

# Surgical treatment of a Malgaigne fracture

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## ABSTRACT

Sacral fractures are generally accompanied by pelvic ring fractures. They rarely develop in an isolated form. Sacroiliac dislocation without sacral fracture is extremely rare. We report a case with a sacroiliac dislocation without sacral fracture, which was treated surgically. Lumbopelvic stabilization was applied using iliac wing plates. The case was evaluated according to his clinical condition and visual analogue score (VAS), American Spinal Injury Association (ASIA) and Oswestry scales. Considering the role of the sacrum, which transmits the load of the entire spine to the pelvis, meticulous care must be given to ensure the mechanic stability of the spine when evaluating patients with sacral and pelvic fractures. Very serious spinopelvic instability is present in sacroiliac dislocations even in the absence of sacral fractures. Caudal migration of the sacrum together with the cranial migration of the iliac wings can cause serious pelvic imbalance and difficulties in walking and maintaining a standing position. Aggressive stabilization and fusion are required, and these must be performed in the early period.

**Key words:** Iliac plate; malgaigne fracture; sacroiliac dissociation; spinopelvic instability; spinopelvic stabilization.

## INTRODUCTION

Unstable pelvic injuries characterized by the dissociation of the sacroiliac complex cause serious problems in the late period, including continuous pain and functional restrictions, in addition to the morbidity and mortality in the early period.<sup>[1,2]</sup> Ensuring anatomic reduction with stabilization and fusion is extremely important in sacroiliac dislocations. Since most of these injuries arise from high-energy traumas, other accompanying traumas must be investigated as well. A thorough physical examination including neurological and radiological examinations is required to determine the treatment. Studies have shown that functional outcomes are poor when sacroiliac dislocations are not reduced completely.<sup>[3]</sup>

Malgaigne dislocation was described in the mid 1800s by a

famous French anatomist and orthopedist. Malgaigne fracture consists of fracture of both pubic rami and posterior fracture of the sacroiliac complex. There is a vertically oriented combined fracture of the anterior and posterior pelvis.

To date, many surgical techniques have been used in the fixation of the sacroiliac joint. It was not possible to ensure complete anatomic reduction with most of these techniques. Very important technical problems are encountered in the open procedures, particularly in delayed cases. Stabilization techniques involving lumbar vertebrae and iliac wings were developed over time to ensure complete anatomic reduction.<sup>[4-8]</sup> Van Savage and colleagues<sup>[2,9]</sup> were the first to use the Galveston technique for this purpose. Later, Käch and Trentz<sup>[2,10]</sup> proposed the distraction spondylodesis with L4-5 for the fixation of iliac bones. In 1998, Schildhauer et al.<sup>[2,11]</sup> reported the triangular osteosynthesis method, which included lumbopelvic distraction and transverse fixation of the sacral fracture. Abumi et al.<sup>[12]</sup> were the first investigators to use sacral pedicles and iliac wing for this purpose. They performed the fixation using Galveston technique between both pedicles of S1 and the iliac wings.

When the anatomic importance of the sacrum and its role in mechanical stability as the bony ring of the pelvis are considered, giving meticulous care in the evaluation of patients with pelvic trauma is essential. Fixation with an iliac plate in

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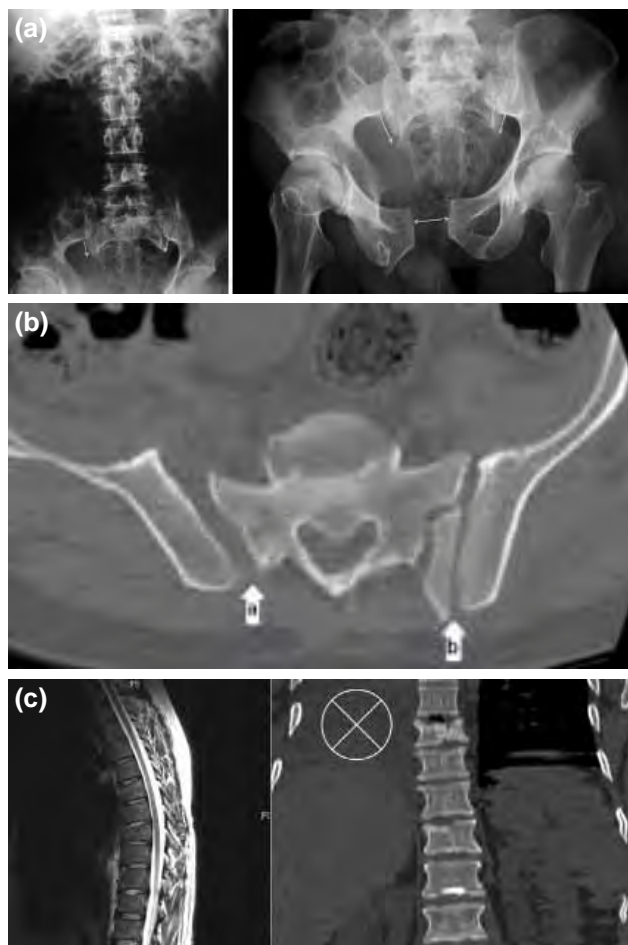
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sacroiliac complex instability is a technique that has not been applied until now. This method ensures the reduction and stabilization in sacroiliac dislocations with or without sacral fractures. Further, there is the possibility of applying this stabilization method in other pathologies requiring sacroiliac fusion.<sup>[4]</sup>

We report a patient with Malgaigne fracture that developed due to a fall from a height, without sacral fracture, who underwent surgery using iliac plates. The preoperative and postoperative American Spinal Injury Association (ASIA) neurologic status scale, visual analogue scale (VAS) and Oswestry scales and the clinical condition of the patient were evaluated. Pre- and postoperative changes in the computed tomography (CT), magnetic resonance imaging (MRI), and plain X-rays were examined.

The patient was treated under elective conditions under general anesthesia in the prone position with the accompaniment of biplane scopy.



**Figure 1.** (a) Sacroiliac dissociation with the caudal displacement of the sacrum and separation of the pubic symphysis. Fracture in the right acetabulum can be seen. (b) Axial CT image. Sacroiliac dislocation (a) without sacral fracture. The fracture line (b) in the iliac wing is seen on the left. (c) Accompanying pathologies: T8 compression fracture and right hemothorax.

## CASE REPORT

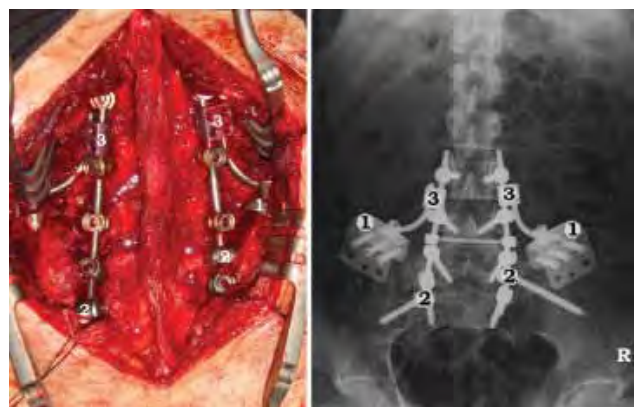
A 38-year-old male experienced trauma due to a fall from a height (from a walnut tree). No fractures were present in the sacrum. There was dissociation fracture in the left iliac wing together with dissociation displacement in the sacroiliac joints bilaterally, and caudal sacral displacement together with sacroiliac dislocation (Figs. 1a, b). Linear fracture in the right acetabulum and compression fracture at T8 and T11 levels were determined. Thoracic vertebrae and left hemothorax were found as the accompanying traumatic pathologies (Fig. c). He was treated and followed with thoracic tube in the intensive care unit of the medical center to which he applied initially. He was referred to our center 45 days after the trauma. During that period, the patient underwent no operations, and was treated with medications and immobilization. Bilateral cutaneous traction was applied pre- and perioperatively. Preoperative VAS score of the case was 10 and Oswestry score was 94.

## Surgical Technique

Paravertebral muscles were dissected with a midline approach. Both iliac wings were clearly exposed together with area between L3 and the sacrum. Bilateral transpedicular screws were placed in the L3, L4, L5, and S1 vertebrae. Bilateral iliac wing plates were placed. Pedicular and iliac wing screws were fixed by placing rods. Complete reduction could not be achieved because of the delayed surgery. The combined spinopelvic stabilization was applied using a system we designed according to the anatomy of the iliac wings, in which the system sits on the iliac wings and is fixed to the iliac wings with nuts. The systems were connected to each other using dominos (Figs. 2-4).

The duration of the operation was 245 minutes, and bleeding was determined as 1950 cc. Four units of erythrocyte suspension and two units of fresh frozen plasma were used.

The case was mobilized 24 hours later and was discharged



**Figure 2.** Perioperative view and postoperative radiograph after one year (right) showing the lumboiliac stabilization, performed using transpedicular screws between L3 and S1, iliac plates (1), iliac screws (2), and domino fixture connecting the rods to each other (3).

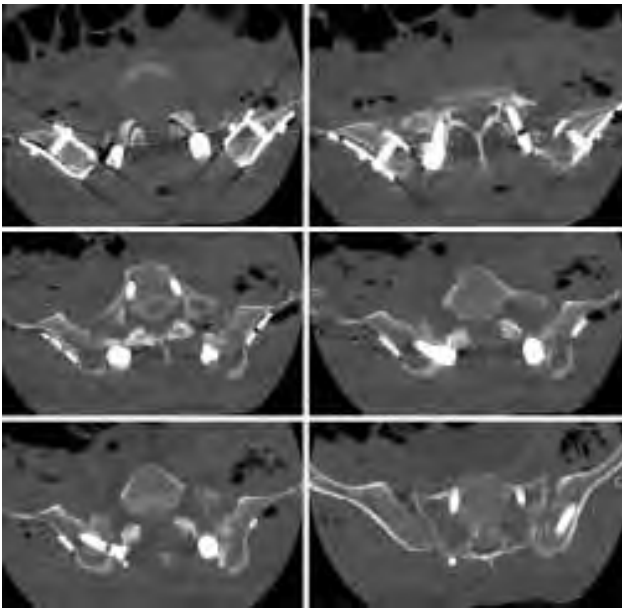


Figure 3. Postoperative CT sections.

on postoperative day 5. No complications developed. Follow-ups were performed in postoperative months 2 and 6. In postoperative month 2, VAS score was 4 and the Oswestry score was 36, while in month 6, these values were 2 and 10, respectively. The patient had difficulty in walking during the initial mobilization related with the acetabulum; however, in the 6th month follow-up, it was observed that the gait of the patient was painless and regular.

## DISCUSSION

Sacroiliac fractures constitute a complex group of injuries including the interruption of the pelvic ring, nerve root damage, cauda equina syndrome, and direct or indirect damage to the spinal segments. The rate of sacroiliac dislocation together with sacral fractures is extremely high.<sup>[3]</sup> Particularly according to the Dennis classification, the incidence of sacroiliac dislocation is high in zone I fractures.<sup>[13]</sup> Pure sacroiliac dislocation without sacral fracture is extremely rare. Vertical shear fractures, known as Malgaigne fractures, are the results of high-energy trauma. Sacroiliac dislocations are pathologies occurring as a result of axial loading, and almost all occur following falls from a height onto the feet. These injuries are characterized by rupture of the entire pelvic floor, including the posterior sacroiliac complex as well as sacrospinous and sacrotuberous ligaments. Malgaigne fracture consists of both anterior and posterior lesions: disruption of the symphysis or disruption of the inferior and superior pubic rami; disruption of all four rami; disruption of two rami plus pubic symphysis and posterior lesion; fracture of ileum; dislocation or fracture dislocation of the sacroiliac joint; or fracture of the 4th or 5th lumbar transverse process. Similar to the patient reported in this article, injuries to different regions, most frequently thoracic and lumbar vertebrae fractures and pelvic and abdominal organ injuries, accompany the sacroiliac dislocation.

<sup>[14,15]</sup> Serious instability can be seen in patients with sacroiliac dislocation. Therefore, absolute fixation is required. In the articles about improvement in the neurological deficits in patients who do not undergo surgery, outcomes are not satisfactory.<sup>[4,8,11,13,16-20]</sup> Our opinion also favors surgery in the early periods in these cases. Inappropriate fusion developing in surgeries in the late period makes ensuring complete anatomic reduction during the operation more difficult. Purposes of the surgical sacral fixation include stabilizing the dislocation, improving the neurological condition and reducing all the disabilities. Surgical fixation in sacroiliac dislocations ensures the stability to allow early mobilization, preserving the local neurovascular structures and reducing the pelvic pain.<sup>[2-5,20]</sup>

Lumbopelvic fixation was designed to remove the effects of the instability pattern, which is frequently misunderstood. Stabilization methods include pelvic fixation, sacroiliac screws, direct sacral fixation, and lumbopelvic fixation to repair the stability of the lumbosacral joint.<sup>[2,4-7]</sup>

In pediculoiliac fixation, reduction is done with the help of the rods between the screws, and full anatomic reduction is obtained with compression and distraction maneuvers possi-



Figure 4. Preoperative and postoperative pelvic X-ray. Partial closure of the dissociation at the pubic symphysis with compression of the iliac wings is shown.

ble in every direction; compression between the fragments is also possible. In this method, the fixation points are the sacral pedicle and the cortices of the iliac bone. Using the area between the internal and external cortices of the ilium as the fixation site has been determined as the most stable method in the biomechanical studies performed in various lumbosacral fixation methods. In addition, it has been shown that the peel resistance increases when the sacral pedicle screws are located anteriorly and bicortically.<sup>[2,21,22]</sup> On the other hand, screws are generally placed in the same direction in sacroiliac transfixation or in anterior double plate applications. In this method, however, directions of both screws are different in each plane. All these features ensure important advantages, particularly for the primary stability.<sup>[2]</sup> Use of iliac screws in lumbosacral fixation is a modification of the Galveston method. Its modular characteristic eliminates the requirement of beveling the rod, and performing the construction according to the anatomy of the area becomes easier. Furthermore, applying the Galveston rod in a short level is rather difficult, and it is not possible to prevent the piston movement of the rod within the ilium, since the rod is straight. Another advantage of using the iliac screw is that it allows compression distraction in each plane.<sup>[2,9,23,24]</sup> Use of interlocking iliac wing plates in sacroiliac dislocations has gradually increased in recent years, presenting a new tool for stabilization. This technique is a rather effective method in the correction of translation deformities or residual angular deformities in transverse fractures.<sup>[4]</sup>

Ensuring reduction in cases with sacroiliac dislocation in the early period is extremely important. Early surgical intervention allows the early mobilization of patients and more effective rehabilitation. Satisfactory improvement is also obtained in the neurologic deficits occurred during the trauma.<sup>[3-5,16,20,25]</sup>

We believe that the interlocked iliac plate applied in this case represents a good alternative that can be used stand-alone in cases with serious instability requiring sacroiliac stabilization or in combination with other methods in view of its ease of use, its structure that complies with the iliac wing anatomy, and the very strong stabilization it ensures.

In conclusion, the purpose of our study was to show that sacroiliac dislocation, which is generally seen simultaneously with sacral fractures and causes sacral instability, can also be seen without sacral fracture, though very rare. Early operation in patients with sacroiliac instability is extremely important to ensure early mobilization. Although application of an iliac wing in sacroiliac fixation is a new method, it is very effective in ensuring stabilization.

Conflict of interest: None declared.

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## OLGU SUNUMU - ÖZET

**Malgaigne kırığı'nın cerrahi tedavisi****Dr. Sedat Dalbayrak,<sup>1</sup> Dr. Murat Ayten,<sup>1</sup> Dr. Fahir Özer,<sup>2</sup> Dr. Onur Yaman<sup>3</sup>**<sup>1</sup>Nöro Spinal Akademi, Nöroşirürji Bölümü, İstanbul;<sup>2</sup>Koç Üniversitesi Tıp Fakültesi, Nöroşirürji Anabilim Dalı, İstanbul;<sup>3</sup>Tepecik Eğitim ve Araştırma Hastanesi, Nöroşirürji Kliniği, İzmir

Sakral kırıklar pelvik halkanın dağılması, sinir kök hasarı, kauda ekuina sendromuna neden olan direkt ve indirekt spinal segment hasarına neden olan karmaşık yaralanmalardır. Malgaigne kırıkları pubis rami kırığı ya da simfisis pubisin ayrılması ile birlikte sakroiliak kompleksin kırığı ile birlikte olur. Pelvisin ön arka vertikal kırığıdır. Bu yazıda sakroiliak ayrılma nedeniyle sakral kırığı ve instabilitesi olan Malgaigne kırığı olan hastanın cerrahi tedavisi sunuldu. Yüksekten düşme nedeniyle Malgaigne kırığı olan hasta iliak plaklarla cerrahi olarak tedavi edildi. Cerrahi öncesi ve sonrası nörolojik durumu ASIA skorlaması, ağrı düzeyi VAS ve Oswestry skorlaması and klinik durumu tespit edildi. Cerrahi öncesi ve sonrası durumları BT, MR ve direkt grafi ile incelendi. Gecikmiş cerrahi nedeniyle redüksiyon tam olarak sağlanamadı. Spinopelvik stabilizasyon iliak kanatlara uygun olarak dizayn edilmiş iliak kanat plakları ile ameliyat edildi. L3, L4, L5 ve S1 iki taraflı transpediküler vidalar ile iliak kanat plakları dominolar aracılığı ile rodlarla birleştirildi. İliak kanatlar için geliştirdiğimiz iliak kanat plakları sakroiliak instabilitesi olan sakroiliak stabilizasyon gereken hastalarda tek başına ya da diğer yöntemlerle kullanılabilecek uygulanması kolay ve güçlü stabilizasyon sağlayan alternatif bir yöntemdir. İliak kanat plakları sakroiliak fiksasyon için kullanılabilecek etkili yeni bir yöntemdir.

Anahtar sözcükler: İliak plak; Malgaigne kırığı; sakroiliak ayrılma; spinopelvik instabilite; spinopelvik stabilizasyon.

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