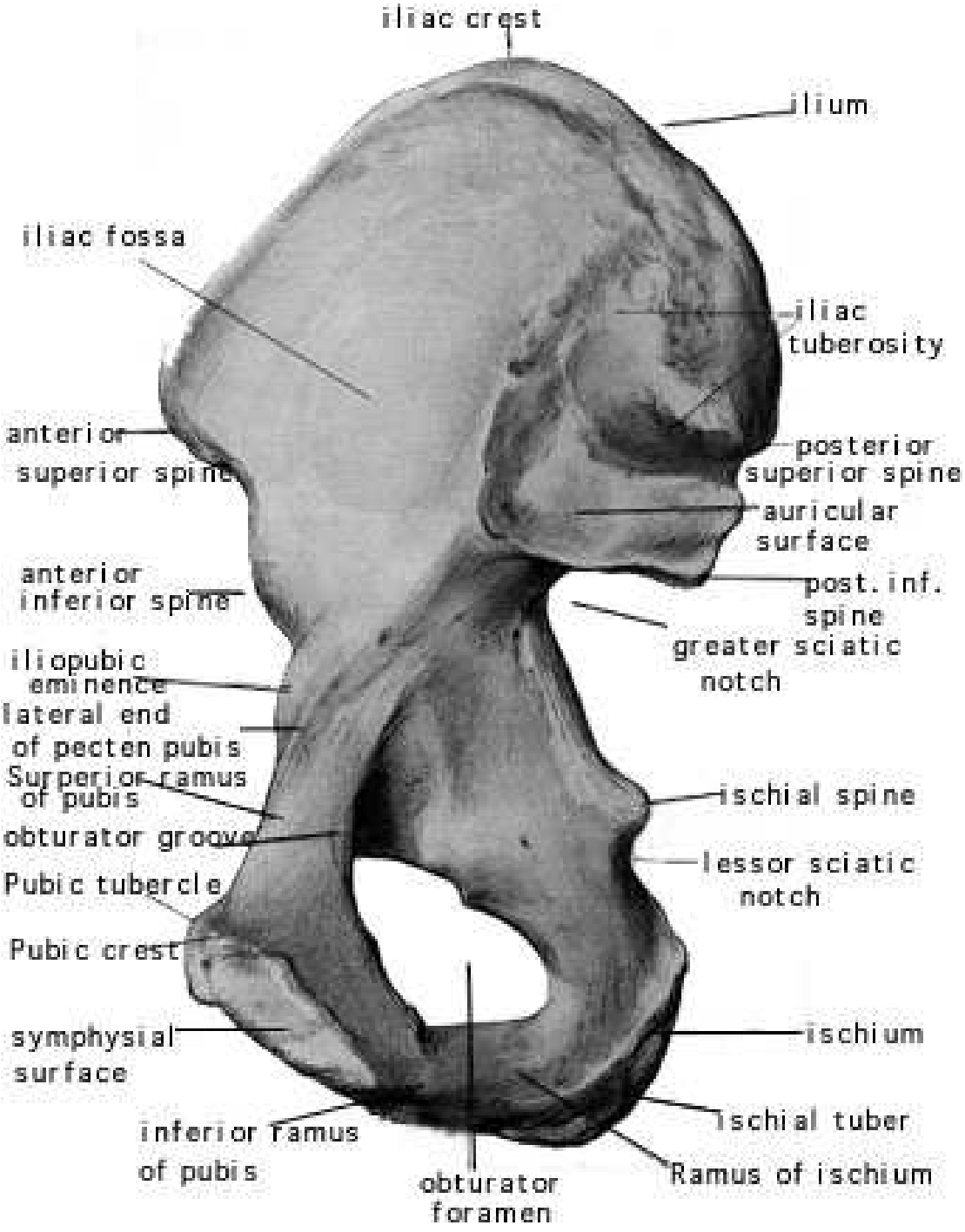

Fig.2: Internal surface of hip bone **(*MCMinn, 1994*).**

Posterior column:

This is called the ilio-ischial in order to indicate its components ; above, iliac, and below, ischial. It is thick so the surfaces are easily recognized, and it offers solid material for internal fixation. It is triangular in section, and present internal, posterior and antero-lateral surfaces ***[fig.3 & 4] (letourenel, 1993)***.

a- the internal surface comprises the quadrilateral area on the inner aspect of the body of the ischium. The middle part of the posterior margin of this area is continuous with the inner surface of the ischial spine. This illustrates its oblique in the internal and posterior directions.

b-the posterior surface comprises from above downwards, an area forming part of the posterior wall of the acetabulum, the subcotyloid groove in which runs the tendon of obturator externus, and the ischial tuberosity.

c-the anterolateral surface includes above, the posterior part of the acetabular surface, below it is formed by the body of the ischium ***[fig.3 & 4] (Tile, 1996).***

Anterior column:

This, ilio-pubic column, extends from the anterior end of the iliac crest to the pubic symphysis. It is concave both anteriorly and medially. its arc being bridged by the inguinal ligament. One can distinguish from above to below three segments; iliac, acetabular and pubic, capped by the iliac crest ***(Tile, 1996).***

a-iliac segment**:** this forms the anterior part of the iliac wing and presents two surfaces:

1.The pelvic surface**:** is concave from above to below and extends as far as the iliopectineal line.