Surgical management of pelvic ring injuries: a study of twelve cases

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ABSTRACT

The bony pelvic ring is constituted of the sacrum and bilateral innominate bones and stabilized by the sacroiliac, sacrospinous and sacro tuberous ligaments. Secondary stabilization is provided by the iliolumbar ligaments. Injury to the posterior ring structures brings more severe clinical instabilities. Assessment of mechanisms and mode of injuries is necessary for management of pelvic injury. Twelve patients were involved in this study of different kinds of injuries by classification and methods of treatment four patients were treated by anterior fixation. Three by posterior and three by anterior as well as posterior. One was by conservative means. Anterior includes symphysis plating, posterior includes intrapelvic plates as well as sacroiliac percutaneous screw fixation. Combined includes posterior plating and sacroiliac screw and external fixator anteriorly. All patients showed good results in terms of stability, union of fracture, relief of pain and movements. Two patients had some residual neurological deficit as foot drop. Pelvic ring injuries need a specialized approach for management and outcomes. Application of appropriate classification for management plays a significant role in outcomes.

Keywords: Pelvic ring injuries, Classification, Fixation methods, Sacral fractures

INTRODUCTION

Pelvis is a basin like structure that connects the spine to the lower limbs. Pelvis is formed by two innominate

bones joined by sacrum bone in centre posteriorly, so basically it's a ring like structure. Ring is strengthened by ligaments anteriorly by pubic symphysis comparatively weaker than stronger posterior sacroiliac ligaments. Pelvic ring is further supported by sacro tuberous ligaments. Pelvic stability depends upon the integrity of bones and ligaments of anterior and posterior joints. better understanding of the disruption of pelvic ring helps in the treatment of injuries.[1-3]

Present study involves different injuries to pelvic ring in different cases and treatment modalities, so to make decisions regarding fixation methods whether to go anterior fixation or posterior fixation or both one has to follow the classification system.

Classification of pelvic ring injuries

There are various systems for classification, these are the two most often used. Tile classification based on pelvic stability and useful for guiding pelvic reconstruction Young-Burgess classification it is based on mechanism and also indicates stability (I to III sub classification).[1-3]

Tile classification

Tile A- rotationally and vertically stable, pubic ramus fracture, iliac wing fracture. Pubic symphysis diastasis <2.5 cm. Tile B- rotationally unstable, vertically stable; B1: pubic symphysis diastasis >2.5 cm and widening of the sacroiliac joints (open book fracture due to external rotation forces on the hemi pelvises), B2: pubic symphysis overriding (internal rotation force on hemi pelvises tile, C: rotationally and vertically unstable, disruption of SI joints due to vertical shear forces; C1: unilateral, C2: bilateral, C3: involves acetabulum.[1]

Young-Burgess classification

The injury classification system was based on the vector of force involved and the quantification of disruption from that force, i.e., lateral compression, anteroposterior compression, vertical shear, and combined mechanical injury. Anteroposterior compression (APC) common feature is diastasis of the pubic symphysis or vertical fracture of the pubic rami APC I: pubic symphyseal diastasis, <2.5 cm, no significant posterior ring injury (stable) APC II: pubic symphyseal

diastasis >2.5 cm, tearing of anterior sacral ligaments (rotationally unstable, vertically stable) APC III: hemi pelvis separation with complete disruption of pubic symphysis and posterior ligament complexes (completely unstable) lateral compression (LC) common feature is a transverse fracture of the pubic rami LC I: posterior compression of sacroiliac (SI) joint without ligament disruption (stable) LC II: posterior SI ligament rupture, sacral crush injury or iliac wing fracture (rotationally unstable, vertically stable) LC III: LC II, with open book (APC) injury to contralateral pelvis (completely unstable) vertical shear injuries (VS) is common feature is a vertical fracture of the pubic rami displaced fractures of the anterior rami and posterior columns, including SI dislocation (completely unstable) combined mechanism (CM) fractures massive pelvic injuries that don't fit the other categories.[2,3]

CASE SERIES

Case 1

53 years old female h/o RTA with fracture sacroiliac joint right side with ipsilateral pubic rami fracture classified as tile C2y and bVS.

As sacrum was fractured with comminution was operated by anterior dual plating. She was advised bed rest for 8 weeks then weight bearing with support was allowed she did very well and at 5 years follow up doing very well.

Figure 1: (a) Pre-operative X-ray and (b) Post-operative X-ray.

Case 2

19 years old male having pubic symphysis disruption in caudal direction with undisplaced sacral fractures in right side. No associated urethral or bladder injuries reported classified as tile B2y and bLC1 was treated by symphysis plating before 6 years patient was allowed weight bearing with support at 6 weeks. He is doing did very well.

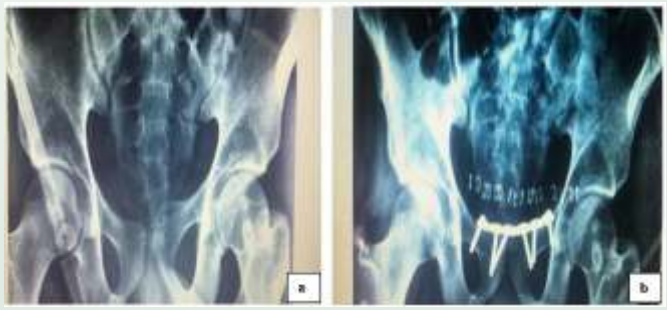

Figure 2: (a) Pre-operative X-ray and (b) Post-operative X-ray.

Case 3

25 years male with h/o RTA presented with open book injuries and wide separation of symphysis and sacroiliac joint left side. Pubic separation was operated by symphysis plating and left SI joint with posterior percutaneous screw fixation was classified a tile B2y and b APC 2 patient was allowed wight bearing after 8 weeks with support.

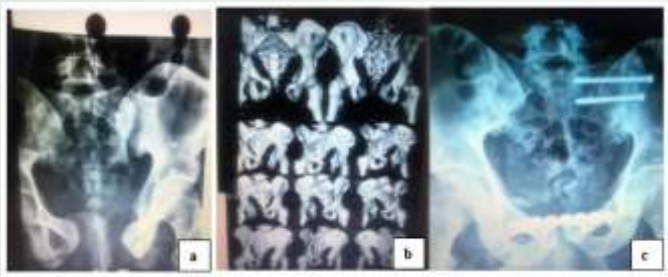

Figure 3: (a) Pre-operative X-ray, (b) pre-operative CT scan, and (c) post-operative X-ray.

Case 4

Tile c1-y and b-LC2

40 years male having road traffic accident operated by long plate across symphysis and left side iliac bone with additional plate and screw for symphysis separation and iliac bone fracture, 10 years following doing very well.

Figure 4: Post-operative X-ray.

Case 5

21 years old male reported to us after 2 weeks of accident with open infected perineal injury open book injury and urethral trauma was operated by external fixator and right-side percutaneous screw fixation for SI joint fixation classified as tile B1y and b APC2.

Figure 5: Post-operative X-ray.

Case 6

22 years old presented with segmental fracture of symphysis and rotation and separation was operated with overlapping plates across symphysis doing very well even after 4 years was classified as tile C2y and bAPC2CC's.

Figure 6: (a) Pre-operative X-ray, (b) pre-operative CT scan, (c) post-operative X-ray, (d) and (e) clinical photographs.

Case 7

Classified as tile c3 y and b APC3 LC2 VS

28 years old presented with open fracture pubic bone and symphysis separation and vertical separation of SI joint along with 2nd and 3rd right side sacrum fracture was operated by anterior plate of right SI joint and plate fixation of symphysis and anterior column of acetabular fracture patient developed foot drop injury postoperatively but recovered partly within 1½ years.

Figure 7: (a and b) Pre-operative CT scan, (c) post-operative X-ray, (d and e) clinical photographs.

Case 8

Classified as tile C2y and bAPC2. 30 years old male presented with polytrauma having fracture forearm bones, fracture wrist, open fracture tibia and fibula, and SI joint right side with vertical migration and pubic bone fracture same side was operated by percutaneous screw fixation of SI joint after recovery from fat embolism doing well even after.

Figure 8: Post-operative X-ray.

Figure 9: Post-operative X-ray.

Case 9

Classified as tile C3y and bAPC3 LC2 VS

30 years old male with uncontrolled diabetic and chronic alcoholic with RTA having potentially infected open injuries on right side of SI region area he has fracture sacrum and vertical shear fracture right SI joint and acetabulum anterior column. Operated by anterior plating of sacrum and anterior fixation of acetabular fracture. Patient had foot drop pre op and recovery was partial even after 3½ years after.

Case 10

19 years old male having RTA sustained symphysis diastasis and right sided fracture of pubic bone and un displaced sacrum was operated with plate for pubic symphysis and long cannulated screw for pubic bone. Classified as tile B1y and bAPC2.

Figure 10: (a) Pre-operative X-ray, (b) pre-operative CT scan, and (c) post-operative X-ray.

Case 11

Female 26 years fell down from 2nd story of a building sustained 4cms of symphysis diastasis on X-ray picture on CT scan. There was avulsion of ischial spine right side and ipsilateral vertical fracture of sacral body which is undisplaced classification wise it was tile B1, young and burgess APC.

Was operated with symphysis plate and fractured sacrum treated with bed rest she allowed with pelvic exercises in bed and weight bearing after 8 weeks.

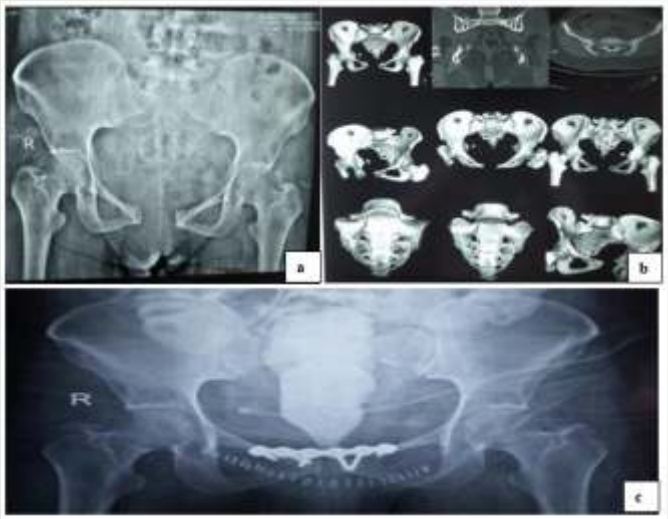

Figure 11: (a) Pre-operative X-ray, (b) pre-operative CT scan, and (c) post-operative X-ray.

Case 12

16 years male met with a road traffic accident presented in hypovolemic shock. X-ray pelvis showed bilateral pubic rami fracture with right sided comminution of fracture fragments urinary catheter showed haematuria. Laparotomy was done and anterior wall of urinary bladder was repaired. Bone fragments was piercing to bladder wall packing was done. Next day angiography was done to see the active source of bleeding. Embolization of anterior branch of the internal iliac artery done post-operative blood transfusion was done. Classification wise it was tile-1 Young and Burgess was lateral compression. Fracture was treated conservatively.

Minimal displacement in X-ray pelvis but can be a fatal visceral and vascular injury may take place.

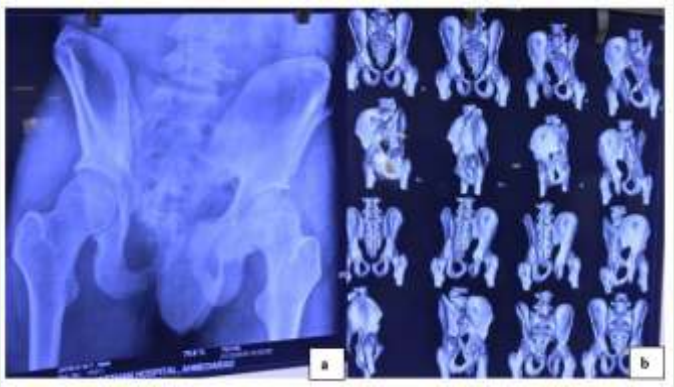

Figure 12: (a) Pre-operative X-ray and (b) pre-operative CT scan.

DISCUSSION

Pelvic ring injuries are not uncommon now a days whether it is part of Polytrauma due to road traffic accident, fall from a height or crush injuries. In elderly patients, nondisplaced or minimally displaced pelvic ring injuries may also result from low-energy trauma or falls and are distinct from displaced fractures secondary to high-energy trauma.[4,5] Typically, these injuries are not life threatening and often heal without intervention. Thus, displaced pelvic ring injuries are a marker for high-energy trauma and are often associated with other life-threatening injuries. A systematic approach with rapid and accurate identification of injuries and prompt intervention is critical in the initial treatment of patients with pelvic fractures.[6,7] Although the anterior structures, the symphysis pubis and the pubic rami, contribute approximately 40% to the stiffness of the pelvis, clinical and biomechanical studies have shown that the posterior sacroiliac complex is more important to pelvic-ring stability classifying these injuries according to their mechanism and instabilities occurred provide outcome. Another classification system which includes the hemodynamic status, impaired anatomical function and associated organ injuries is in practice now a days. Better known as WSES classification. The classification considers the Young-Burgees classification, the hemodynamic status and the associated lesions. Minor pelvic injuries WSES grade I (should be formatted in bold and cursive as the other grade of classification) includes APC I, LC I hemodynamically stable pelvic ring injuries. Moderate pelvic injuries WSES grade II includes APC II-III and LC II-III hemodynamically stable pelvic ring injuries WSES grade III includes VS and CM hemodynamically stable pelvic ring injuries. Severe pelvic injuries WSES grade IV includes any hemodynamically unstable pelvic ring injuries.[8]

In this series of twelve cases treated in last ten years showed excellent results in nine cases in terms of stability and neurological complications. One case 7 showed residual foot drop without shortening. In another case 9 resulted in shortening and residual foot drop as patient had sacral fracture and vertical shear and migration. Due to

open and potentially infected injuries on posterior aspect it was not possible to operate posteriorly. Six out of twelve were in anteroposterior compression injuries category treated with anterior symphyseal plates or posterior sacroiliac joint fixation with screws. One case was fixed with external fixator and posterior SI joint screw fixation as it presented late with perineal infected injuries two cases were of lateral compression type operated posterior SI joint screw fixation with in one case and anterior dual plating across SI joint as sacrum had comminuted fracture. Gray et al showed the similar results as ours.[9] The pelvic ring fracture was classified as stable in 54.8% (type A injury), as rotationally unstable in 24.7% (type B injury), and as unstable in translation in 20.5% (type C injury). The overall rate of operative stabilizations was 21.6%. Type B injuries were stabilized in 28.9% and type C injuries in 46.7%.[10]

CONCLUSION

The orthopedic surgeon dealing with pelvic fractures is to determine the causative forces and their underlying biomechanical implications management and overall prognosis depends on understanding of the above factors.[4] An understanding of the Young and Burgess classification system enables clinicians to better understand pelvic ring injuries, detection of potentially critical associated musculoskeletal and visceral injuries.[5] Early and judicious fixation of fracture leads to better results. Sacral fractures represent a special problem for the surgeon because of the frequency of fair results in which neurologic lesions whose pathophysiology is poorly known seem to be responsible.[6] Any classification system must therefore be seen only as a general guide to treatment. The management of each patient requires careful, individualized decision making.

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REFERENCES

1. Tile M. Acute pelvic fractures I, Causation and classification. J Am Acad Orthop Surg. 1996;4:143-51
2. Alton TB, Gee AO. Classifications in brief: Young and Burgess classification

of pelvic ring injuries. Clin Orthop Relat Res. 2014;472:2338-42.

3. Burgess AR, Eastridge BJ, Young JW. Pelvic ring disruptions: effective classification system and treatment protocols. J Trauma. 1990;30:848-56.
4. Denis F, Davis S, Comfort T. Sacral fractures: an important problem. Retrospective analysis of 236 cases. Clin Orthop Relat Res. 1988; 227:67-81.
5. Dujardin FH. Long-term functional prognosis of posterior injuries in high-energy pelvic disruption. J Orthop Trauma. 1998;12(8):592-3.
6. Durrant JJ, Ramasamy A, Salmon M S. Pelvic fracture-related urethral and bladder injury. J Roy Army Med Corps. 2013;159:32-9.
7. Gibbons KJ, Soloniuk DS, Razack N. Neurological injury and patterns of sacral fractions ures. J Neurosurg. 1990; 72:889-93.
8. Cocolini F, Stahel FP, Mintori G, Bifi W, Honor MT, Catena F, et al. Pelvic trauma: WSES classification and guidelines. World J Emergency Surg. 2017;12:5.
9. Gray A, Chandler H, Sabri O. Pelvic ring injuries: classification and treatment: pelvic and acetabular trauma. 2018; 32(2):80-90.
10. Gansslen A, Pohlemann T, Paul C, Lobenhoffer P, Tscherne H. Epidemiology of pelvic ring injuries. Injury. 1999; 27(1):13-20.

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