

# FRACTURES OF PELVIS: REVISION

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## 1- ANATOMY OF THE PELVIS HUMAN.

The pelvic ring was formed by the two iliac bones and the sacrum, which are joined posteriorly through the sacroiliac joints and anteriorly in the symphysis pubic, that you allow low burden a mobility very limited.

Both bones iliacus they are formed by the Union of the ischium, the ilium and the pubis to through of the cartilage triradiated. In the part external of the bone iliac HE finds the acetabulum

biomechanically the weight of the body from the column vertebral (fifth vertebra lumbar) is transferred until the three superior segments of the sacrum, going through the sacroiliac joints to the iliac bone and finally transferring towards the acetabulum standing and to the tuberosities ischiotic sitting. Therefore, most of the load is transmitted by the structures posterior of the ring, being its correct integrity clue to the time to evaluate the stability pelvic

The bony pelvis is by itself unstable, getting its stability through a powerful complex ligamentary that holds her, So as multiple muscles that exercise your action in the floor pelvic. The ligaments more important are:

- keeping the stability former the ligaments of the symphysis pubic, keys for the support of the stability rotational.
- keeping the stability later:
  - sacrospinous ligaments and sacrotuberous, which maintain the stability rotational and secondarily the stability axial.
  - ligaments sacroiliacs: anterior, middle and posterior (shape the ligament of Grant, the more powerful of all the here present and the most resistant of the whole organism human). are the key ligaments in maintenance of stability axial, especially the ligament of Grant.
  - fascia lumbar.

The main function of the pelvis will therefore be to support and transmit the axial burden of the body, although its importance also lies in the

protection of multiple viscera contained in the abdomen lower (straight, bladder and Uterus in women) and of structures neurovascular, to know:

Items vascular: arteries as the artery iliac internal and their branches, the gluteal arteries or the Sphincter. At the venous level we find the plexus venous foreshadowing (cause of the bleeding in the 40% of the fractures pelvis) and plexuses venous around of the joints sacroiliac and symphysis pubic.

At this point it is important name existence of the corona mortis, an anatomical variation related to the anastomosis between the obturator artery (branch of the artery iliac internal) and the artery epigastic lower (branch of the iliac external), through a space that HE arch by on and by behind of the bouquet superior of the pubis. This disturbance can give yourself also between the veins of the same name. Can meet according to series until in the 80% of the specimens studied, and its importance clinical is that fractures at the level of the branches pubic they can cause a hemorrhage massive extraperitoneal hardly containable.

Nervous elements: lumbosacral plexus. subsequent lesions of the pelvis can damage nerves such as the femoral, sciatic or branches of S1 and S2, whose correct integrity has to be explored

- o Lumbar plexus (innervation of the extremities lower bilaterally).
- o Plexus sacrum (innervation of the zone perineal).

## 2- INCIDENCE.

The injuries pelvis are bit frequent in comparison with others fractures, representing 3% of all of them. Of these, only 12% were fractures unstable. This incidence increases in patients polytraumatized, meeting according to series in up to 42% of autopsied patients after suffer a accident of trophic mortal.

Of shape isolated associate a twenty% of mortality, but when they associate to head and thoracoabdominal trauma (relatively common in patients polytraumatized), mortality can rise until 90%. Is by this what a injury pelvic is a indicator of gravity in trauma, both for the associated injuries as for the possible injuries neurovascular of the structures pelvic

The leading cause of death in these patients it will be the hemorrhage, being the major complication associated to fracture pelvic. The bleeding in these patients proceeded in 40% fragments bleeding bones (stroke of fractured, a 40% of plexus venous foreshadowing and a twenty% of injury arterial direct. Therefore, our goal when treating a fracture of this nature will be always in first place safeguard the life of our patient.

### 3- MECHANISM OF ACTION.

Know the mechanism that has produced fracture, so as the kind of accident, direction and the magnitude of the force involved is the key for classify and appreciate the gravity of the patient. Of this shape, will exist:

fractures produced by a mechanism of low energy, being typical accidental falls in patients seniors and the fractures by muscle avulsion inserted in apophysis in patients with skeleton immature (typical of athletes young), in which the tuberosities are mainly injured ischiotic and the Thorn iliac anterosuperior. Frequently are fractures of bones isolated that do not affect to the integrity of the pelvic ring in his set.

by mechanisms high energy, that usually associates injuries vascular and visceral. Are those produced in accidents of trophic, outrages, precipitation or crushing, among others. In this case, generally two or more fractures are associated in the pelvic ring, being able to also get injured others structures bony.

### 4- ASSESSMENT CLINIC AND DIAGNOSIS.

in a patient polytraumatized, a more serious situation to which we can face, evaluation diagnostic initial begins with the ATLS system, being necessary continue a algorithm diagnostic-therapeutic of control of damage for decrease to the maximum the life risk of the patient.

once discarded the doom imminent, we will move on to inspection, searching injuries that demonstrate possible fracture of the bones pelvis (ecchymosis, abrasions or bruises, injuries by detachment of Morel-Lavallée, blood at urethral meatus (indicates section of urethra and determines the need of probing suprapubic) or in straight (can indicate bleeding pelvic by false way to the straight), wounds, dysmetria of MMII...) So as

deficits neurological associates that must discard in are first phases of the process exploratory.

In the evaluation secondary pelvis HE study through the palpation, pressing both crests iliac and each side of the pelvis, applying after pressure in internal, anteroposterior and superior inferior rotation, being distraction maneuvers contraindicated of the pelvis or examination repetitive of stability, by power exacerbate bleeding. Is considered abnormal and sign of instability pelvic all that movement No conjugate of the same, that is, difference in the movement of one hemipelvis regard to other.

Once suspected the fracture pelvic through the maneuvers exploratory, we will place a pelvic strap or a sheet in the emergency box for minimize inherent damage to the fracture. The next essential step for him definitive diagnosis and classification of the fracture, will be the tests iconographic, to know:

1. Bone scan conventional: are necessary three projections:
  - a. Projection anteroposterior of the pelvis as the first passed, including from the fifth vertebra lumbar until he trochoter elderly of both femurs. Although it gives us information rude on anatomy and architecture of the injury, it will not be enough for grasp he streak of fracture.
  - b. projection of input/ top (INLETj: first exploration complementary, with inclination lower of  $60^{\circ}$  of the beam. Useful to determine stability horizontal, showing the symphysis pubis and the previous offset or posterior of the sacroiliac joints, So as the address of the displacement rotational.
  - c. Projection departure/ lower (OUTLET): exploration complementary, in this case with inclination higher than  $45^{\circ}$  of the beam, shows the instability vertical when displaying the displacement of the sacroiliac in he same axis.
  - d. Bone scan of profile of sacrum: useful for assess fractures of sacrum unnoticed, as the fracture in h sacral (that produces dissociation spinopelvic) and fractures in the branches iliosacral. This exploration radiographic is fundamental, already that Yeah we diagnose a fracture of this nature we will need for his treatment No only instrumentation pelvic, Yeah not spinopelvic.

There are also radiological signs which may indicate pelvic injury indirectly, being fundamental recognize them for avoid failures diagnoses. The most important are avulsion of the transverse processes of the vertebra L5, fractures of the four branches either fracture "in butterfly", diostasis

of the symphysis pubis greater than 2.5 cm or from the sacroiliac joints of more than 5 mm.

2. Tomography computerized: gave the diagnosis definitive to be the proof what else information gives, by it that always will be necessary although requires of certain stability hemodynamics for his realization, by it that in occasions No could carry off to cape of shape urgent. Useful for the study of the part later of the ring pelvic, diastasis that demonstrate secondarily ligamentous injuries, bleeding through extravasation of the contrast, and as aid in the planning preoperative

3. MRI nuclear (jNMR has not shown improvements significant in its diagnosis, being also a problem added the existence of fixatives (which produce artifacts on MRI) and the possible instability clinic of the patients, that contraindicates the MRI.

4. In unstable situation hemodynamic function and imminent risk of hemorrhagic shock, ecofast can give information quick about the bleeding, leaving the rest of the explorations for a second time, when let's reach the stability hemodynamics.

## 5- CLASSIFICATION.

TO weigh of that exist plenty of classifications of fractures pelvis, today in day HE use preferably two guys of classification by his utility and speed in the diagnosis:

1. Classification from Tile: more used, group the fractures basing in stability horizontal and vertical pelvic ring (classification anatomoclinical). The forecast gets worse to extent increases the degree.

a. TYPE A: STABLE. Affection I mean no break or injury clear of the complex ligamentous.

i. A1: No affect to the ring. Avulsions of thorns iliac either tuberosity hamstring

ii. A2: minimum and stable that affect to the ring, usually without displacement (in this guy this included the

fracture simple of branches pubic of the old man, the more frequent of all).

iii. Some authors consider also the existence of a degree A3, that HE corresponds to fractures of sacrum isolated (branches osacral).

b. TYPE B: rotationally unstable. vertically stable. Affectation partial of structures later of the ring.

i. B1: fracture in open book (compression anteroposterior), with rotation external hemipelvis affected and partial breakage of complex ligamentary.

- B1.1: diastosis of symphysis pubic of <2.5 cm without injury of items later.

- B1.2: diastosis of >2.5 cm with injury partial of items later of the pelvis.

- B1.3: diastosis of >2.5 cm with injury bilateral partial of items later.

ii. B2: by compression side ipsilateral. Hemipelvis it affects in rotation internal.

ii. B3: by compression side contralateral. Bilateral.

c. GUY C: rotational and vertically unstable. Affectation complete of the items later of the pelvis.

i. C1: rotational and vertically unstable. Unilateral.

ii. **C2: bilateral**

iii. C3: affectation associate of the cotyle

2. Classification of Young and Burgess, more useful for the assessment urgent of the fractures, according to the vector of the force that produces the disruption the degree of displacement originated (based in its mechanism of production and criteria radiographic).

a. compression fractures AP: those in which the vector of force arrives through the tuberosities ischiotic from \_ extremities lower, provoking a fracture in book open.

b. By compression side: collapse pelvic by a force applied sideways that shortens the ligaments, submitting them to a

mechanism of shearing. The pattern of fracture will consist in a fracture transverse of to the less a of the branches pubic. United to this injury, they alter the items later of the pelvis.

c. By shearing: when pelvis suffers a force longitudinal, as in a patient precipitate either crushed. Exists disconnection complete between the sacrum and the pelvis, usually associated with ascroll to posterocranial or posterocausal given the anatomy of the ring pelvic.

d. to this classification we must add the possibility of fracture by mechanisms combined,

The main utility of these classifications is that they manage to divide the types of fracture in fractures stable or unstable, this division being very important in the decision therapy later:

fractures guy TO of tile: completely stable.

fractures Tile type B: vertically stable but unstable rotationally.

Tile Type C Fractures : Unstable both upright and rotationally.

## 6- TREATMENT.

early stabilization of these fractures have demonstrated reduce the bleeding, decrease the answer inflammatory sharp, So as decrease he pain and he request of analgesia and care of Nursing, getting a wandering more early and a reduction of morbidity and mortality. Is by it what a correct treatment and the urgency with which it is carried out serón keys in he forecast of our patients.

In he treatment of the fractures of pelvis have different options:

systems of compression pneumatic (sheet either belt pelvic) and pelvic harness: can be used for a maximum of 24 hours, since they present like effects main adverse the risk of compartment syndrome and necrosis I mean.

Fixation external (fixers previous and c-clamp later).

Urgent rescue measures, such as embolization through angiography, packaging or packing pelvic (especially useful in the bleeding of origin venous) and the occlusion arterial. Pannier out zadas as latestlines when we meet before a patient who is hemorrhaging incoercible with techniques more accessible.

Fixation internal, almost never raised in the first phases of treatment, being the treatment definitive in many cases but reserving for one second time therapeutic.

Traction.

Conservative (based on pain management, rest for control from pain and wandering early with rehabilitation).

To select the treatment more suitable we should kiss in the clinical situation of the patient. This way we will meet before three ~~but~~ scenarios, in which the therapeutic choice it will be therefore different and adequate to the same.

First of all we can meet before a patient with pelvis mechanically unstable that also it's found in situation of hemodynamic instability. In these cases the fracture is usually accompanied of injuries added, as trauma cranioencephalic, injuries in chest either abdomen, urological either of bones long, by it that it will be followed a protocol of control of damage in which decisions must be taken in the first 30 min post arrival at the emergency room. Its purpose is to determine the need of surgical treatment immediately in case of bleeding massive external or flattening with risk imminent for the life of the patient. in the rest of cases, patients are subjected to evaluation previous diagnosis (that includes bone scan of pelvis although No CT of shape urgent). Yeah HE maintains the situation of hemodynamic instability, It has to be done ring stabilization pelvic immediate, already be through a belt pelvic either a fixative external, it that usually be enough for reduce the amount of blood lost since this procedure avoid movement of the bone fragments, prevents dislodgement of hemostatic clots, compresses bleeding bone surfaces and decreases blood loss hemotic. Yeah instability remains 10-15 min after application of these measures, we must resort to hemostasis techniques surgical, such as tamponade pelvic, packed (Useful in venous bleeding) or definitive surgery, being techniques rescue angiography or embolization of glasses bleeding (only he 10% of the indented are due to injury arterial).

the second situation it will be that patient hemodynamically stable than also presents a fracture of pelvis mechanically stable, being this the most frequent situation (about 85-90% of fractures pelvics). This kind of fracture corresponded with a files guy TO. In they he treatment is



conservative, through analgesia, initial rest for pain control and wandering with rehabilitation early. No usually require surgery except infew exceptions, as open, displaced fractures of branches leftpubic either avulsions in athletes of elite.

Finally we meet before that patient stable hemodynamically with a fracture unstable pelvis . These correspond to Tile B and Tile C types. Ideally, the treatment final in these cases has to complete before of the 14 days post fracture, avoiding So issues as the absence of consolidation or consolidation vicious. The treatment surgical by osteosynthesis internally, it should not be done in the first four days after the injury for avoid incurring in he freak of second hit" in which surgery could exacerbate the basal damage of the patient. Different subtypes of fractures required different choices therapeutic:

-B1 :

or B1.1 (symphysis <2cm): repose.

or Symphysis >2cm: fixative external 8 weeks, plate former either two screws cannulated crusaders.

B2: conservative. in heavily displaced may need to reduce by via former and place a plate.

B3: generally he complex later (sacrum) this compressed: in these cases No is accurate the stabilization later, Yeah good has to reduce the pelvic ring circumference . Separation of it up to 1.5 cm can be acceptable.

Yeah the separation is of 1 cm or exists a deformity big the reduction HE will do with a fixative external either plate in symphysis pubic (No usually require stabilization later).

C: fixative external with or without traction and reduction open and osteosynthesis deferred, with double plate in it pubis by via former and screws either plates between ridges iliac by via later.

## 7- FIXERS EXTERNAL.

The goals persecuted with the placement of a fixative external pannier the following:

1. Avoid he motion of the fragments bony.
2. favors the stabilization of the clots hemostatics
3. compress the surfaces bony bleeding
4. decreases he volume global (continentj).

In order to achieve these objectives, the indications main of theplacement of the themselves pannier the following:

1. Temporary stabilization of fractures UNSTABLE pelvics in patients hemodynamically unstable in phase of resuscitation.
2. Stabilization of fractures UNSTABLE in patients polytraumatized for control of the pain and allow mobilization early
3. Stabilization relative of fractures unstable rotationally andstable vertically (Tile B) no need of ORIF later.
4. Treatment of instability of fractures of the ring pelvic previous in tiles guy C. WITH ORIF later.
5. fractures of pelvis associates to injury abdominal, of bladder either ofparts soft.

This class of device No will be useful in the stabilization of fractures of pelvis that provoke instability later or upright (Tile type Cj by way of isolated.

exist mostly two guys main of fixers, to know:

Fixers route type short, in which two pins (nails of Schanz) They are placed in a supraacetabular position one centimeter below and internal to the Thorn iliac anteroinferior in address to the notch sciotic elderly. Both pins HE union through a bar forming a frame pelvic. Thesecure better the stability rotational, by it that are the more used in emergencies. Allow the insertion in a bone more robust presenting minor incidence cutout, although its placement entails elderly difficulty by location anatomical.

Fixers guy route long, with one, two either three pins situated in each crest iliac of cepholic to flow, getting high he first two fingers

by on of the Thorn iliac anterosuperior. His insertion is more simple anatomically, although he bone in he that HE anchor is more weak and by itHE shape a frame pelvic more unstable.

In the placement of both guys must have in account that the bars must leave space enough as for can carry out a intervention abdominal of urgency (Yeah is necessary laparotomy HE stoned in the zonelower abdomen and that they should not be placed on soft parts injured (high risk of infection and of failed of the stabilization).

## BIBLIOGRAPHY

papathanasopoulos TO, tzioupis c, Giannoudis v, Roberts c, Giannoudis Q. biomechanical aspects of pelvic ring reconstruction techniques: Evidencetoday. injury. 2010;41(12):1220-1227.

Toth L, King K, McGrath B, Balogh Z. Efficacy and security of emergency non-invasivepelvic ring stabilization. injury. 2012;43(8):1330-1334.

Croce M, Magnotti L, Savage S, Wood G, Fabian T. EmergentPelvicFixation in Patients with Exsanguinating Pelvic Fractures. journal of the American College of Surgeons. 2007;204(5j):935-939.

Queipo-de-Llano A, Perez-Blanca TO, ezquerro F, Luna-González F. simultaneously former and later compression of thepelvic ring with external fixation using a pre-tensed curved bar: A biomechanical study. injury. 2013;44(12):1787-1792.

of Pablo-Morquez B, Bailez-Arias A, Yela-Verdú C, Santano-Rivas b. Pelvis fracture, attention extrahospital. SEMERGEN - Medicine of Family. 2014;40(7):405-406.

Skitch Yes, Engels Q. Acute management of theTraumaticallyInjured Pelvis. Emergency Medicine Clinics of North America. 2018;36(1):161-179.

White T. Mackenzie Yes, Gray TO. McRae Traumatology. 3rd ed. Spain: elsevier Spain SLU: 2017.

Ruedi you, murphy W, Renner m, colton c, hiltbrand K. Beginning AO in he treatment of the fractures. Barcelona: Masson; 2003.

bucholz R, Heckmann J, rockwood c, Green d. Rockwood&Green's fractures in he adult. [Madrid]: MarbaDn; 2003.