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ORIGINAL RESEARCH

Crescent Technique with Dual C-Shaped Reconstruction Plates for Posterior Acetabular Wall Fractures

Cem Yalın Kılınc[1], Ahmet Emrah Acan[1], Emre Gultac[1], Rabia Mihriban Kılınc[2], Sancar Serbest[3], Ugur Tiftikci[3] and Nevres Hurriyet Aydogan[1]

[1]*Faculty of Medicine, Department of Orthopedics and Traumatology, Mugla Sitki Kocman University, Mugla, Turkey;* [2]*Faculty of Medicine, Department of Radiology, Mugla Sitki Kocman University, Mugla, Turkey;* [3]*Faculty of Medicine, Department of Orthopedics and Traumatology, Kırıkkale University, Kırıkkale, Turkey*

ABSTRACT

Background: Here we have defined a novel technique for repairing posterior acetabular wall fractures called the "crescent technique," in which dual C-shaped reconstruction plates overlap at the distal ends and, if necessary, at the proximal ends. We also analyzed the efficacy and reliability of this method. *Patients and Methods:* This was a retrospective analysis of 27 patients undergoing the crescent technique. All of the fractures were treated by the senior author for a mean of 7.9 days (0–15 days) after the trauma. The mean follow-up period was 19 months (13–29 months). The clinical results were evaluated using the modified clinical grading system developed by Merle d'Aubigne and Postel, and then modified by Matta. The radiographs were graded according to the criteria described by Matta. *Results:* In the clinical grading, 16 (59%) of the patients were excellent and very good, 5 (19%) were good, 3 (11%) were moderate, and 3 (11%) were poor. According to the Matta radiological evaluation criteria, 19 (70%) were excellent, 4 (15%) were good, 4 (15%) were fair, and none were poor. Statistically significant consistency was seen between the clinical and radiological results ($p = 0.002$). *Conclusions:* The crescent technique is a dual plate technique modification that can provide a stable fixation. It appears to be an effective and reliable method for treating posterior wall fractures of the acetabulum.

Keywords: acetabulum; dual plate; fracture; posterior wall

INTRODUCTION

Fractures of the posterior wall of the acetabulum are the most common acetabular fractures. In Letournel's series of 940 acetabular fractures, 24% were isolated and 26% involved a fracture of the posterior wall as part of a more complex fracture pattern [1,2]. Since these are usually high-energy fractures, there is often concomitant hip dislocation. In an unstable hip and/or when a large part of the posterior wall is involved, an open reduction and internal fixation are required [3–5]. Most of these fractures are comminuted; therefore, the reduction and stabilization are extremely difficult [2]. Moreover, the clinical results are directly affected by the reduction quality [3,6,7]. The main goal of surgery is to obtain a stable hip with an anatomical reduction and no step or gap formation [3,8–10]. In addition, the reduction must be protected until solid union is complete. Saterbak et al. emphasized the importance of this in a study reporting a 33% reduction loss rate at the end of a 1-year follow-up [6].

In order to overcome the challenges in reconstruction and to maintain anatomical reductions in comminuted posterior acetabular wall fractures, different fixation techniques have been described. For example, Im and Chung reported that interfragmentary screws used solely for single fragment or moderate comminution were useful for improving the clinical outcome [11]. Mast et al. reported the use of a spring plate technique that provided compression on the fragments via its hook [12]. Moreover,

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Address correspondence to Sancar Serbest, Faculty of Medicine, Department of Orthopedics and Traumatology, Kırıkkale University, Kırıkkale, Turkey. E-mail: dr.sancarserbest@hotmail.com.

Giannoudis et al. reported that a stable fixation could be achieved in comminuted posterior wall fractures with a two-level reconstruction technique, first using subchondral miniscrews, then lag screws and a buttress plate [13]. Li et al. reported the use of two parallel plates buttressing a posterior wall fracture without using fragment-specific screw fixation as a reliable and effective method [3].

The aim of this study was to define a novel technique using dual C-shaped reconstruction plates that overlap at the distal ends and, if necessary, at the proximal ends, called the "crescent technique" due to the geometry of the plates. We also analyzed the efficacy and reliability of this method.

PATIENTS AND METHODS

Approval for this study was granted by the Faculty Ethics Committee. Retrospective analysis was conducted of 37 patients who underwent the crescent technique using dual c-shaped reconstruction plates for a posterior acetabular wall fracture in our institution between June 2013 and July 2016. The inclusion criteria were as follows: the fractured part included >20% of the wall, there was an intra-articular fragment along with the wall fracture, an unstable hip after the reduction of the traumatic dislocation, irreducible fracture-dislocation, nonconcentric joint reduction, >2mm or more displacement in the dome of the acetabulum and complete preoperative and postoperative radiological evaluation with 3 standard plain radiographs (anteroposterior, 45° oblique Judet views), and fine-cut computerized tomography (CT) images. The exclusion criteria were as follows: an open fracture, associated head trauma that caused prolonged immobilization, fracture pattern rather than isolated posterior wall and posterior wall associated with posterior column fracture, patients who were lost in follow-up or with incomplete follow-up and medical records, and disease or conditions which made postoperative compliance unreliable.

Surgical Technique

In order to benefit from full muscle relaxation, all of the patients were operated on using the standard Kocher–Langenbeck approach in the lateral decubitus position under general anesthesia [1,13]. Trochanteric osteotomies were not needed to improve the approach in the entire group. A routine preoperative antibiotic prophylaxis of 1 g of cefazolin was administered; in those patients with known penicillin allergies, vancomycin was used. In this approach, the sciatic nerve was located first, and it was protected throughout the surgical intervention. In cases with sciatic nerve palsy, neurolysis was performed. Then fracture hematoma was debrided, and the posterior wall of the acetabulum was evaluated with respect to comminution and impaction and if accompanied, posterior column fracture assessed.

The plate placed lateral to the acetabular posterior wall is overlapped at its distal ends and, if necessary, at the proximal ends by a longer plate that extends more medially, which can also provide posterior column fixation (Figure 1). By contouring the 3.5-mm reconstruction plate to a mild C shape that would both buttress and fit the curvature of the acetabulum, the lateral plate was positioned at a distance of 3–4 mm from the labrum (Figure 1). After the appropriate placement of the lateral plate, a temporary fixation was made with a K-wire. Then, the second 3.5-mm reconstruction plate, selected to be longer than the first plate, was contoured to fit the acetabular wall and placed more medially both for to overlap the distal ends of the lateral plate and

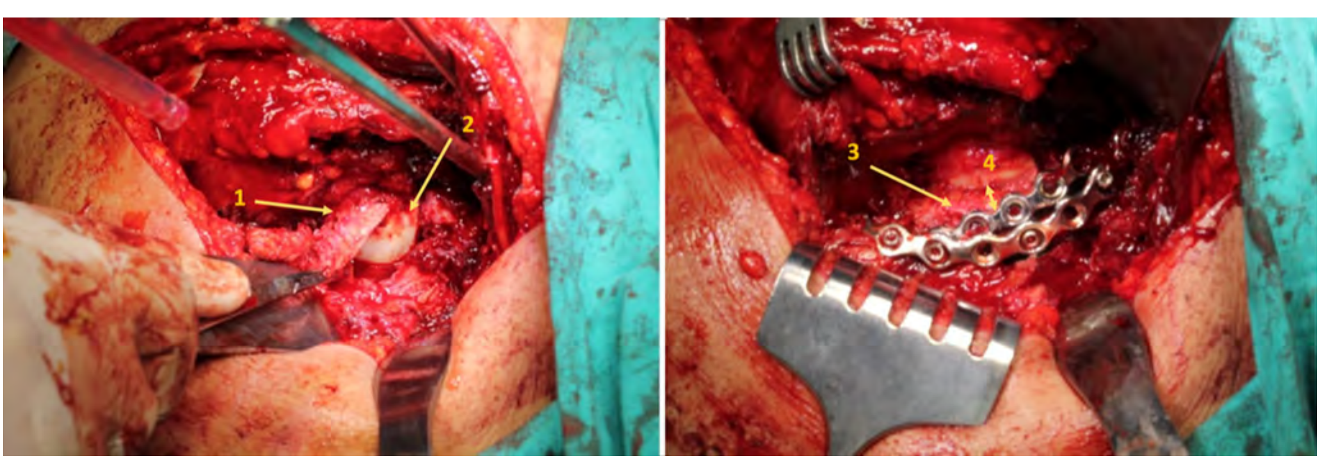

FIGURE 1. (1) Posterior wall fracture of the acetabulum. (2) Femoral head. (3) Reduced posterior wall fracture. (4) Distance between the labrum and the plate (3–4 mm).

acetabular posterior column fixation, if necessary. In cases with posterior column detachment, first posterior column was reduced with the help of reduction clamps or Schanz screws, and then reduction of the posterior wall and temporary fixation with K-wires followed with lateral plate and medial plate fixation in a sequence. Furthermore, the position of the medial plate can be adjusted more medially than the position in posterior wall only fracture to ride more along the medial edge of the posterior column for better fixation. The sciatic nerve was located and protected in all of the patients because of the proximity when placing the medial plate (Figure 2). Since there was limited bone surface for side-by-side fixation with double plate in the distal end of the acetabulum (when compared to the proximal), the plates in all of the cases were overlapped (Figure 3). The variation in the overlapping or side-by-side of the medial and lateral plates in the proximal area depended on the fracture configuration and proximal extent. In those patients with posterior column with posterior wall fractures in particular, the side-by-side fixation position was preferred to overlapping.

FIGURE 2. (1) Sciatic nerve. (2) Placement of the plates using the crescent technique.

Postoperative Follow-up

For the postoperative radiological evaluation, anteroposterior 45° oblique Judet view radiographs were taken [1,3,4]. Fine-cut CT images were taken of all of the patients before discharge, and the radiographs were graded according to the criteria described by Matta [5]. On the first postoperative radiographs, the fracture reduction was assessed and graded as anatomical (0–1 mm displacement), imperfect (2–3 mm displacement), or poor (>3 mm displacement) [5]. The drain was removed on the

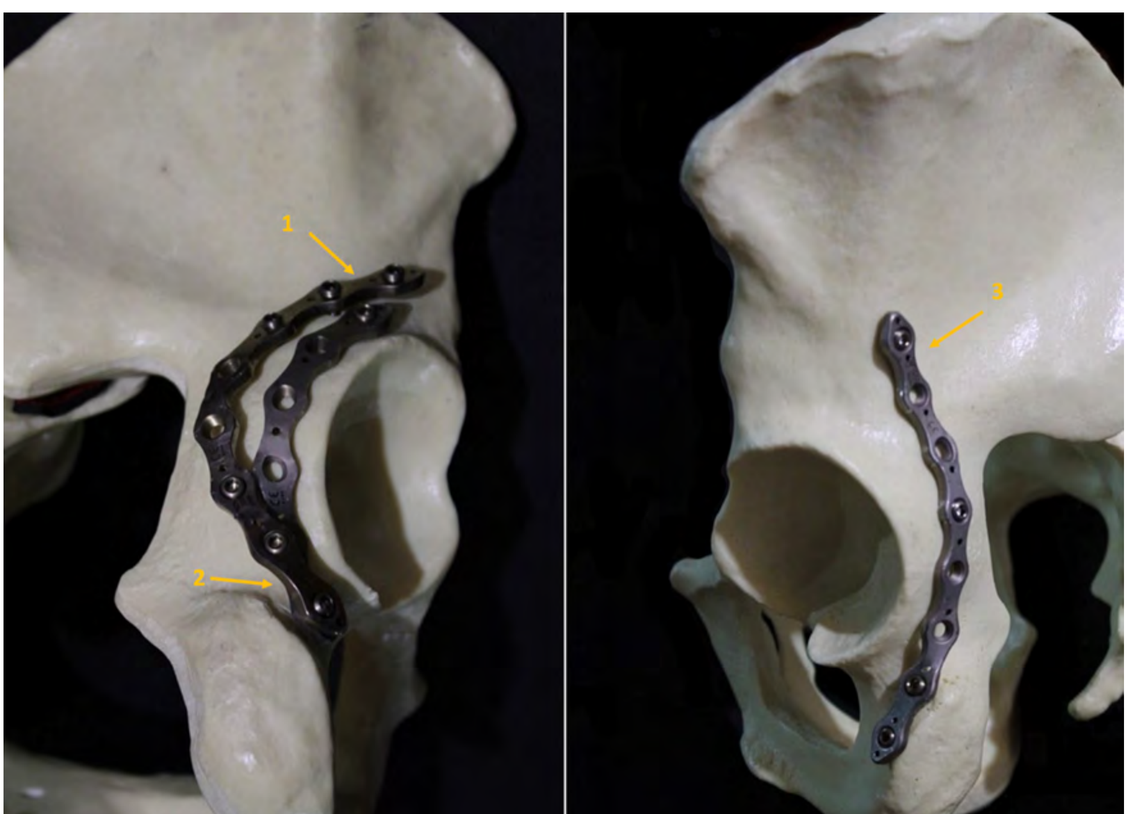

FIGURE 3. (1) Side-by-side placement of the plates proximally. (2) Overlapped placement of the plates distally. (3) Inappropriate plate placement.

2nd postoperative day, and until drain removal, all of the patients were administered 3 × 1 g of 1st generation cephalosporin. Enoxaparin was started at 1 × 0.6 ml for all of the patients and continued for 30 days postoperatively. Routine prophylaxis against heterotrophic ossification was not recommended. Mobilization was encouraged as early as medically possible and as tolerated, beginning with bed exercises. Depending on the fracture fixation stability, mobilization was limited to toe-touch weight-bearing with crutches or a walker for 10 weeks before partial weight-bearing was permitted. Full weight-bearing was only permitted after clinical and radiological bone union was confirmed. On the third month control radiographs, fracture union was complete in all patients and they permitted to have full weight-bearing.

The clinical follow-up was planned for 2 weeks, 6 weeks, 3 months, 6 months, and 1 year postoperatively. The mean follow-up period was 19 months (range 13–29 months). The clinical results were evaluated using the clinical grading system that was developed by Merle d'Aubigne and Postel and modified first by Letournel and Judet, then by Matta [5].

Statistical Analysis

The clinical results were separated into two groups: good-excellent and moderate-poor. The radiological results were classified as excellent, good, fair, and poor. Statistical analyses were conducted using SPSS version 20.0 software (SPSS Inc., Chicago, IL, USA), and a value of $p < 0.05$ was accepted as statistically significant. The relationships between the clinical and radiological results were evaluated using Fisher's exact test. For the categorical variables, the chi-squared test was used, and when the expected cell numbers were <5, a Fisher's exact test was used.

RESULTS

With the application of the exclusion criteria, two patients with open fracture, three patient with anterior wall/column fracture and five patients with incomplete follow up after treatment, were excluded. A total of 27 patients, comprised of 19 males and 8 females, were included in this research, and all of them had unilateral injuries (right-sided in 15 and left-sided in 12 patients). Eleven of the patients had a posterior column fracture in addition to the posterior acetabular wall fracture whereas 16 patients had isolated posterior wall fracture. The mean patient age at the time of injury was 37 years old (range 18–67 years). The mechanism of injury was as follows: traffic accident within the vehicle in 16 cases, motorcycle accident in 5 cases, and a fall from a height in 6 cases (Table 1). Of the 27 patients in this study, 12 had concomitant hip dislocations and 11 had posterior column fractures. Three of the patients with concomitant hip dislocations had sciatic nerve palsy with peroneal component involvement. In all the patients with hip dislocations, a closed reduction under anesthesia was attempted within the first 6 hours after the injury. Of these, 3 were irreducible with closed manipulation, and 2 with posterior column fractures required emergent open reductions and internal fixations. In the 9 cases that were reduced and the 15 cases without hip dislocation, the follow-ups were applied in the ward with skeletal traction until the surgery because of the risk of occult instability. Two of the patients with head trauma, 4 patients with spinal injuries, 3 patients with chest trauma, and 3 with abdominal trauma were admitted for surgery after a mean of 9 days (range 4–11 days) after the follow-up with skeletal traction in the neurosurgery, thoracic surgery, and general surgery clinics, respectively (Table 2). Provided there were no contraindications, a deep vein thrombosis prophylaxis of 40 mg/day of enoxaparin was administered until surgery. None of the patients required inferior vena cava filters due to contraindications to anticoagulation. None of the patients required antibiotic prophylaxis until 1 hour before the surgery.

The mean time from trauma to surgery was 7.9 days (range 0–15 days). The mean time to

TABLE 1. Demographic characteristics.

Characteristic	Value
Patient age (years), mean (range)	37 (17–67)
Male/female	19/8
Concomitant posterior column fracture	11
Dislocated hip concomitant to posterior wall fracture	12
Mean time from trauma to surgery (days)	7.9 (0–15)
Mean operating time (min)	141 (105–215)
Intraoperative blood loss (ml)	257 (100–650)
Mechanism of injury	
Traffic accident within the vehicle	16
Motorcycle accident	5
Fall from height	6

TABLE 2. Concomitant injuries.

Region of injury	Number of patients
Abdomen	3
Chest	3
Extremity	15
Head	2
Spine	4

TABLE 3. Clinical and radiological functional evaluation.

	Value
Clinical Grading System	
Very good	59% (16)
Good	19% (5)
Moderate	11% (3)
Poor	11% (3)
Radiological Evaluation	
Excellent	70% (19)
Good	15% (4)
Fair	15% (4)
Poor	–

operation for those patients with concomitant injuries was 9.4 days (range 7–15 days); in the remaining patients, it was 6.3 days (range 0–11 days). The 3 patients with sciatic nerve palsy after a hip dislocation underwent surgery on the same day in 1 case and at a mean of 5.5 days in the other 2 cases. All of the fractures were treated by the senior author, who expertised in pelvic fractures. The mean length of hospitalization was 14 days (range 10–23 days). The mean operating time was 2 h and 21 min (range 1 h and 45 min to 3 h and 35 min), while the mean blood loss during surgery was 287 ml (range 100–650 ml). Four of the patients required cartilage elevations due to defect areas or cartilage impaction; the defect site was filled with a graft taken from the iliac wing. Spring plates were used in 11 patients; as a single plate in 9 cases and 2 plates in 2 cases. If used, the spring plates overlapped by the 3.5-mm reconstruction plates according to crescent technique described in this study. No iatrogenic sciatic nerve palsy was encountered in any patient postoperatively. In 3 of the 12 patients with hip dislocations, the sciatic nerve palsy in the peroneal compartment was identified as contused but intact intraoperatively and fully recovered in a mean of 4 months (range 2–7 months).

In the clinical grading, as modified by Matta, based on the Merle d'Aubigne and Postel scoring, 16 (59%) patients were excellent and very good, 5 (19%) were good, 3 (11%) were moderate, and 3 (11%) were poor. According to the Matta radiological evaluation criteria, 19 of the patients (70%) were excellent, 4 (15%) were good, 4 (15%) were fair, and none were poor (Table 3). Statistically significant consistency was seen between the clinical results and the radiological results (Fisher's exact test $p = 0.002$). No statistically significant difference was determined between the male and female patients with regard to the clinical results ($p = 1$). In the evaluation of the clinical results of the 12 patients with hip dislocations, a significant relationship was found between a hip dislocation and the clinical results (Fisher's exact test $p = 0.001$). The clinical results of the patients who presented with concomitant hip dislocations were worse than those without hip dislocations.

According to the Merle d'Aubigne and Postel clinical scoring system modified by Matta, 3 patients were evaluated as poor, with avascular necrosis (Stage 4, Ficat and Arlet classification) seen in 2 cases and heterotrophic ossification in 1 case [14]. The reduction quality of the 2 patients with avascular necrosis was excellent in 1 and faulty in 1, and clinically, both were determined to be poor. A statistically significant correlation was seen between avascular necrosis and the clinical results ($p = 0.004$); however, no significant correlation was seen between avascular necrosis and the reduction quality ($p = 1$). Total hip prostheses were recommended for these 2 patients and the surgeries were scheduled.

No infections requiring antibiotic treatment or debridement developed in any of the patients in this study. In the patient with heterotrophic ossification, an evaluation was made based on the anteroposterior, iliac oblique, and obturator oblique radiographs, and it was determined to be grade III according to the Brooker et al. heterotrophic ossification classification [15]. Despite the excellent reduction quality in this patient, the clinical results were poor.

DISCUSSION

Although many surgeons are familiar with the posterior approach, the treatment of these fractures is not simple, and the clinical results reported after surgical treatment have varied [1,3,5,6,13,16–19]. In addition to the reduction quality, many other factors, such as the type of fracture and/or dislocation, time from trauma to surgery, femoral head injury, osteonecrosis, local complications, and other associated injuries, can affect the surgical outcome.

In the postoperative radiological evaluation of the current study, according to the Matta criteria, 19 (70%) patients were classified as excellent, 4 (15%) as good, and 4 (15%) as fair. None of the patients were evaluated as poor. According to the Merle d'Aubigne and Postel scoring modified by Matta, 16 (59%) patients were excellent and very good, 5 (19%) were good, 3 (11%) were moderate, and 3 (11%) were poor. Of the 3 patients evaluated as clinically poor, 2 had avascular necrosis and 1 had heterotrophic ossification. A statistically significant relationship was seen between the clinical results and the radiological results ($p = 0.002$). Other studies in the literature have reported that the reduction quality is a significant factor directly affecting the clinical results [3,5,8,9,20].

Since the majority of posterior acetabular wall fractures are comminuted, the reduction and

FIGURE 4. Preoperative and postoperative radiographs and CT of a 52 years-old patient who had an in-car traffic accident. (1) Preoperative pelvic AP X-ray. (2) Preoperative pelvic Judet X-ray. (3) Preoperative pelvic axial CT. (4) Preoperative pelvic sagittal CT. (5) Postoperative pelvic AP X-ray. (6) Postoperative pelvic Judet X-ray. (7) Postoperative pelvic axial CT. (8) Postoperative pelvic sagittal CT.

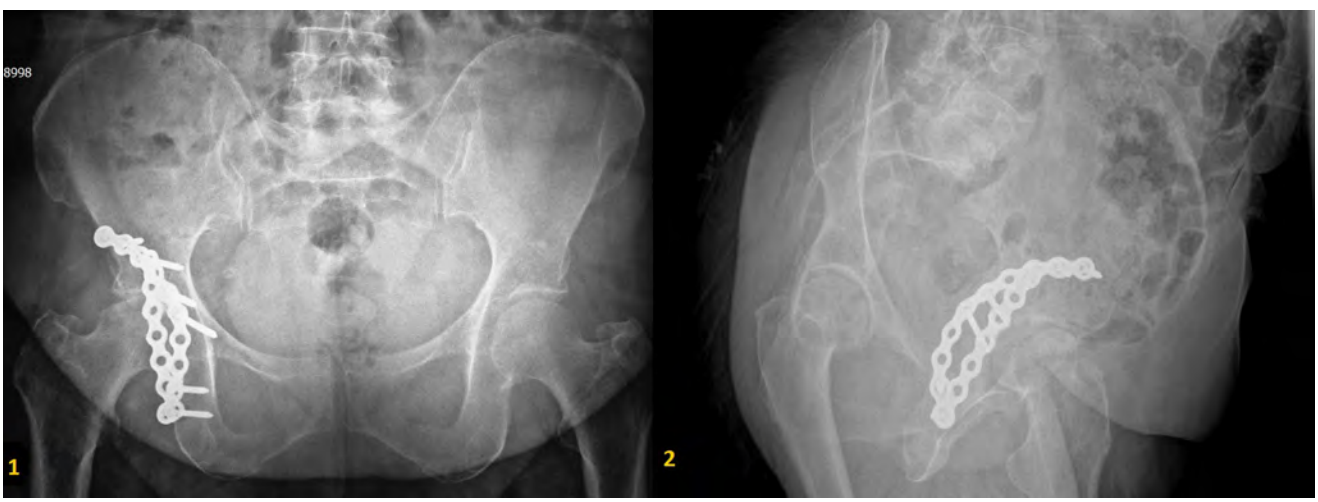

FIGURE 5 Postoperative 1st year radiographs of the 52 years-old patient who had an in-car traffic accident. (1) Postoperative pelvic AP X-ray. (2) Postoperative pelvic Judet X-ray.

stabilization are extremely difficult [2]. Saterbak et al. reported a reduction loss of up to 30% at the end of a 1-year follow-up period, and questioned the sustainability in addition to the reduction quality [6]. Different fixation techniques have been reported to overcome these difficulties in reconstruction and in maintaining the anatomical reduction of comminuted posterior wall fractures. In a series of 15 patients, Im and Chung reported that the use of screws alone for a single fragment or moderate comminution in their series with 15 patients was helpful to improve the clinical outcome [11]. However, no clear definition was given of the exact percentage of comminution and the minimum size of the fragments that could be fixated. Stöckle et al. reported excellent to good results using the lag screw technique with 3.5-mm cortical screws in 38 of 45 patients, and they recommended this technique for acetabular fractures with sufficiently large fragments. It was also recommended that an additional reconstruction plate be used for those patients with comminuted fractures, osteopenic bone, and reduced compliance [19]. Mast et al. reported the first use of the spring plate technique for the comminution of the posterior wall, with the plate secured to the posterior column by being bent into a slightly convex position, thereby providing compression on the fragments with its hook [12]. In a study by Giannoudis et al., a two-level reconstruction technique was used to provide stable fixation with the application of subchondral miniscrews before the lag screws and a buttress plate in comminuted posterior wall fracture cases [13]. In contrast, Li et al. used two parallel plates to buttress the posterior wall fracture without using fragment-specific screw fixation, and this was reported to be a reliable and effective method [3]. It was suggested that screws were not used in order to avoid fracture fragment injuries as a result of the bit drilling and vascular insults, since these can lead to necrosis and absorption [3]. Li et al. used two parallel reconstruction plates molded appropriately to the shape of the posterior wall [3]. Contrarily, Giannoudis et al. stated that it would be better to apply the plate wrapped around the acetabulum, rather than straight [13]. The crescent technique described in this study is a dual plate application technique primarily designed for posterior wall fractures of the acetabulum and based on the idea that the buttress effect of the lateral short plate is increased when overlapped at its distal ends and, if necessary (depending on the fracture configuration), at the proximal ends by a longer plate which extends more medially. Thus, the loading to the lateral plate is distributed to the medial plate, which has been fixed with better bone stock, and a higher load to failure can be obtained (Figure 4 and Figure 5). With this technique, the plates better encircle the acetabulum, as described by Giannoudis et al., and no fragment-specific fixation is made, as described by Li et al., thereby encompassing the advantages of both techniques. However, we used this technique also for posterior column with posterior wall fractures in 11 patients by taking advantage of the medial plate can fixate the posterior column. In cases with posterior column with posterior wall fractures, additional modifications can be used such as side-by-side fixation position proximally rather than overlapping and more medial positioning of the medial plate to ride more along the medial edge of the posterior column for better fixation. As side-by-side fixation position proximally can be seen from Figure 3, through their contact points, medial plate can still support the lateral plate fixation although there is no overlapping between medial and lateral plates. We also think that, even if there are no contact points between the medial and lateral plates proximally, it will still increase the overall fixation strength of the lateral plate due to distal overlapping. This technique can also be supported by spring plate technique, if necessary. Thus, with a more rigid and stable fixation provided, earlier postoperative functional exercise will lead to better functional outcomes, and reduction losses, such as the 33% (14/43 cases) after 1 year reported by Saterbak et al., can be overcome [6]. Furthermore, following the congruent reduction and rigid fixation provided by the dual plate buttress effect, the limited micromotion that develops together with weight-bearing has been reported to have effects that could facilitate the elastic deformation of the acetabulum, which has become more congruous with the femoral head. It could also promote callus formation in the early period of fracture healing, which might result in increased mechanical stability [3,7,21–23]. Throughout the 19-month (range 13–29 months) mean follow-up of the current study, no reduction loss was observed in any of the patients. This suggests that the crescent technique provided sufficient rigidity during the postoperative period.

Recently, W-shaped acetabular angular plate (WAAP) was invented to manage the posterior wall fracture (associated with posterior column). WAAP has different sizes that fits the contour of the posterior column of the acetabulum, and the plate itself can be thought to consist of three regions: the iliac region, the danger zone region, and the ischial tuberosity region. Screw penetration into the hip joint can be avoided with the help of angled design of the drilling guide. Zhang et al. reported a study that assess the medium-term results of the reconstruction of posterior acetabular wall fractures using a WAAP in 25 patients compared to using a long reconstruction plate from the ilium to ischium in 28 patients [24]. In the control group, intra-articular screw placement was observed intraoperatively in 5 patients (17.86%), and the definitive location of the periarticular hardware could not be determined in 4 patients (14.29%) during the operation. The differences between the two groups were statistically significant ($p = 0.002$). In contrast, the quality of fracture reduction, clinical outcomes, and radiological grading in the study group were not significantly different between groups ($p > 0.05$). They concluded that reconstruction of posterior wall fractures of the acetabulum using a WAAP can help avoid screw penetration of the hip joint with the help of angled design of the drilling guide, thus reducing the operation time and blood loss and provide a stable fixation of the posterior wall, and ensure good clinical outcomes [24]. As emphasized by Zhang et al. the avoidance of screw placement in the danger zone of the pelvis could minimize the possibility of screw penetration into the hip joint. However, by not placing a screw in the danger zone, the overall stiffness of the internal fixation would be reduced, potentially leading to a loss of fixation in time [24]. With the crescent technique, these problems can be overcome. Because the medial plate that overlaps the lateral plate, fixated with better bone stock and more screws, increases buttress effect of the lateral plate, distributes the load of the lateral plate to the medial plate to achieve a higher load to failure, and provides better overall stiffness. Therefore, we utilized buttress effect of the medial plate instead of attempting to use more screws in fixation of lateral plate, especially in the danger zone. Contrary to Zhang et al., no patients that had articular screw penetration detected on postoperative CT with crescent technique. Moreover, no reduction loss was observed in any of the patients.

In a study by Matta et al., which compared 83 cases of acetabular fracture with and without concomitant hip dislocation, an excellent or good clinical outcome was reported in 71% ($n = 59$) of those with hip dislocations and in 78% ($n = 140$) of those without hip dislocations, with no statistically significant difference between the groups [5]. Similarly, in a series of 57 cases reported by Li et al., no significant difference was determined in the clinical results between 10 cases with concomitant hip dislocations and 47 cases without [3]. However, in the current case series of 27 patients, a statistically significant difference was seen in the clinical results between the 12 cases in which the acetabular posterior wall fracture was accompanied by a traumatic hip dislocation and the 15 cases with no hip dislocations ($p < 0.0002$). A traumatic hip dislocation concomitant to a posterior acetabular wall fracture generally occurs after exposure to high-energy trauma and is thought to be reflected in the clinical results.

Those patients admitted for surgery on the first day because the hip was unstable after a reduction or a closed reduction could not be applied obtained excellent, very good, and moderate results according to the clinical evaluation scores. Results from good to poor were obtained in those patients who were thought to be stable and underwent surgery following traction ($p < 0.0003$). Therefore, those patients with acetabular wall fractures and concomitant traumatic hip dislocations should undergo surgery on the first day, provided there are no contraindications.

Following a posterior acetabular fracture, there can be an impairment in the feeding of the femoral head, and subsequently, avascular necrosis may develop, which will lead to poor clinical results, irrespective of the treatment [5,6,25]. Osteonecrosis following an acetabular fracture was reported at a rate of 3% (8/262 patients) by Matta et al., 4% (19/492) by Letournel and Judet, and 2% (2/57) by Li et al. [1,3,5]. The 2 (7%) patients that developed avascular necrosis in the current study had hip dislocations. Despite receiving hip reductions within the first 6 hours, avascular necrosis did develop in these patients. In parallel with the findings of other studies, the development of avascular necrosis in the current study led to poor clinical results [5,13,19].

Major limitations of this study are the small sample size with no control group and retrospective analysis. If the control group was consisted of WAAP and two parallel reconstruction plate technique, this study would have been more valuable, and due to its retrospective nature, prone to various forms of bias such as selection bias and recall bias. The fact that the current study only included 27 cases is one limitation with respect to understanding the advantages and disadvantages of this technique and for the comparison with the other techniques. Moreover, the possible mechanical advantage asserted is the distribution of the loading of the lateral plate to medial plate, which has been fixed with better bone stock, to have higher load to failure is not supported by any data in the literature and needs some cadaveric study to formally assess the mechanical stability of the technique. This is also another important limitation of the study.

CONCLUSIONS

The reconstruction of posterior wall fractures and also posterior column with posterior wall fractures of the acetabulum using the crescent technique is a modification of the dual plate technique and can provide stable fixation without a loss of reduction during the postoperative period and is safe for functional rehabilitation. Despite the relatively low number of cases and the absence of biomechanical tests, the crescent technique appears to be an effective and reliable method for the treatment of posterior wall fractures and also posterior column with posterior wall fractures of the acetabulum.

DECLARATION OF INTEREST

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

ORCID

Cem Yalın Kılınc http://orcid.org/0000-0003-2568-0500
Sancar Serbest http://orcid.org/0000-0003-2696-8303
Ugur Tiftikci http://orcid.org/0000-0002-2403-071X

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