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An Anterior Column Posterior Hemitransverse Fracture of the Acetabulum with Associated Posterior Wall Fracture: A Case Report

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Abstract

There are some unclassified acetabular fractures due to their complexity. Determining the appropriate approach and fixation strategy is a challenge and may impact the outcomes. A case of a patient with an anterior column posterior hemitransverse fracture with associated posterior wall fracture is presented.

1. Introduction

Various approaches and materials have been introduced to tackle the complex challenge of achieving satisfactory fixation for displaced acetabular fractures involving the quadrilateral plate [1]. Many surgeons focus on the direction of fragments to manage the complexity of the fractures [2]. The traditional Judet-Letournel classification describes five simple and five associated fractures, surgeons may occasionally find it challenging to classify certain fractures into one of these categories. Reports of unclassified fractures prompted researchers to develop alternative classification systems [1,3-6]. Thus, supplementary classifications have been proposed such as the «three column theory» based on the growth period of hemipelvis [1], the Cairo University Hospital classification based on comminution of the quadrilateral plate [6], the four point classification system [7].

The anterior column posterior hemitransverse fracture (ACPHT), is based on the cranial exit of the fracture in the ilium, with high fractures exiting above the iliac crest, intermediate fractures crossing between the spines, and low, exciting through the psoas gutter and very low fractures exiting through the iliopectineal eminence [8]. On the axial computer tomography (CT)

scan, it is presented as a primary perpendicular fracture line, separating the anterior column and a typical transverse fracture exclusively in the posterior part the acetabulum (hemitransverse component) showing a T-letter [9]. The ACPHT is really a variant of the T-type fracture, and these fractures may be confused with both column (BC) fractures and with the Transverse with posterior wall (TPW) fractures, where no part of the joint surface remains attached to the stable proximal part of the iliac wing and axial skeleton (TABLE 1) [10,11]. However, according to the current classifications, the possibility to have ACPHT with a separate combined posterior wall fracture, makes the preoperative planning and implant selection a challenge.

TABLE 1. **A guide to distinguish the anterior column (or wall) posterior hemitransverse fracture (ACPHT or AWPHT) from the T-type fracture and both column fracture. PW – posterior wall.**

Main differences & characteristics of the similar associated Letournel Fractures			
	BC	**T-type**	**ACPHT or AWPHT**
Relation to ilium	The fracture divides both columns above the level of the acetabulum and the ilium is broken in the coronal-frontal plane (floating acetabulum).	The ilium is not fractured above the acetabulum	The posterior column with a portion of articular surface remains always attached to the iliac wing.
Head Dislocation	Central dislocation	Central dislocation of the head is more common because of high energy fracture.	Dislocation of the head anteriorly
Variant of T-type	It is a variant of a T-type fracture through or proximal the joint.	The T-type fracture splits the acetabulum vertically.	It is a variant of T-type fracture.
X-ray typical signs	There is “spur sign” in the obturator oblique view.		There is often a gull sign.
Subgroups/Modifiers	Include PW fractures. Modifiers based on the fragmentation of the PW (simple or multifragmentary).	Include PW fractures. Modifiers based on the fragmentation of the PW (simple or multifragmentary or marginal impaction).	Modifiers based on the fragmentation of the anterior wall (or column) as simple or multifragmentary.

Characterization of the morphology of the fragments is important, as the variability within the patterns may result in changes in approach, sequencing and fixation construct. Ilioinguinal and/or Kocher-Langenbeck approaches are usually used to obtain reduction in complex acetabular fractures, however, approaches such as Stoppa or pararectal approach have been described when direct visualization of the fragments is needed [12,13]. It is known that anatomical fixation of posterior wall is required for delaying the osteoarthritis [14]. On the other hand, due to the greater pelvic stability provided by the anterior column compared to the posterior column, many surgeons aim to an anatomical reduction in the anterior column combined with rigid internal fixation to preserve the hip function [15].

Our purpose was to present a treatment sequence and postoperative outcome of ACPHT fracture combined with posterior wall fracture. A characteristic case selected among others for discussing and contemplating. The patient was informed that data concerning the case would be submitted for publication, and he provided written consent.

2. Case

A 42-year-old male worker who fell from 5m height, was admitted to our hospital due to an ACPHT fracture of the acetabulum with posterior wall fracture, without any associated injury (FIG. 1). He had 98 Charlson Comorbidity Index, without any medical record. The preoperative CT scan images and 3D reconstructions are presented in FIG. 2 and 3. The fractured quadrilateral plate (Qp) and its displaced fragment due to the transverse component of the fracture, drifts the posterior column and displaces the quadrilateral plate and the column as a whole system (FIG. 4). He underwent surgery five days after the accident.

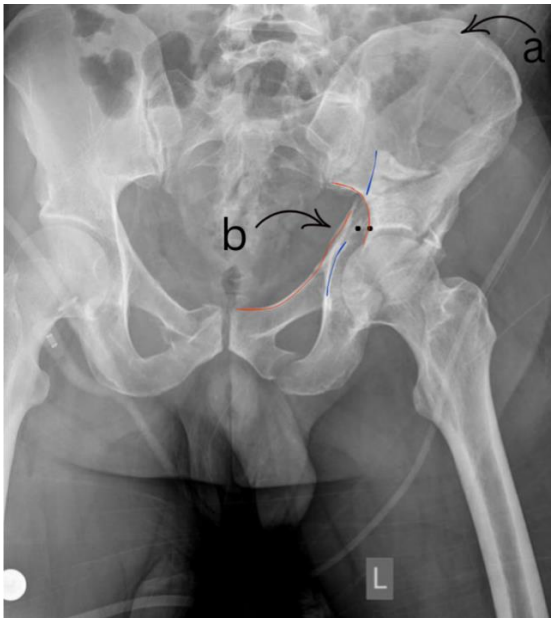

FIG. 1. **Preoperative anteroposterior x-ray view demonstrating a high ACPHT fracture with PW fracture. The disruption of the iliopectineal (blue line) and the ilioischial (red line) lines at their confluence is noted with black dots. The cranial extent of the fracture exits the iliac crest (a), but there are multiple fragment lines in the ilium due to comminution. There is a displacement of the posterior column (b).**

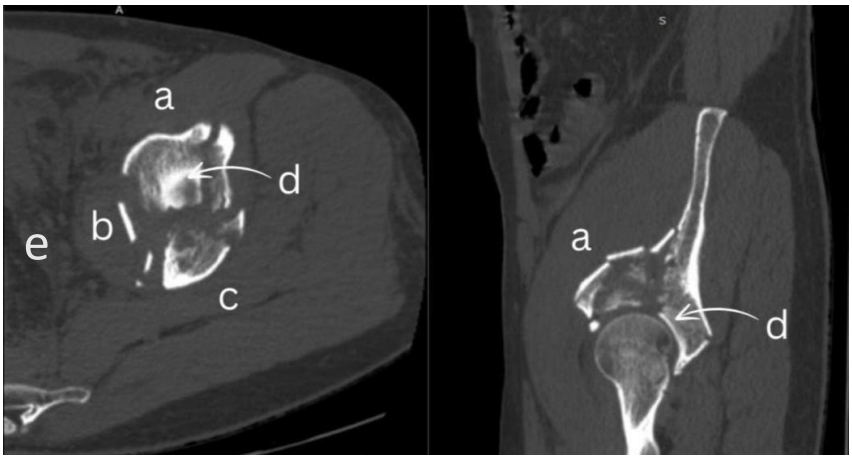

FIG. 2. **Preoperative CT scan axial (left) and coronal (right) images showing an anterior column posterior hemitransverse fracture with posterior wall fracture. There is an anterior column fracture (fragment a). The displaced quadrilateral surface is presented by fragment (b). The posterior hemitransverse fracture follows an oblique vertical orientation and there is a small posterior column fragment (fragment c). Moreover, there is a segment of the acetabular roof remaining intact with the uninjured innominate bone (d). A fragment of the acetabular lateral roof (e).**

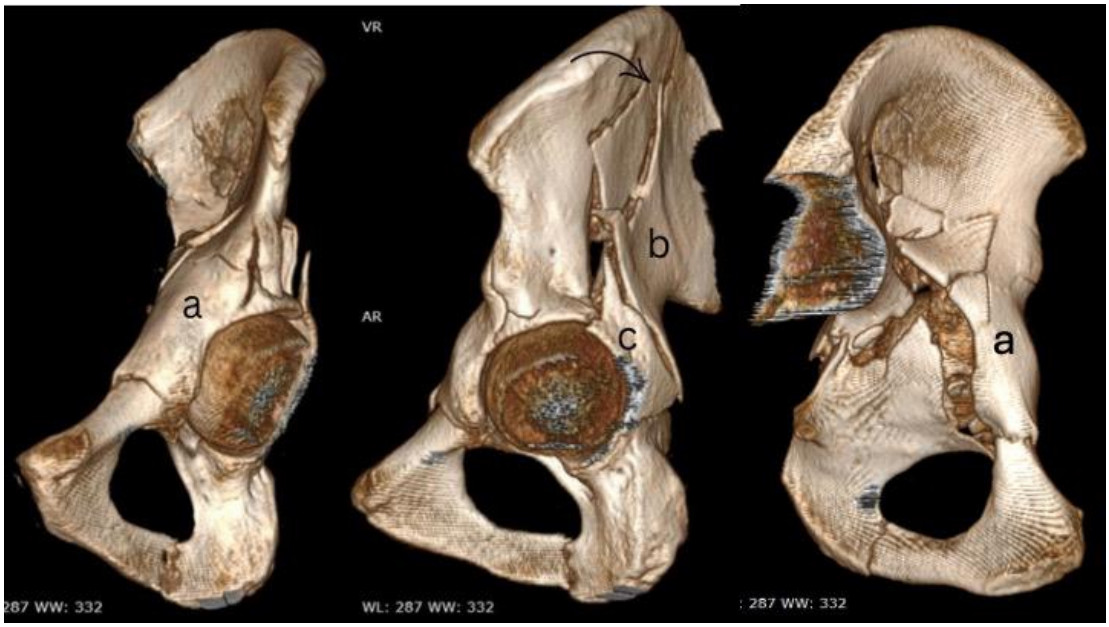

FIG. 3. **Preoperative CT scan 3D reconstruction showing the anterior column fracture (fragment a), with extends as a posterior hemitransverse fracture, having a segment of the roof remaining intact with the iliac bone (fragment b). There is also a fracture line through the posterior wall that results in a separated posterior wall fragment (c).**

Under general anesthesia, the patient was placed in supine position, and we performed an ilioinguinal-intrapelvic modified approach (FIG. 5), in order to reduce the fracture under direct visualization. We reduced the anterior column fracture and the Qp fracture, using the buttress effect of the suprapectineal plate (PRO - Pelvic Reconstruction Orthopedics, Stryker, Selzach, Switzerland).

Due to the comminution of the posterior wall fragment, the patient was turned in lateral decubitus position and we performed a Kocher Langenbeck approach. The posterior column was fixed rigidly (FIG. 6 and 7) with an 8-hole reconstruction plate (Matta Pelvic System - MPS Curved R88 Plate, Stryker, Selzach, Switzerland) and two spring plates (MPS Straight Plate, Stryker, Selzach, Switzerland) were used to stabilize the posterior wall fragment.

FIG. 4a. **Preoperative CT scan 3D reconstruction depicting in detail the anterior column with the displaced quadrilateral plate, and a minor central dislocation of the head. 4b. showing displacement of the Qp as a whole piece with the posterior column. Thus, we consider that this fracture is closer to the characteristics of anterior column posterior hemitransverse fracture than to the two-column fracture type.**

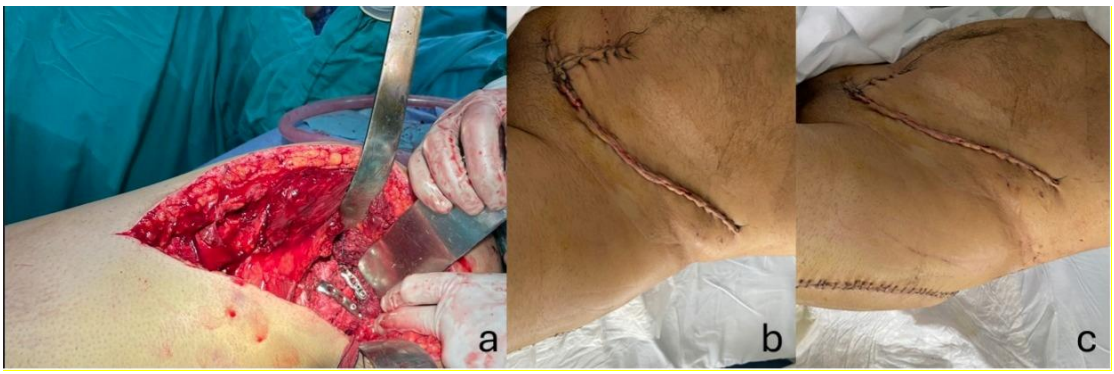

FIG. 5a. **Intraoperative illustration of the two spring plates placed posteriorly to stabilize the posterior wall. 5b. Postoperatively, showing the incision of the ilioinguinal-intrapelvic modified approach. Notice the vertical limp of the anterior intrapelvic approach or Stoppa approach. 5c. Postoperatively, illustrating the two incisions of the ilioinguinal-intrapelvic modified approach and the lateral one of the Kocher-Langenbeck approach.**

At the 1st year postoperatively, he was walking without walking aid, but he had poor Harris Hip Score (HHS=60), good Merle d' Aubigne and Postel score (MAP=12) and he reported pain 4 out of 10 based on Visual Analogue Scale (VAS). The x-rays of the patient immediately after surgery and at first year's follow up are demonstrated a screw pull out, which did not affect the stability of the osteosynthesis (FIG. 6 and 7). At the last follow up, two years postoperatively, the patient reported a fall and started walking with cane. He had poor Harris Hip Score (HHS=54), good Merle d' Aubigne and Postel score (MAP=12) and he reported pain 8 out of 10 based on VAS. The x-rays demonstrated flattening of femoral head, narrowing of joint head, indicating posttraumatic arthritis (FIG. 8).

FIG. 6. **X-rays immediately postoperatively. The reduction with a suprapectineal plate (Stryker, Selzach, Switzerland), an 8-hole reconstruction plate (Curbed R88, Stryker, Selzach, Switzerland) and two spring plates (Stryker, Selzach, Switzerland) is demonstrated.**

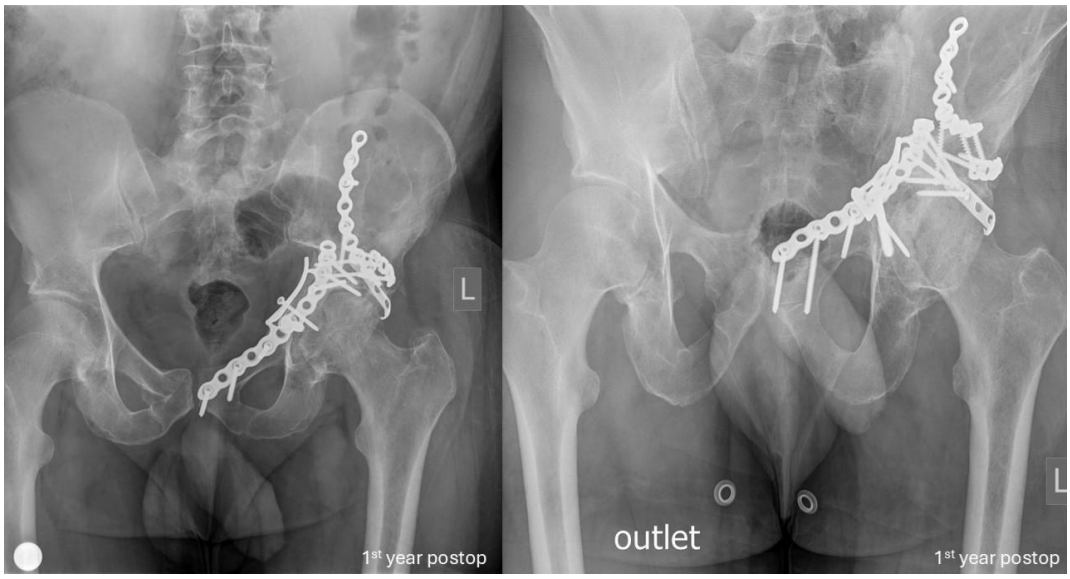

FIG. 7. **X-rays at 1 year postoperatively. A screw pull out is observed.**

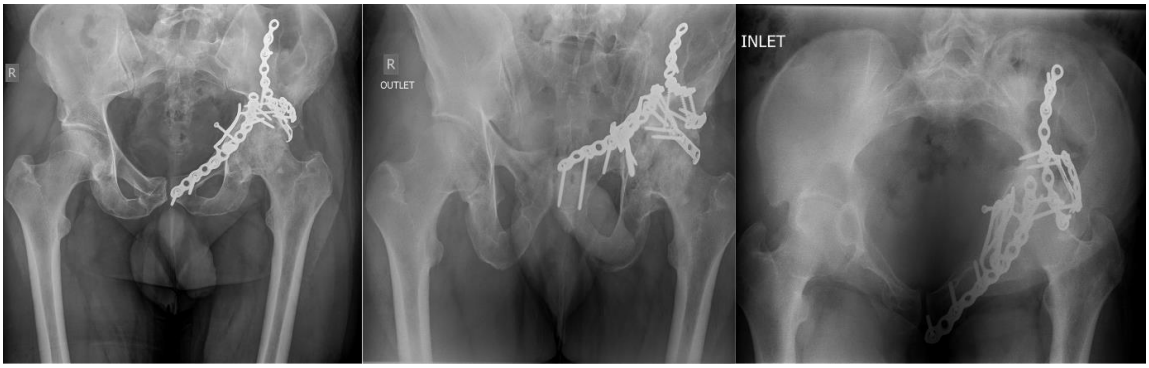

FIG. 8. **X-rays at last follow up (2 years postoperatively). Flattening of the femoral head and narrowing of the joint space are revealed, indicating posttraumatic arthritis.**

3. Discussion

According to the Judet–Letournel classification, this fracture could be included in the type of ACPHT fractures, due to the transverse component of the fracture which crosses the acetabulum and the posterior column as a whole system. In our case, the posterior hemitransverse fracture followed an oblique sagittal orientation. Moreover, the femoral head was medially subluxated. In our case, there is an odd parameter which was the involvement of the posterior wall, which is usually not described in these types of fracture [2].

The purpose of the fracture classification systems was to provide a reasonable assessment of injury severity and enhance communication among colleagues to manage appropriately the patient preoperatively, intraoperatively and postoperatively [1,16]. Surgeons should keep in mind that the interobserver agreement ranges from 0.5 to 0.7 [16-19]. There are a few reports in the literature on unclassified fracture types using the Judet-Letournel classification, due to isolated quadrilateral fractures, isolated roof column fractures, or combinations of associated fractures with anterior wall, posterior wall and roof column fractures [5,20]. Managing these unclassified fractures is challenging, thus surgeons assess them with various surgical approaches and techniques [21].

Some biomechanical studies support that the double-column fixation with plates is more rigid, but do not oppose the single-column fixation approach with plate and lag screw [22,23]. The exit point of the anterior column fracture, with the extent of completeness and comminution, are key factors influencing the choice of approach and fixation strategy. For ACPHT fracture, as an unstable, incomplete anterior column fracture with lower exit point could be reduced and repaired through an isolated anterior intrapelvic approach, a combination of Stoppa with ilioinguinal approach, which may not be enough in the case of a more extended, complete and comminuted fracture [24]. It should be noted that the supratectal exit point may compromise the stability of the hip [2]. Due to severe comminution of ilium and the complete hemitransverse fracture in the presented case, we decided to visualize and assess the fracture with both anterior intrapelvic approach and Kocher Langenbeck approach.

As an initial approach, we utilized the anterior intrapelvic approach-ilioinguinal modification. We believed, that by reducing the Qp onto the anterior column, the posterior column would follow the Qp as whole system, and thus the posterior column would be reducted indirect, in a good position simultaneously. Unfortunately, the Qp fragment acted as a “hinge”, being stuck

deep in the pelvis, and we could not pull it anteriorly onto the anterior column. All in all, the anatomic reduction of the quadrilateral plate was impossible from the anterior exposure.

Even more, with the use of the collinear clamp or with the use of asymmetrical forceps through the second window of the ilioinguinal approach, the precise reduction was impossible. The quadrilateral plate with the posterior column remained unmovable, unreducible. We believe that this "phenomenon" happened, because the displaced of the Qp and posterior column as a whole system, needed huge power for reduction, for coming upwards to the optimum position. It is unfeasible to apply to the bone this enormous power for succeeded the optimum reduction. Then to address this issue and provide rigid fixation, we decided to performed a Kocher Langenbeck approach in order to reduce the posterior column and the Qp from behind and buttress the posterior wall fragment. Unfortunately, the anatomical reduction of the posterior column and quadrilateral plate and moreover of the posterior wall fragment was not feasible, due to the rigid fixation of the Qp with the anatomical suprapectineal plate which had been performed as first choice of approaching.

Anatomical reduction and firm internal fixation are the main actions to achieve a good outcome in acetabular fractures [21]. Single-center study indicated that 12%-45% of patients with acetabular fractures treated with open reduction and internal fixation eventually required at least one secondary surgical procedure that compromises the repaired native acetabulum [25]. In addition, the success rate for anatomical reduction even in the most expert centers, was no higher than 60% [11]. Evaluating the postoperative functional outcome and the early posttraumatic arthritis, we will probably change our strategy to the future in order to reduce the posterior fragment through K-L approach, before stabilizing the anterior column and quadrilateral plate from anterior approach. It is recommended to remember the general rule existing among the pelvic surgeons which is: "reduce from posterior to anterior and from upward to downwards".

Understanding of the variability of acetabular fractures is crucial for both clinical applications and research. We recommend evaluating the fracture by simplifying the fragments. The classifications are essential for comprehending the pelvis as a system, providing stability to the upper body, particularly during the initial steps of a novice pelvic trauma surgeon. The details of each fragment are critical to the decision-making process, of both approach and fixation and influences the postoperative outcomes.

4. Authors Contributions

Design of the study: K.S., I.P., F.N.; data collection: K.S., A.K., E.Z.; data analysis and interpretation: K.A., A.K., I.P.; drafting of manuscript: K.S., E.Z., F.N.; revision of the manuscript: I.P., F.N. All authors have read and agreed to the published version of the manuscript.

5. Institutional Review Board Statement

This study was approved by the Institutional Review Board of General Hospital of Piraeus "Tzaneio" with No. 8194/03-06-2024.

6. Informed Consent Statement

The patient was informed that data concerning the case would be submitted for publication, and he provided written consent.

7. Conflicts of Interest

The authors declare no conflict of interest.

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