



Open reduction technique for overlapping and locked pubic symphysis

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A locked pubic symphysis can occur following a lateral compression injury of the pelvic ring when one pubic bone becomes entrapped behind the contralateral pubis or obturator foramen. In selecting the treatment modality, it is important to know the mechanism of injury. We presented the use of an open reduction technique in the treatment of a locked pubic symphysis in which open reduction external fixation application failed in the emergency department.

Key words: Closed reduction; locked pubic symphysis; open reduction; pelvis.

Locked pubic symphysis injuries occur after a lateral compression injury of the pelvic ring and are classified as type B2 injuries according to the Tile classification.^[1-3] Such injuries are rare in literature and were first described in 1952.^[4-11] Locked pubic symphysis occurs when one pubic bone becomes entrapped behind the contralateral pubic bone or into the obturator foramen. Closed reduction is not always possible. The injury can be accompanied by a urogenital track injury. In selecting the treatment modality, it is important to know the mechanism of injury. We presented a case in which an open reduction technique was used in the treatment of locked pubic symphysis.

Case report

A 21-year-old male presented to the emergency room, following a motor vehicle collision. On arrival, the patient's vital signs were stable and no neurological deficit was observed. Ecchymosis was noted in the suprapubic region. The patient had pain with palpation

of the right sacroiliac joint and symphysis pubis; and also complained of pain around the epigastric region. His right hip was in hyperextension, adduction and internal rotation position. When lying supine on the bed, his right leg was not in contact with the bed. A diagnosis of transected urethra was made after contrast urethrography evaluation. Fracture of the sacrum and left ramus pubis inferior, dislocation of the symphysis pubis and locked pubic symphysis was diagnosed following clinical and radiographic evaluations (Figs. 1-3).

Closed reduction of the locked pelvis was attempted and failed in the emergency room. The patient was transferred to the operating room and a suprapubic catheter was applied by the urologist. A closed reduction was again attempted unsuccessfully under general anesthesia. Open reduction and external fixation of the pelvis was then planned. The open reduction was performed using a Pfannenstiel incision. The rectus abdominis muscle was dissected and the symphysis pubis exposed. The attempt at open reduction failed and an

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Fig. 1. Preoperative anteroposterior radiograph of the pelvis.

external fixator was applied. As the patient's vital signs were stable, we performed the second operation on the fifth day following the accident. Because of the failure of the previous attempts at reduction and the need to obtain pelvic stability, the decision was made to perform open reduction once more with the presence of a suprapubic catheter. The Pfannenstiel incision was used and both funiculus spermaticus were dissected. No damage was noted. After extensile exposure, the right pubic tubercle was found to be incarcerated in the left obturator ring.

The previously applied external fixation device was used to compress the pelvic ring to relax the locked



Fig. 2. Axial CT of the sacroiliac joints. Note the fracture line on the sacrum (arrow).

region in same manner of the injury mechanism. During compression, a curved elevator was placed in the obturator foramen between the left pubis and right pubic tubercle and was used as a lever arm (Fig. 4). The right pubic tubercle was released from the foramen through repetitive maneuvers and relaxation was accomplished. Pubic symphysis was unstable and two 3.5 mm reconstruction plates with 4 and 6 holes were applied anteriorly and superiorly and the external fixation device was removed (Fig. 5).

The patient had no postoperative complaints and recovered well. Urethral repair was performed 3 months after the operation. The patient was mobilized 2 months postoperatively with crutches. No sign of osteitis pubis was detected at the 12th month follow-up and the patient had no complaints of pain during daily activities. However, he had erectile dysfunction.

Discussion

Locked pelvis injuries occur following high energy traumas. According to some authors, this injury is the result of an indirect trauma caused by a lateral compression force with the hip in hyperextension, hyperadduction and internal rotation position.^[2,5,6,8-10,12] Others attribute it to a direct lateral compression force acting onto the iliac wings.^[2,3,9,12]

Such injuries are rare and as blood loss is less than in other types of pelvic fractures, patients are hemodynamically more stable.^[13] A locked pubic symphysis occurs when one pubic bone becomes entrapped behind the contralateral pubis after rupture of the symphysis stabilizer ligaments. This entrapment can occur into the obturator foramen as in our case. The pubic tubercle locks into the obturator foramen.^[8-10,14]



Fig. 3. 3D CT image of the pelvis.

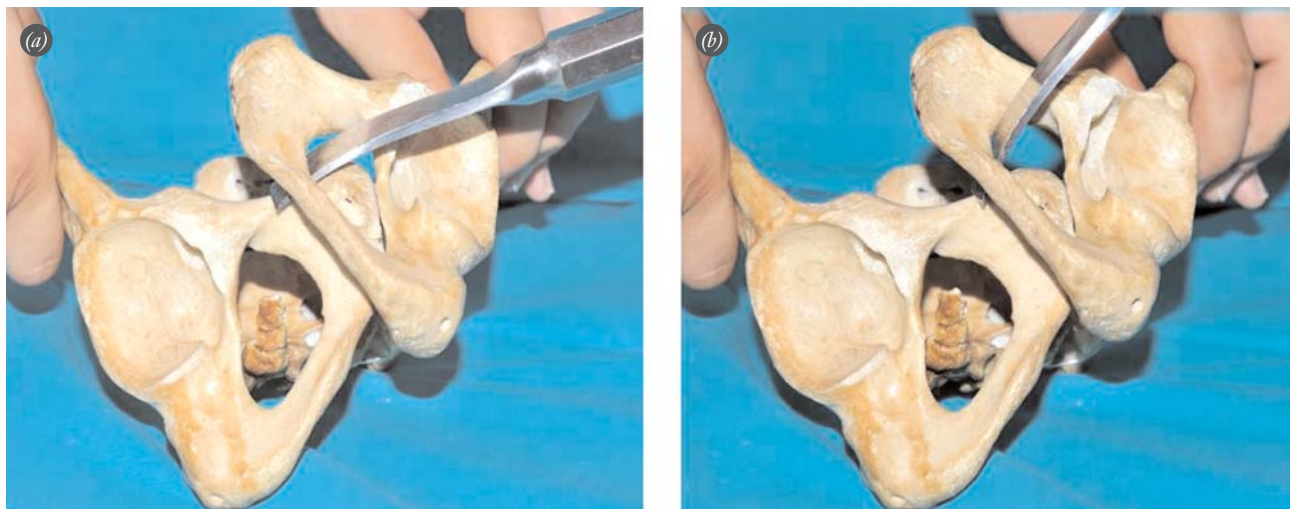


Fig. 4. Animation of the reduction maneuver. **(a)** Bilateral iliac compression, **(b)** reduction of symphysis pubis with the help of curved elevator is seen. [Color figure can be viewed in the online issue, which is available at www.aott.org.tr]

With the hip in hyperextension, adduction and internal rotation, the effected side does not come in contact with the bed when the patient is placed in a supine position. However, in accompanying ipsilateral femur fractures, this important clinical feature is not present.^[5]

The symphysis pubis consists of 2 pubic bones and the fibrocartilage tissue between, and 4 ligaments that stabilize the region. As the anterior and arcuate ligaments play a more important role in stabilization than others, the symphysis pubis is stable in hyperextension. When hyperextension is applied to this region, the femur locks onto the acetabulum because the iliofemoral ligaments are more tensile in abduction and adduction. The force then radiates to the pelvis, causing internal rotation. If the sacroiliac region is stable while the deforming force radiates to the pelvis, the pelvic ring moves back to its original position because of muscular tension and rotational movement. The effect of the force moves the pubic bone either posteriorly or anteriorly, towards the contralateral pubic bone. Closed book phenomenon occurs and compression may occur in the sacroiliac joint when the strong posterior ligaments are intact during this motion, making external rotation of the pelvis difficult. Dislocations and deadlocks may occur as a result of all these mechanisms.^[5]

As in our case, this mechanism entraps the tubercle of the pubic bone into the obturator foramen. In this situation, called closed book phenomenon, the sacroiliac ligaments can stay intact. In our case, there was no vertical displacement and the presence of a non-dis-

placed sacrum fracture on the CT confirmed that this region was relatively stable. According to Eggers,^[6] this mechanism occurs because of the tension of the iliofemoral ligaments, and a reduction maneuver involving the abduction and external rotation of the hip with the hip and knee in 90 degrees of flexion was recommended. Gentle loading during the external rotation of the hip will help the reduction of the dislocated pubis, although there is a risk of femoral neck fracture with this maneuver. Another reduction technique is to apply a longitudinal traction to the effected



Fig. 5. Pelvis radiograph 12 months after the operation.

extremity.^[5,6] The contralateral iliac bone is stabilized in a figure four position and the femur can be used as a lever arm for reduction.^[4] Direct pressure to the symphysis pubis and lateral compression is another reduction technique.^[8,10] Additionally, lateral iliac distraction and direct pressure to the symphysis pubis has also been described as a reduction maneuver.^[9] Lateral distraction may not be successful if the obturator foramen is entrapped.^[4]

In our case, we applied lateral compression through the external fixator that was previously applied. Anterior to posterior translation force was applied with the help of the elevator. We believe that applying lateral iliac compression eased open reduction.

Closed reduction may be successful in some cases.^[8] However, the presence of accompanying injuries and the strong ligaments and muscles can complicate closed reduction.^[2,4,5,7,14] Open reduction is advocated when closed reduction is unsuccessful.^[2,5,7,11]

We applied a modified closed reduction technique during our open reduction. External fixation helped us during the lateral compression phase. In the absence of

external fixation, lateral compression can be performed manually.

Superior ramus pubis osteotomy is another possible open reduction technique although it has a higher morbidity due to the aberrant junctions between the obturator neuromuscular bundle and the obturator and iliac systems (corona mortis). For these reasons, a different reduction technique should be chosen.^[4,7]

Internal fixation should be performed if the pubic symphysis is unstable following open reduction.^[14] Anterior and superior plates must be applied to overcome of the traction force created by the strong abdominal muscles. Reconstruction plate and screw fixation should be performed for a stable fixation in the presence of vertical and rotational instability. A stable fixation is mandatory for early rehabilitation.

External fixation has been suggested in lateral compression injuries although it may not provide sufficient stabilization, has a poor cosmetic outcome and causes a more difficult rehabilitation. However, supraacetabular external fixation may be preferred in patients in whom a suprapubic catheter has been applied due to the resultant risk of retropubic infection.^[4] While

Table 1. Our cases and review of the literature.

| References | Age/Sex | Treatment/Fixation | Urethral injury | Posterior sacral and sacroiliac injury | Closed reduction |
|-----------------------------|---------|--|-----------------|---|---|
| Shanmugasundaram (1970) | 28/M | Open reduction/Bed rest/Casting | Yes | None | Yes (Tried and failed) |
| Webb (1977) | 21/M | Closed reduction/Bed rest/No fixation | Yes | Intact sacroiliac joint | Yes |
| Robinson et al. (1989) | 44/M | Closed reduction/Bed rest/No fixation | No | Fracture of the right sacral ala | Yes |
| Dorai and Kareem (1991) | 30/M | Closed reduction/Bed rest/No fixation | Yes | Fracture of the right sacral ala | Yes |
| Catonné et al. (1996) | 30/M | Open reduction/Internal fixation/ Double-plate fixation | Yes | Fracture of the lateral sacrum | No |
| Ansari et al. (2003) | 32/M | Open reduction/Internal fixation/ Double-plate fixation | No | Minimal disruption of the posterior ligaments and compression of the sacroiliac joint | Not tried/Because of the ipsilateral femur fracture |
| O'Toole et al. (2006) | 16/M | Open reduction/External fixation | Yes | Fracture of the bilateral sacral ala | Yes (Tried and failed) |
| Sreesobh et al. (2006) | 20/M | Open reduction/Internal fixation/ Double-plate fixation | No | None | No |
| Cannada and Reinert (2009) | 17/M | Open reduction/External fixation | Yes | Fracture of the right sacrum | Yes (Tried and failed) |
| Tadros et al. (2009) Case 1 | 23/M | Open reduction/Internal fixation/ Double-plate fixation | No | Fracture of the left sacral ala | No |
| Tadros et al. (2009) Case 2 | 30/F | Open reduction/Internal fixation/ Single-plate fixation | No | Vertical fracture of the left sacral foramina | No |
| Tadros et al. (2009) Case 3 | 14/F | Open reduction/Internal fixation/ Double-plate fixation | No | Vertical fracture of the left sacral foramina | Yes (Tried and failed) |
| Our case (2010) | 21/M | Open reduction/Internal fixation/ Double-plate fixation | Yes | Fracture of the right sacrum | Yes (Tried and failed) |

external fixation was used in 2 of the 12 cases in the literature,^[4,7] it can also be used for distraction in lateral compression type injuries.^[15]

Fractures or ligament injuries of the posterior pubic region have also been reported in locked symphysis injuries, although no posterior fixation was performed in these cases.^[2]

Two of the 12 cases in the literature were female. The cartilaginous intra-articular disc in the symphysis pubis joint is 2-3 mm thicker than the one in the male pelvis^[12] and the female pelvis has a larger inner diameter to facilitate labor, although the male pelvis has a longer vertical length. Resultantly, locked symphysis pubis injury is less likely to occur in women.^[4]

The mean age of the previously reported patients with locked symphysis injury was 25 (range: 14 to 44) years. No patient had any disease that reduced bone quality, such as osteoporosis. The young age and high bone quality of the patients make the fracture pattern stable. The stress derived from the injury radiates to the pelvic bones with the rupture of the pubic symphysis and facilitates internal rotation without a fracture.

In the literature, 3 closed reductions and 9 open reductions have been reported. Patients who underwent closed reduction were followed up with bed rest. Of the patients who underwent open reduction, cast application was performed in one, external fixation in 2 and internal fixation in 6 (Table 1).^[2-5,7-11,14]

Plate and screw fixation is an effective treatment modality that secures fixation and reduction.^[2,5] The patients who received plate and screw fixation for open reduction had full range of motion and no pain.^[5,10]

Urethral injury is the most common accompanying injury in locked pelvic fractures (7-55%).^[1-3,5,8,10,11,16] Urethral injury occurs due to the crush and shearing forces applied during the vertical displacement of the pubic bone. In such cases, catheterization and urethrography must be performed.^[2,17] Urethral stricture is the most common complication, and erectile dysfunction, osteitis pubis and avascular necrosis of the femoral head can also be seen.^[2,3,5,12]

In conclusion, identifying the injury mechanism is important in planning the treatment and facilitating the reduction of a locked pubic symphysis. Successful internal fixation can be achieved with reconstruction plates and screws. Making an accurate treatment plan increases the success of the surgery in these rare injuries.

Conflicts of Interest: No conflicts declared.

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