

## Case Report

# Bilateral crescent fracture-dislocation of the sacroiliac joint: a case-based discussion and review of literature

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**Abstract:** Background: Crescent fractures are a subset of lateral compression injuries associated with high energy trauma and are rotationally unstable. These fractures are rare bilaterally, and we present one such rare case of a bilateral crescent fracture. Case description: A 56-year-old male presented with run-over injury and was diagnosed with bilateral crescent fracture-dislocation of the Sacroiliac joint. He was stabilized hemodynamically and then operated with iliosacral screws and reconstruction plates. The fracture united, and the patient is doing his daily activities without discomfort at follow up of 1 year after fracture fixation. Conclusion: Bilateral pelvic crescent fractures are rare and need optimization and fixation for improved functional outcomes. It is necessary to evaluate associated injuries.

**Keywords:** Bilateral crescent fracture, lateral compression injury, sacroiliac joint, day classification, majeed score

## Introduction

Lateral compression (LC) fractures account for more than 50% of all pelvic injuries and most commonly occur due to impact from the sides of the body [1]. Crescent fractures are a subset of LC injuries of the pelvic ring, defined as fracture-dislocation of the Sacroiliac joint with variable disruption of the sacroiliac ligament complex, extending proximally as the fracture of the iliac crest. The crescent segment remains attached to the sacrum by the intact posterior ligamentous complex [2, 3]. These are usually high-velocity injuries associated with fractures of the pubic rami or pubic diastasis. Such injuries also occur in patients who have osteopenia and suffer low-velocity injury. These injuries are rotationally unstable but are sometimes associated with vertical displacement. Intact sacrotuberous and sacrospinous ligaments in such injuries prevent vertical displacement [4].

These fractures were classified by Day et al. [5] into three subtypes based on the extent of sacroiliac joint involvement for facilitating surgical approach and technique. Operative intervention is the preferred mode of management with the use of iliosacral screws and plates.

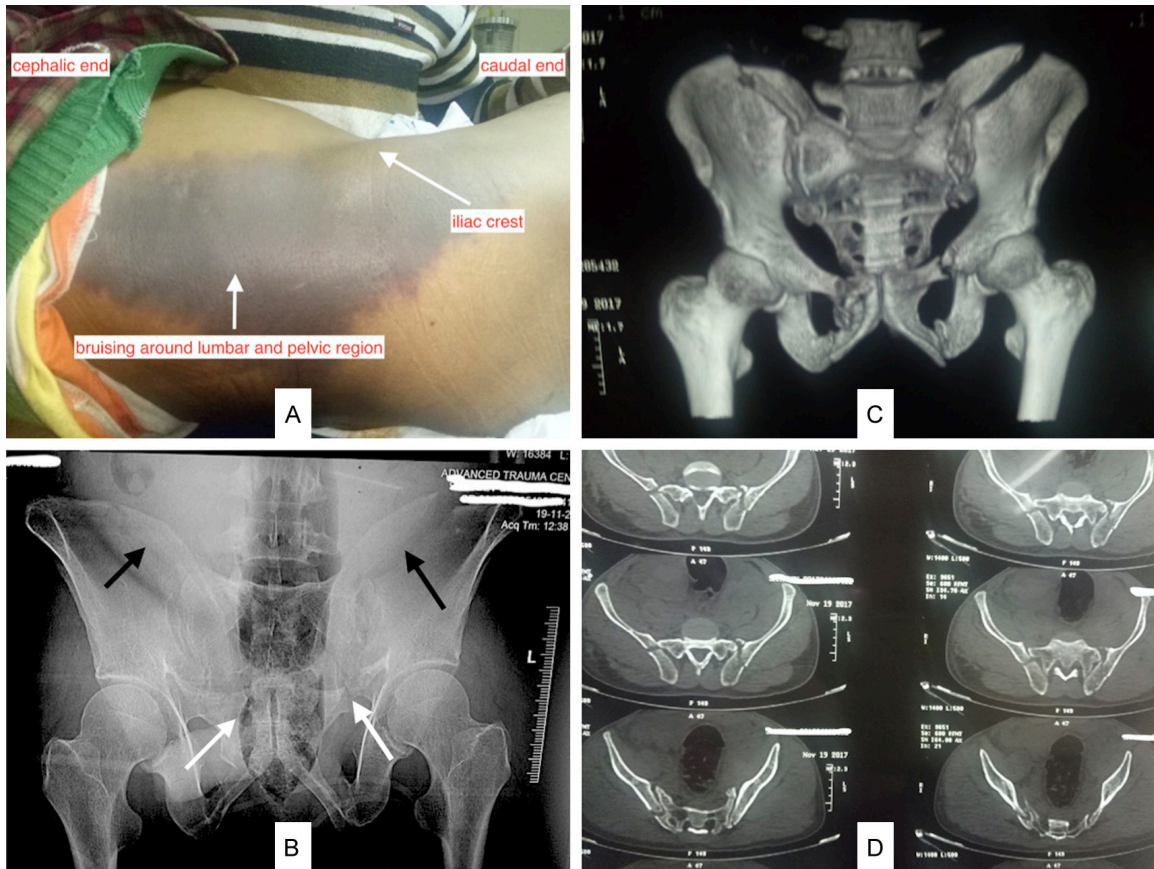
Operative intervention helps in the reduction of malunion, post-traumatic sacroiliac joint arthritis, pain while standing and walking and post-traumatic lumbar pain [3, 6-10].

'Bilateral crescent fractures of the pelvis' are very rare. Only two such cases are reported in the literature, which involved an osteopenic female suffering a pelvic injury following a fall and another involved in a road traffic accident [11, 12]. We thus report a rare case of 'bilateral pelvic crescent' fracture following high-velocity injury. We aim to understand the injury mechanism and ascertain if critiquing Days' recommendation gives a good to excellent functional outcome (Majeed Scoring).

## Case

A 56-year-old male patient presented to the emergency with a history of injury by an oncoming truck. The mechanism of injury involved backing of the truck onto the patient who was standing against a wall, which caused a direct impact at the area of the pelvis from either side (truck and wall). The patient on presentation had grade 2 hypovolemic shock and was resuscitated as per the standard ATLS (advanced

## Bilateral crescent fracture of the pelvis



**Figure 1.** Pre-operative Imaging. A. Bruising in the right flank and pelvic region; B. Pre-operative X-Ray showing bilateral crescent fracture along with bilateral superior and inferior pubic rami fracture; C. 3D NCCT of pelvis showing crescentic fracture-dislocation; D. Axial NCCT showing crescent fracture (Right-Day I, Left-Day II).

trauma life support) protocol. The patient had bruising of the skin on the right lateral aspect of the pelvis and flank region without any Moralle Lavalles lesion on primary survey and examination (**Figure 1A**). In secondary survey, X-Rays and NCCT (Non-contrast computed tomography) were undertaken. A diagnosis of bilateral crescent fracture of the pelvis with fracture of bilateral superior and inferior pubic rami was made (**Figure 1B-D**).

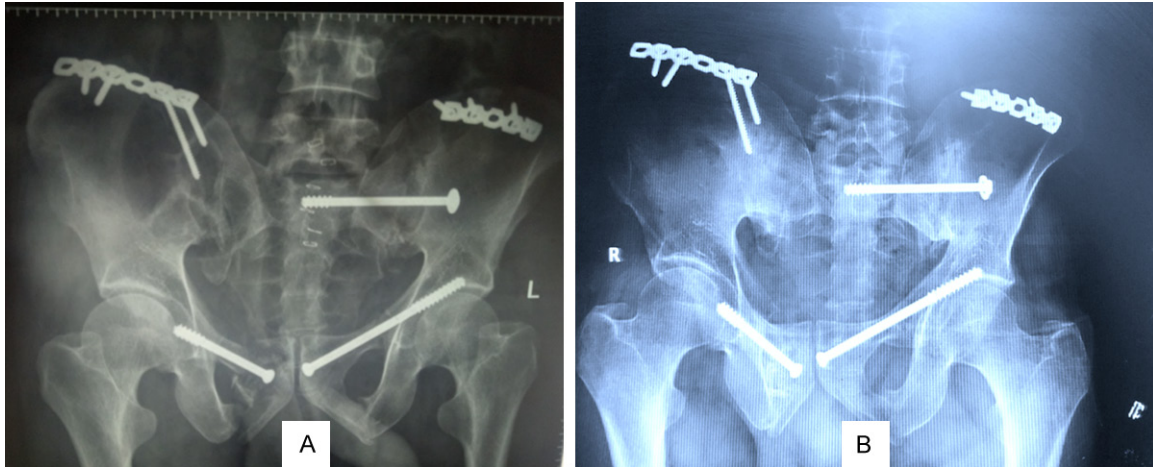
The treatment was started with hemodynamic stabilization, following which he was taken to OR (operation room). The crescent fractures were fixed with reconstruction plates by open reduction and internal fixation (ORIF) through the anterior approach. A single percutaneous Ilio-sacral screw was used to fix the left SI (Sacro-iliac) joint. The anterior pelvic ring was stabilized by two percutaneous partially threaded canulated screws (**Figure 2A and 2B**). No complications occurred in the postoperative

period, and he was discharged after three days of surgery.

The patient was advised not to bear weight for six weeks from the time of surgery. In those six weeks, the patient received physiotherapy, which consisted of pelvic lifts, passive hip, knee and ankle range of motion. The patient also received anti-DVT (Deep vein thrombosis) prophylaxis with subcutaneous enoxaparin 0.6 CC daily for six weeks.

Supervised active range of motion exercise was started after six weeks. The patient was mobilized with a rigid walker, with "weight-bearing" as tolerated by the patient, who gradually increased it to full weight-bearing. Crutch use was eventually stopped three months post-surgery. At one year follow up, the patient could perform all the activities without any discomfort (**Figure 3A and 3B**). He has no functional limitation at the follow up. Functional outcome

## Bilateral crescent fracture of the pelvis



**Figure 2.** Postoperative imaging. A. Immediate postoperative X-Ray showing fracture fixation; B. Follow up X-ray after one year, showing union.



**Figure 3.** Functional status at 1-year follow-up. A. Active Straight leg raise; B. Ability to squat without pain.

was assessed by Majeed scoring, which showed excellent functional outcome. (Majeed score = 91).

### Discussion

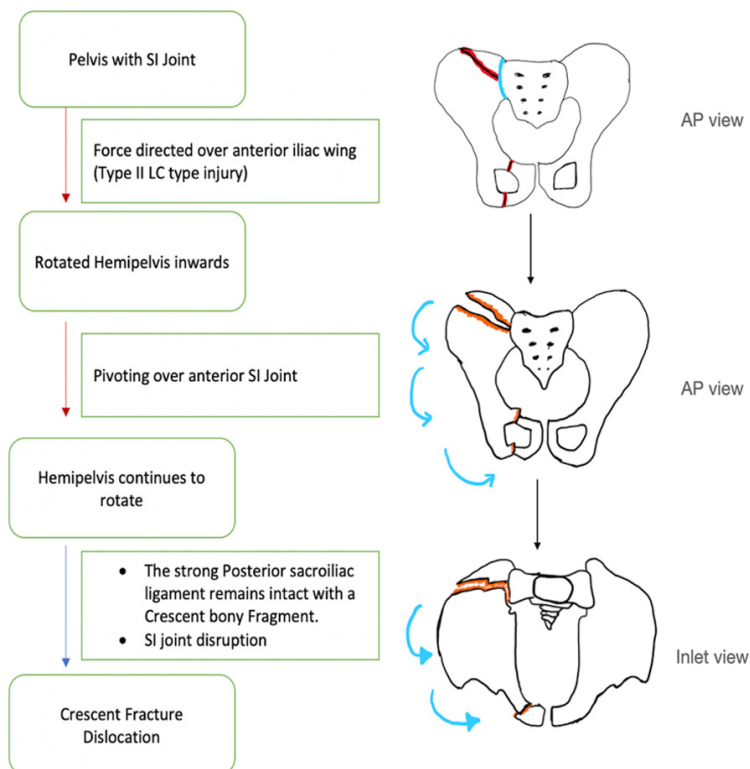
Lateral compression type 2 injuries occur when the force is directed over the anterior portion of the iliac wing. This force tends to rotate the hemipelvis inward, with the pivot point being the anterior SI joint and leaves a small crescent-shaped segment of the posterior ilium firmly attached to the sacrum, a result of a

strong posterior Sacro-Iliac ligament that leads to a crescent fracture (**Figure 4**) [8]. For this very reason, there is usually little or no vertical displacement of the pelvis [8].

Day [5] has classified these injuries into 3 types, based on the location of the fracture line and involvement of the SI joint. In short, type I fracture lies in the anterior one-third of the SI joint, type II fracture in the middle third of the SI joint and type III fracture lies in the posterior third of the SI joint. However, there is no mention of bilateral crescent fracture in this classi-



## Bilateral crescent fracture of the pelvis



**Figure 4.** Mechanism of injury-causing crescent fracture of the pelvis with a diagrammatic representation of forces acting on the pelvis after impact.

fication. Day [5] suggested that “Type I fractures can be fixed with the ilioinguinal approach, whereas “Type II” could be fixed through the posterior approach with plates and screws. “Type III” fractures, on the other hand, could be dealt with using percutaneous screws after closed reduction [5].

Recently Ginnaoudis et al. [9] and Khaled et al. [10] have used iliosacral screws after closed reduction in Day type II and type III with good outcomes. Khaled et al. [10] elaborated that in type II and type III crescent fractures, the entry point of the iliosacral screws remained intact and the iliac table had sufficient space for the placement of the guide wires for the screws without the risk of breakage in the entry fragment.

An extensive search of the literature on Pubmed, Embase and Scopus showed only a few similar cases of bilateral crescent fracture of pelvis reported earlier. O’Neill et al. [11] reported a case of bilateral crescent fracture-dislocation of the pelvis in a female osteopenic patient who sustained a low-velocity injury. The

anterior pelvic ring was stabilized with reconstruction plates following which the crescent fractures were fixed with supra-acetabular screws bilaterally. Two percutaneous screws stabilized the posterior pelvic ring for both the Sacroiliac joint [11].

In comparison, our case had a high-velocity injury (**Table 1**). The right-sided crescentic fracture was classified as ‘Day type I’ and the left ‘Day type II’. Both the crescent fractures were fixed first using reconstruction plates and the left SI joint disruption was fixed percutaneously. The right SI joint was stable intraoperatively. The bilateral superior pubic rami were then fixed through percutaneous screws to complete the continuity of the pelvic ring. Multiple authors have emphasized fixing the pelvic ring com-

pletely because it increases stability and improves the prognosis [4-6].

Trikha V et al. [12] in their series of 4 cases of crescent fracture, only one had a bilateral crescent fracture of the pelvis. All the cases were operated on using open reduction and internal fixation with reconstruction plates and screws. Their average follow-up was 18 months. They concluded that early reduction of the iliac fragment and anatomic reduction was necessary to achieve a good functional outcome. Similar to Trikha et al. we utilized both the anterior approach for open reduction and the posterolateral approach for screw placement for the SI joint.

Li et al. [13] have also reported a case of a 30-year male who had sustained a unilateral crescent fracture of the pelvis was operated on with reconstruction plates and a single cannulated iliac screw to stabilize the pelvic ring. They concluded that the combination of plates and cannulated screws reduced/restrict the damage to the surroundings and promote good functional results. Similar to Li et al., we used

## Bilateral crescent fracture of the pelvis

**Table 1.** Similar case comparison (Bilateral crescent fracture of the pelvis)

Sl. No.	Authors	No. of cases	Day classification	Side involved	Treatment modality	Follow up (months)	Conclusion
1	Li M	30	Type II	Unilateral	Single Cannulated Iliac screw + Reconstruction plate	29 months	The combination can restrict the damage to surroundings and promote good functional results
2	Menon KV	10	Type I (4) Type III (3) Unclassifiable (3)	All Unilateral	ORIF (open reduction and internal fixation) with a plate	13 months	Sacroiliac articular alignment is important irrespective of the approach of surgery
3	Trikha V	4	-	Unilateral Bilateral Unilateral Unilateral	ORIF with plates and screws ORIF with plates and screws ORIF with plates and screws ORIF with plates and screws	24 months 18 months 12 months 18 months	Early reduction of the iliac fragment helps in achieving anatomical reduction and good functional outcome in such patients
4	Park SE	1	Type III	Unilateral	ORIF with the plate (anterior approach)	30 months	ORIF via anterior approach can give good functional results
5	Qin H	18	-	Unilateral	ORIF with the plate (anterior approach)	16. 1 month	Operation via anterior approach is a good choice in crescent pelvis fracture
6	Borrelli J Jr	22	-	unilateral	ORIF (posterolateral, extrapelvic approach without transarticular sacroiliac joint fixation)	19 months	anatomical restoration of the weight-bearing sacroiliac joint gives a better clinical outcome
7	O'Neill	1	-	Bilateral	ORIF for pubic rami fracture + Percutaneous screws for crescent fracture	16 months	The bilateral crescent needs good fixation to get optimum functional results

## Bilateral crescent fracture of the pelvis

a combination of plates and screws to fix the fracture dislocation.

While Park et al. [14] and Qin et al. [15] have reported a case of unilateral crescent fracture each, wherein they have approached anteriorly to fix the crescent fracture with reconstruction plate alone. They concluded that ORIF with the anterior approach is a better choice to fix the crescent fracture of the iliac wing. In comparison, we utilized both posterior and anterior approach for fracture fixation and used minimal invasive percutaneous screws for stabilizing the anterior pelvic ring. While Park et al. [14] classified the fracture to be Day type III, yet the intervention was contrary to the Days guideline of closed reduction and percutaneous fixation. Thus concluding, the need for the reduction was of primary, irrespective of the approach utilized.

Similarly, Menon et al. [16] in their case series classified the fractures according to Days' classification. But they produced a good functional outcome, as seen by the Modified Majeed score postoperatively. Thus concluding that Sacro-iliac articular alignment was necessary irrespective of the approach used for a good functional outcome. Our case had a 'bilateral crescent injury' with the right fracture classified type I and the left as type II. But both the fractures were fixed with the anterior approach and the left SI joint was fixed with a percutaneous screw after adequate reduction, thus acting critique against days guideline. We are in strong agreement with Menon et al. [16] in concluding that type of approach is secondary while the fracture realignment is of importance.

Operative intervention is recommended in these patients to prevent malunion and sacroiliac joint arthritis, as these complications significantly affect the prognosis and activities of daily living [5]. It is also important to rule out other associated injuries like blunt trauma abdomen and Moralle Lavalles lesions in such cases owing to the high velocity of the injury. Patients do report some pain and functional limitation in the long term but are generally able to perform their daily activities when the patients are fixed with adequate reduction and stability [2, 6].

### Conclusion

Conventional operative procedures remain the gold standard in stabilizing pelvic ring injury. However, mini-open and minimally invasive techniques are fast catching up with their added advantages. Thus, it is essential to understand the mechanism of injury for the classification of pelvic fractures for deciding the type of intervention. Operative techniques, whether percutaneous, open or a combination of both, need to be tailored to every individual considering other injuries sustained by the patient as well and not merely on the type of classification. Evaluation of other associated injuries is therefore equally important as these fractures ultimately need operative intervention. Bilateral crescent fractures are rare and need surgical stabilization for better functional outcomes.

### Acknowledgements

Informed and documented consent from the participant was obtained for the study and publication. All the procedures performed involving the patient followed the highest ethical standards and was approved by the departmental review board (DRB/ortho/2020/143).

### Disclosure of conflict of interest

None.

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## Bilateral crescent fracture of the pelvis

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