



Long-term outcome and quality of life of patients with unstable pelvic fractures treated by closed reduction and percutaneous fixation

Kapalı redüksiyon ve perkütan vidalama ile tespit edilmiş anstabil pelvis kırıklı hastalarda yaşam kalitesinin ve uzun dönem sonuçların değerlendirilmesi

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BACKGROUND

Treatment of unstable pelvic fractures has evolved recently, and percutaneous treatment has become the choice of treatment in most cases. The aim of this study was to evaluate the outcome of percutaneous treatment in patients with unstable pelvic fractures.

METHODS

Twenty patients (11 females, 9 males; mean age, 32 years, range, 11-66 years) who had unstable pelvic fractures and were treated percutaneously were enrolled in the study. Short Form-36 (SF-36) scores, Majeed scores, Iowa Pelvic Scores, and Pelvic Outcome Scores were determined for the outcome assessment.

RESULTS

The minimum duration of follow-up was 2 years, (range, 24-48 months). The mean Injury Severity Score (ISS) was 31 (range, 16-50). The average SF-36 scores were comparable with the general population in terms of bodily pain, general health and social function. The mean Majeed functional pelvic score was 93.3 (range, 72-100; 19 excellent and 1 good clinical grades) and the mean Iowa Pelvic Score was 86 (range, 82-90). The mean Pelvic Outcome Score was 33 (range, 24-37; maximum score, 40).

CONCLUSION

We have demonstrated better outcomes in patients with pelvic fractures treated with percutaneous fixation. The technique may be advantageous as it avoids the use of extensive approaches, bleeding, wound complications, and prolonged surgeries.

Key Words: Pelvic fracture; percutaneous treatment; outcome.

AMAÇ

Kapalı redüksiyon ve perkütan vidalama ile tespiti son zamanlarda pelvis kırıklı hastaların çoğunda tedavi seçeneği olmuştur. Bu çalışmanın amacı, anstabil pelvis kırıklı hastalarda uygulanan perkütan tedavinin uzun dönem sonuçlarının ve hastaların yaşam kalitesinin değerlendirilmesidir.

GEREÇ VE YÖNTEM

Ortalama yaşı 32 (dağılım 11-66 yaş) olan 20 hasta (11 kadın, 9 erkek) çalışmaya dahil edildi. Sonuçların ve yaşam kalitesinin değerlendirilmesi amacıyla Kısa Form-36 (KF-36) anketi, *Majeed* skorlaması, *Iowa* pelvis skorlaması ve pelvis sonuç değerlendirme skorlaması kullanıldı.

BULGULAR

En kısa takip süresi 2 yıl (dağılım 2-4 yıl) idi. Ortalama yaralanma şiddet skoru 31 (dağılım 16-50) olarak bulundu. Ortalama KF-36 skorları vücut ağrısı, genel sağlık ve sosyal fonksiyonlarda normal toplum değerleri ile benzer bulundu. Ortalama *Majeed* skoru 93.3 (dağılım 72-100; 19 mükemmel ve 1 iyi klinik sonuç) ve ortalama *Iowa* pelvis skoru 86 (dağılım 82-90) olarak bulundu. Ortalama pelvis sonuç değerlendirme skoru ise 33 (dağılım 24-37; en yüksek olası skor, 40) idi.

SONUÇ

Pelvis kırıklarında perkütan tedavi yöntemi ile iyi sonuçlar elde etmek mümkündür. Geniş cerrahi yaklaşımların önlenmesi, kanamanın, yara problemlerinin az olması ve uzun süreli cerrahilerden kaçınılması tekniğin avantajlarıdır.

Anahtar Sözcükler: Pelvis kırıkları; perkütan tedavi; sonuç.

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Despite the fact that unstable pelvic fractures are the most serious orthopedic injury, controversy exists regarding the recommended treatment and outcome.^[1-12] The outcome of these fractures is dependent on anatomic reduction and stabilization. Early anatomic reduction and stable fixation of the unstable pelvis have been shown to diminish pain, allow early mobilization and improve patient outcome.^[1-5]

Open reduction and internal fixation of pelvic ring disruptions were routinely delayed to avoid entering the pelvic hematoma and thereby causing additional hemorrhage. The techniques of closed reduction and percutaneous pelvic fixation can be used for early stabilization of unstable anterior and posterior pelvic fractures and provide stable internal fixation, while avoiding large surgical exposure, derangement of hematomas and potential complications associated with these major surgeries.^[8-12] Percutaneous fixation is thought to improve the outcome of unstable pelvic injuries; however, to our knowledge, no studies have yet demonstrated the long-term functional outcome and quality of life of patients with these injuries.

The aim of the present study was to evaluate the long-term functional outcome and quality of life of patients with unstable pelvic fractures who were treated with closed reduction and percutaneous fixation.

MATERIALS AND METHODS

In the present study, 32 patients with pelvic fractures treated in our institution between August 2004 and August 2006 by one surgeon (EA) were evaluated retrospectively. Patients with unstable pelvic fractures who were treated with closed reduction and percutaneous fixation with at least 2 years of follow-up were included in the study. The patients treated with conservative or open methods and those with <2 years of follow-up were excluded. A total of 20 patients (11 females, 9 males) who fulfilled the inclusion criteria were enrolled in the study. Two patients were excluded (1 patient died in the postoperative 2nd week due to multiorgan failure and nosocomial sepsis, and 1 patient died in the postoperative 11th

month following a myocardial infarction). Hospital charts, pre- and postoperative posteroanterior, inlet and outlet pelvic X-rays and computed tomography scans were evaluated.

There were 9 male and 11 female patients, with an average age of 32 years (range, 11-66 years) at the time of injury. All of the injuries were related to motor vehicle accidents or pedestrian-vehicular collisions. Fractures were classified according to Young and Burgess^[13] (Table 1), and the Injury Severity Scores (ISSs) were calculated.

All of the operations were performed under general anesthesia in the supine position. A radiolucent operating table and conventional fluoroscopy were used. The initial step was closed reduction of the fracture with the aid of traction or an external fixator. For the placement of iliosacral screws, a guidewire was passed from the lateral edge of the ilium, perpendicular to the sacroiliac joint, towards the body of the first sacral vertebra. The pelvic inlet and outlet views and lateral views of the sacrum were obtained to confirm the correct positioning of the guidewire within the safe zone. A 7.3 mm (Kanghui medical) or 6.5 mm (Smith and Nephew) cannulated screw was then placed perpendicular to the sacroiliac joint. Longer screws were used for fixation of sacral fractures. Following placement of the first screw, a second screw was used when needed. For retrograde placement of the superior pubic ramus screw, an incision, 1 cm in length, was performed inferior and lateral to the ipsilateral pubic tubercle. A guidewire was passed at a 45° angle from medial-to-lateral through the superior pubic ramus across the fracture and above and anterior to the hip. Obturator-outlet and iliac-inlet views were used to check the correct position of the screw. Then, a 7.3 mm or 6.5 mm cannulated screw was used for fixation.

A general health survey (Short Form-36 [SF-36]), commonly used to assess the overall outcome in orthopedic injuries, was used. Orthopedic outcome tools (Majeed score,^[14] Iowa Pelvic Score [IPS], and Pelvic Outcome Score) were also used to determine patient

Table 1. Young and Burgess classification

Mechanism and Type	Characteristics	Displacement	Stability
AP compression, type I	Pubic diastasis <2.5 cm	External rotation	Stable
AP compression, type II	Pubic diastasis >2.5 cm, anterior SI joint disruption	External rotation	Rotationally unstable, vertically stable
AP compression, type III	Type II plus posterior SI joint disruption	External rotation	Rotationally unstable, vertically unstable
Lateral compression, type I	Ipsilateral sacral buckle fractures, ipsilateral horizontal pubic rami fractures (or disruption of symphysis with overlapping pubic bones)	Internal rotation	Stable
Lateral compression, type II	Type I plus ipsilateral iliac wing fracture or posterior SI joint disruption	Internal rotation	Rotationally unstable, vertically stable
Vertical shear	Vertical pubic rami fractures, SI joint disruption ± adjacent fractures	Vertical	Rotationally unstable, vertically unstable

AP: Anteroposterior; SI: Sacroiliac.

outcome. All of the surveys and tools were applied by an independent observer via personal interviews, except for the Pelvic Outcome Score, which evaluates the radiographs for residual displacement. The SF-36 is a general health assessment tool constructed to provide a broad measurement of health and has been vali-

dated and shown to be reliable for the Turkish population.^[15] The survey was administered by means of a personal interview or telephone conversation. Each scale is evaluated with a range score of 0 to 100, and can be compared with an age- and gender-matched set of normal values.

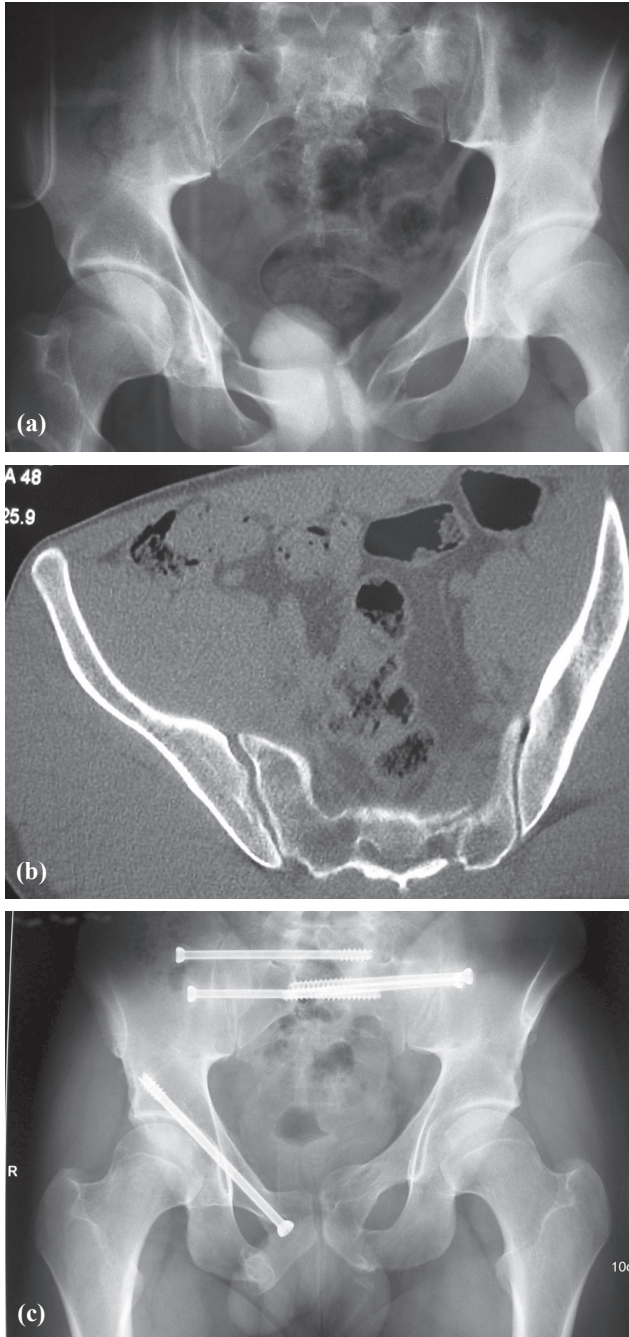


Fig. 1. (a) Anteroposterior pelvic X-ray of a 21-year-old man with unstable pelvic fracture. (b) Computed tomography section showing posterior injury. (c) Anteroposterior pelvic X-ray three years after percutaneous treatment of the fracture. The Majeed radiographic score was excellent. The Iowa Pelvic Score was 87 points (excellent). The physical function score of SF-36 was 94.4.

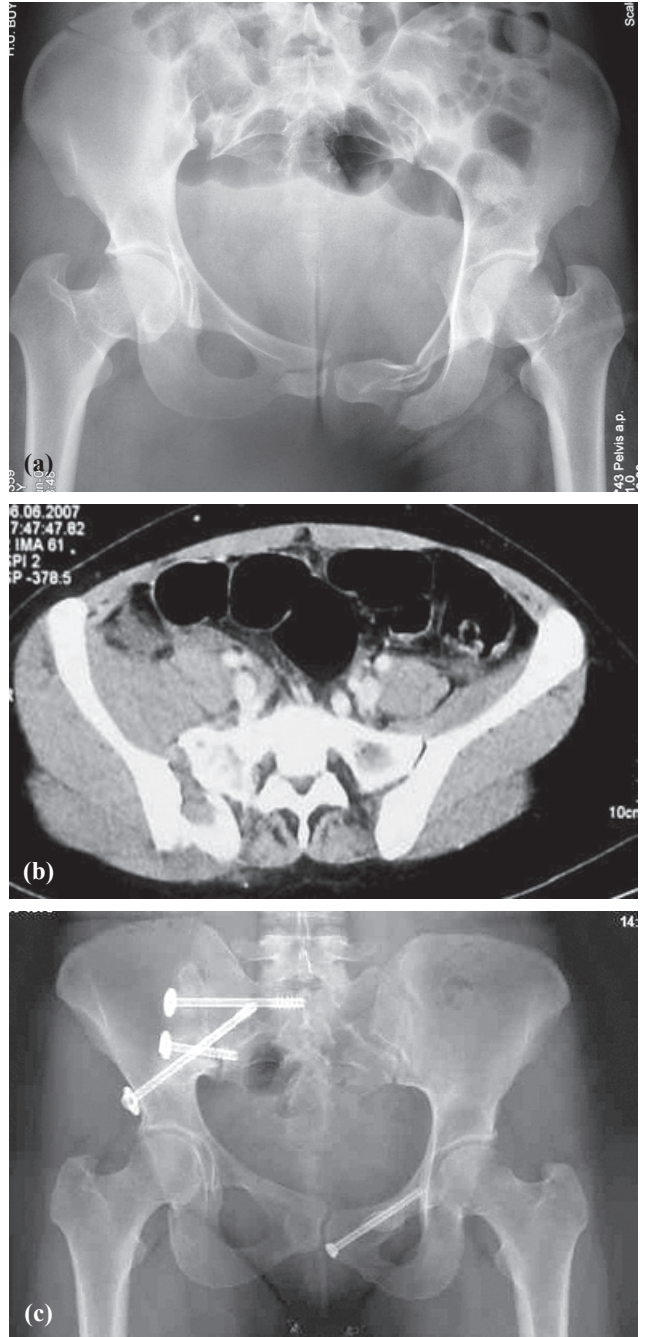


Fig. 2. (a) Anteroposterior pelvic X-ray of a 39-year-old woman with unstable pelvic fracture. (b) Computed tomography section showing posterior injury. (c) Anteroposterior pelvic X-ray two years after percutaneous treatment of the fracture. The Majeed radiographic score was excellent. The Iowa Pelvic Score was 90 points (excellent). The physical function score of SF-36 was 100.

The Majeed score is a pelvic injury-specific functional assessment divided into the following seven items: pain, work, sitting, sexual intercourse, standing, unaided gait, and walking distance.^[14] The IPS is also a pelvic injury-specific assessment divided into the following 6 items: daily living activities (20 points), work history (20 points), pain (25 points), limping (20 points), visual pain line (10 points), and cosmesis (5 points).^[16] Each of the total Majeed scores and IPSs range from 0-100; higher scores represent decrease in disability.

A 40-point Pelvic Outcome Score is used to assess the following items: pain, ambulation, work and activity status, clinical examination, and radiographs.^[6] Postoperative anteroposterior and inlet and outlet views of the pelvis were used to determine a radiographic score based on the presence of healing, reactive changes or fusion at the sacroiliac joint and the degree of anterior or posterior displacement.

RESULTS

The minimum follow-up was 2 years, with a mean duration of follow-up of 33.3 months (range, 24-52 months). The mean ISS was 31 (range, 16-50). Five patients had anteroposterior compression type III (APC-III), 3 patients had APC-II, 3 patients had lateral compression type II (LC-II), 4 patients had LC-III, 4 patients had vertical shear (VS) injuries, and 2 patients had combined mechanism (CM) injuries. The mean delay of surgery was 3 days (range, 0-7 days). Iliosacral screws were used in all patients for posterior fixation, and for anterior fixation, retrograde pubic ramus screws were used in 11 patients and external fixators in 6 patients. Screws were applied in the supine position and under fluoroscopic guidance. One pubic ramus screw was removed because of an intra-articular placement and another screw was removed due to a superficial infection. One iliosacral screw was changed for treatment of pseudoarthrosis. There were no fixation failures or neurovascular complications. The radiographs of two patients are shown in Figures 1 and 2.

The associated injuries were as follows: chest injuries (pneumothorax, hemothorax, rib fractures, lung contusions) in 5 patients; cervical spine injuries in 2 patients; thoracic spine injury in 1 patient; lumbar spine injuries in 2 patients; lower extremity fractures in 9 patients; upper extremity fractures in 2 patients; head injuries (skull fractures, subdural and subarachnoid hematomas); hepatic injuries in 2 patients; splenic injury in 1 patient; sigmoid rupture in 1 patient; and urethral injuries in 2 patients. Two patients with sacral fractures had cauda equina lesions pre-operatively that resolved within 6 months after stabilization.

The average Majeed score was 93.3 (range, 72-

100; 19 excellent and 1 good clinical grades). The average IPS was 86 (range, 82-90). There were 11 patients with an excellent IPS, and 9 patients with a good IPS according to Nepola et al.^[16] The average Pelvic Outcome Score was 33 (24-37).

The average SF-36 scores were comparable with the general population in terms of bodily pain, general health and social function scores, which were 3.3, 4.4, and 7.9, respectively. Similar to the general population, the average physical component score of the SF-36 was 81.3 (range, 22.5-100), and the average mental component score of the SF-36 was 80.8 (range, 33.3-100).

Fourteen patients who were working before the injury had returned to their current full-time jobs at the time of the final follow-up evaluation; of those, only 1 patient working as a salesman had to change his job.

DISCUSSION

In the present study, we have reported the long-term outcome of patients with unstable pelvic fractures treated with closed reduction and percutaneous fixation. The average Majeed score, IPS and Pelvic Outcome Score of the patients were 93.3, 86, and 33, respectively. The average scores of all components of the SF-36 were comparable with the normal population, and 92% of the working patients returned to their full-time jobs after treatment.

The ideal treatment for unstable pelvic fractures remains a matter of debate. The main purpose of the treatment for these serious injuries is to save the patient's life and then to achieve an excellent functional outcome.

Several operative and non-operative treatment options have been suggested for acute management of severe pelvic disruption. External fixation has been previously recommended for the early emergent stabilization of unstable pelvic ring disruptions to aid in hemodynamic resuscitation;^[17] however, the use of external fixation as a definitive means of stabilization in patients with posterior injuries is still questioned because of its mechanical inability to maintain reduction. Current treatment approaches emphasize the need for early anatomic restoration and internal fixation to maintain reduction and to improve the functional outcome of these patients.

Open reduction and internal fixation of pelvic ring disruptions are routinely delayed to avoid entering the pelvic hematoma, thereby causing additional hemorrhage with an increased risk of mortality. Delayed operative intervention allows maturation of the hematoma, but diminishes the success of closed manipulative reduction. However, open reduction and internal fixation of posterior pelvic injuries, in particular, are

associated with a high rate of wound complications.^[18]

Closed reduction and percutaneous fixation can be urgently performed, even during the initial resuscitation of the patient, thereby diminishing pelvic bleeding. Percutaneous pelvic ring fixation using fluoroscopic guidance provides stability. Stable percutaneous pelvic fixation also decreases operative blood loss and time, is associated with a very low wound complication rate, and allows comfortable mobilization of the patient. Accurate closed reduction of pelvic ring disruption is necessary before percutaneous fixation, and is best accomplished before maturation of the pelvic hematoma and deformity. Percutaneous pelvic fixation does not decompress the pelvic hematoma; thus, early surgical stabilization would be possible without the risk of additional hemorrhage, thereby allowing improved patient comfort, mobility and healing. Although these advantages of closed reduction and percutaneous fixation are well known, to our knowledge there is no published data on the quality of life and functional outcome of patients treated in this manner.

The outcome of operatively-treated pelvic fractures has been examined, and many authors have reported that average SF-36 scores were impaired in $\leq 55\%$ of the patients, and $\leq 35\%$ of the patients could not return to their current jobs.^[6,19-25] The associated injuries alter the long-term outcome of patients with unstable pelvic injuries.^[6,19,20] Neurologic injuries have been reported to have a detrimental effect on outcomes.^[20] The lack of long-term follow-up, uniformity in initial treatment and experience of the surgeon in this field are other problems when evaluating the long-term functional outcomes.^[6]

The better findings of the present study regarding the functional outcome of patients may be attributed to the lower percentages of neurologic injuries (10%) compared to studies reported previously ($\leq 38\%$).^[20] Another reason for the discrepancy in findings may be the relatively longer patient follow-up. It has been reported previously that patients with longer than 1 year of follow-up had better outcomes.^[6] In addition to the longer follow-up duration, uniformity of the treatment protocol and application of the procedures by the same surgeon may be regarded as the strengths of the present study. On the other hand, the retrospective design, lack of a control group, small sample size, and presence of heterogeneous injuries were the limitations of the study.

Percutaneous treatment is suggested in the treatment of unstable pelvic fractures as it avoids the use of extensive approaches, bleeding, wound complications, and prolonged surgeries. Better outcomes can be achieved in the long-term follow-up. Further studies with larger sample sizes are needed.

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