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The Reconstruction of Periprosthetic Pelvic Discontinuity

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Abstract: The surgical techniques and outcomes of acetabular reconstruction for periprosthetic pelvic discontinuity cases are reported. The mean time to surgery for 9 patients with acute pelvic discontinuity was 16.3 days, with 8 patients (88%) having posterior column plating and a porous metal acetabular cup. No cases required revision surgery, with a mean follow-up of 34 months (range, 24-67 months). Of the 62 chronic pelvic discontinuity cases, 20 had an ilioischial cage, with a revision rate of 29%. There were 42 cup-cage reconstructions with an 8-year survivorship of 86.3%, with a mean follow-up of 35 months (range, 24-93 months). Stable reconstruction of chronic pelvic discontinuity was achievable by distraction using a cup-cage acetabular reconstruction; however, satisfactory stability of acute pelvic discontinuity was achieved with compression of the posterior column using screw augmentation of the acetabular shell supplemented by posterior column plating. **Keywords:** pelvic discontinuity, acetabular revision, bone loss, ilioischial cage, cup cage.

Massive acetabular bone loss provides a challenge for the reconstructive surgeon. Periprosthetic pelvic discontinuity describes the loss of structural bone between the superior and inferior aspects of the pelvis, resulting from bone loss or fracture through the acetabulum [1,2]. Although relatively rare at present, the incidence is likely to rise with an aging, active population and an increasing caseload of primary and revision total hip arthroplasty [1,3-6].

Recent improvement in biomaterials such as porous trabecular metal have afforded a superior capacity for bone ingrowth that makes the use of hemispherical uncemented cups feasible for acetabular revision with marked bone loss [7-10]. Unlike the algorithms for management of native acetabular fractures, the treatment of periprosthetic pelvic discontinuity is less well defined [2,8,11-14].

The biology and biomechanical stability differs between acute and chronic pelvic discontinuity, and the reconstructive surgical techniques should differ accordingly. The purpose of this study is to report the surgical techniques, outcomes, and complications of acetabular reconstruction for both acute and chronic pelvic discontinuity treated at 2 tertiary referral orthopedic units.

Methods

Institutional board approval was obtained. This 2-center study identified 71 cases of pelvic discontinuity that were classified into acute, less than 12 weeks from primary surgery, or chronic, greater than 12 weeks from primary surgery. All cases were treated at academic tertiary referral units, and all surgeries were performed by senior surgeons.

The patients' demographics in both case series are shown in Table 1. In all patients, pelvic discontinuity was based on the radiologic findings and confirmed intraoperatively by the senior author, with the hemipelvis being separated superiorly and inferiorly because of loss of the host bone or fracture through the acetabular columns. Routine radiographic and clinical follow-up was undertaken, and the incidence of complications or revision surgery was obtained.

Acute Case Series

Nine cases of acute pelvic discontinuity secondary were identified, with a mean age of 67.4 years (range, 30-83 years) and a mean follow-up of 34 months (range, 24-67 months). All cases were female. These

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Table 1. Demographics and Follow-Up for Acute And Chronic Pelvic Discontinuity

	Acute	Chronic
n	9	62
Mean age (y)	67.4	67.5
Age range (y)	30-83	27-88
Male, n (%)	0 (0)	15 (24.1)
Female, n (%)	9 (100)	47 (75.9)
Mean follow-up (mo)	34	35
Follow-up range (mo)	24-67	24-93

cases were managed by senior surgeons at an academic orthopedic department (P.A.M., S.H.B., M.B.), a tertiary referral unit for both pelvic and acetabular trauma and hip reconstruction.

Blunt trauma was the cause of the pelvic discontinuity in 4 cases; iatrogenic trauma during the insertion of uncemented acetabular cups was the cause in the remaining 5 cases. Of the 9 acute cases, most had only 1 previous operation, a primary total hip arthroplasty, on the affected side; whereas a single patient had 2 previous surgeries. All patients with acute pelvic discontinuity had uncemented acetabular components in situ.

The initial diagnosis and referral and preoperative planning used plain radiographs and computed tomography. The criteria described by Berry [15] were used to diagnose pelvic discontinuity including a visible transverse pelvic fracture on anteroposterior pelvic or Judet radiographs, medial offset of the inferior part of the pelvis in relation to the superior part of the pelvis as seen by a break in the ilioischial line, and rotation of the hemipelvis as indicated by asymmetry of the obturator ring on the true anteroposterior pelvic radiograph. However, the senior operating surgeon confirmed the definitive diagnosis of pelvic discontinuity once the entire acetabulum was directly visualized intraoperatively.

A transverse or "T" pattern fracture was seen in most the acute pelvic discontinuity acetabuli. All cases were performed using a posterior or Kocher-Langenbeck approach, and the details of the surgical management of these cases are detailed in Table 2; (available online at www.arthroplastyjournal.org). Acetabular reconstruction used modular trabecular metal acetabular components in all cases. In most cases (8/9), the posterior column was stabilized with a reconstruction plate initially in addition to revising the acetabulum.

Chronic Case Series

There were 62 cases of chronic pelvic discontinuity, secondary to septic or aseptic periprosthetic bone loss, with a mean age of 67.5 years (range, 27-88 years) and a mean follow-up of 35 months (range, 24-93 months). The reconstructive techniques used for the chronic pelvic discontinuity series include an ilioischial cage or a cup-cage reconstruction [8], performed by or under the direct supervision of one of the senior authors (A.E.G.). Of these 62 cases, 18 (29%) concurrently underwent femoral component revision. The diagnosis was frequently not obvious before surgery, despite the routine use of pelvic computed tomographic scans and Judet view radiographs. Therefore, a high index of suspicion was maintained during surgery, with a pelvic discontinuity specifically checked after initial gentle reaming.

Operative Technique

A modified trochanteric slide or extended trochanteric osteotomy was performed to obtain an adequate exposure of the acetabular and has previously been described [16-18]. Maintaining the continuity of the vastus lateralis and abductors by using a trochanteric osteotomy affords a good exposure with acceptable rates of limp and nonunion [16-19]. The acetabulum was gently reamed, the degree of acetabular bone loss was assessed, and the diagnosis of pelvic discontinuity was confirmed. The subsequent reconstruction involved either an ilioischial cage (ZCA or Burch-Schneider; Zimmer, Warsaw, Ind) or a cup cage.

The surgical technique for an ilioischial cage reconstruction used by the senior author has previously been described [20]. Morselized bone graft is used in all cases, and 4 cases had additional structural corticocancellous allograft. The appropriate reconstruction cage was chosen based on the size of the bone-grafted acetabulum using acetabular reamers, trial cups, and then a trial reconstruction cage. The inferior flange was either slotted or screwed to the ischium. The superior flange was carefully molded to the lateral acetabular dome of the ilium, with several screws placed through the cage into the dome positioning the flange on the host bone. A polyethylene liner was cemented into the ilioischial cage, ensuring an acetabular orientation of about 45° and 15° to 20° of anteversion.

The surgical technique for a cup cage has also been previously described [8]. The rationale for this construct is that an ilioischial cage provides initial stability to the reconstruction while shielding the trabecular metal cementless acetabular component from mechanical forces until biologic stabilization has taken place, which gives the entire construct its long-term stability. The acetabulum is prepared as described previously, and the defect was sized for a trabecular metal revision shell and a suitable-sized Trabecular Metal Acetabular Revision System cage (Zimmer) to bridge the ilium to the ischium. Morselized bone graft, a mixture of allograft and autograft, is firmly compressed into the acetabulum using spherical compressors. Screw fixation was used to augment the initial press-fit fixation of the acetabular component, and occasionally, this necessitated new drill holes being made through the trabecular metal of the acetabular component. The initial press fit was achieved with no more than 1 to 2 mm of underreaming. It should be noted that the drilling of new holes through a metal is only approved by the manufacture for the revision acetabular shell component (00-700-56-20; Zimmer). The fixation of the cage was made inferiorly with a slot into the substance of the ischium inferiorly in all patients, thus reducing the risks of screw fracture, cage migration, and sciatic nerve damage [20]. The superior flange of the cage was secured with screws; with care to avoid damaging the extrapelvic (superior gluteal nerve and artery) or intrapelvic (internal iliac and obturator vessels) structures [21-23]. A polyethylene liner was cemented into the cage in the appropriate inclination and version, with cement interdigitating through the holes in the cage to reduce micromotion between the cage and the acetabular component.

The percentage host bone contact to the acetabular shell component was estimated intraoperatively by a method previously reported [24]. In summary, with the trial cup in, each quadrant of the acetabular hemisphere was assessed separately for contact with the host bone, morselized bone graft, or no contact with the bone (uncoverage). Contact with each one of those surfaces was expressed in 20% segments for each quadrant (representing 5% segments for the whole hemisphere). The overall contact was calculated by joining the quadrant scores and was recorded on designated forms.

Statistical Analysis

For both the acute and the chronic case series, revision acetabular surgery either for any cause or for failure of the pelvic discontinuity reconstruction (metalwork failure) was used as the primary outcome measure. Where appropriate, Kaplan-Meier survivorship analysis was performed with respect to these outcomes.

Results

Acute

Six (67%) of the cases used autologous morselized bone graft in addition to the acetabular component. Two patients died of unrelated causes, although at the last follow-up, both hip reconstructions remained intact.

Overall, at the last follow-up, the reconstruction of acute cases had a 100% survivorship, with none of the cases had undergone further revision surgery. There were no reported cases of infection or subsequent dislocation; however, 3 cases had some abductor dysfunction and a limp.

A single case showed radiographic evidence of ischial nonunion but with no associated symptoms, and the patient has not undergone further surgery.

Prereconstruction and postreconstruction radiographs for the reconstruction of acute periprosthetic pelvic discontinuity are shown in Figs. 1 and 2, demonstrating open reduction and internal fixation of the posterior column, revision acetabular cup, and screw supplementation.

Chronic

The commonest primary diagnosis for the previous primary total hip arthroplasty in the chronic pelvic discontinuity case series was osteoarthritis (28/62), followed by inflammatory arthropathy (13/62). Four patients had neoplastic bone as the reported primary diagnosis for the previous total hip arthroplasty, including chondrosarcoma and metastatic lung carcinoma, and 2 patients had unspecified neoplastic bone lesions.

Fig. 1. Radiograph demonstrating an acute periprosthetic pelvic discontinuity with an uncemented total hip arthroplasty.

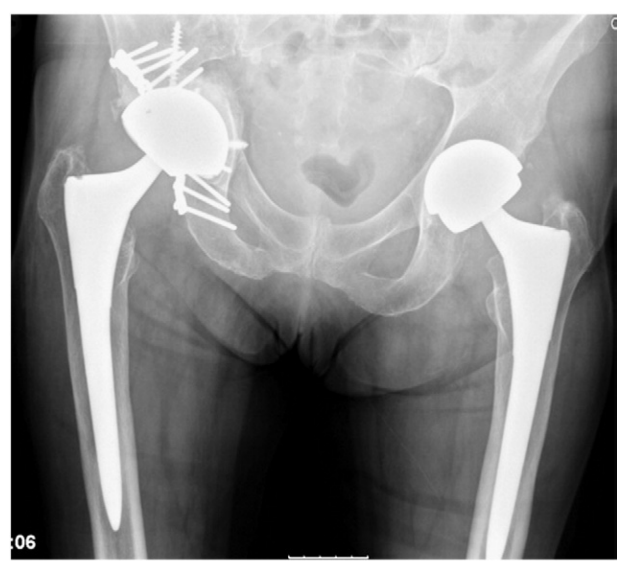

Fig. 2. Radiograph demonstrating acetabular reconstruction of acute periprosthetic pelvic discontinuity (as shown in Fig. 2) with posterior column plating and a large porous metal acetabular component 28 months after surgery.

Table 3. Complications Associated With the Surgical Management of Chronic Pelvic Discontinuity

Complication	Cup Cage (n = 42)	ZCA (n = 7)	Burch-Schneider (n = 13)	Total (n = 62)
Dislocations	6	0	1	7
Infections	1	1	0	2
Loose/Failed	1	0	1	2
Nerve lesion	1	0	0	1
Cup migration*	1	0	0	1
Deaths	1	0	3	4
Revisions—instability	2 (4.7%)	0	1 (7.7%)	3 (4.8%)
Revision—failed cage	2 (4.7%)	2 (28.5%)	3 (23.1%)	7 (11.3%)
Mean follow-up (mo)	32	34	42	35
Revision total	4 (9.5%)	2 (28.5%)	4 (30.7%)	10 (16.1%)
Time to revision (mo) †	6.5	16	19	NA

NA indicates not applicable.
* Radiographic cup migration observed, although not revised.
† Mean time from reconstruction to subsequent acetabular revision.

The revision rate for the cup-cage reconstructions was 9.5% (4/42 cases), with 2 cases revised for instability and 2 for a failed reconstruction. The revision rate for the ilioischial cage reconstructions was 28.5% (2/7 cases) and 30.7% (4/13 cases) for the ZCA and Burch-Schneider cages, respectively. Of the 6 ilioischial cage reconstructions that required revision, 5 were for failed cages and only 1 for instability.

The incidence of complications and revision rates for different reconstructions, including the mean time to further revision surgery, are shown in Table 3.

The cup sizes used and the amount of contact between the acetabular cup and bleeding host bone after reaming for each of the separate reconstructions used for chronic pelvic discontinuity are shown in Table 4; (available online at www.arthroplastyjournal.org). The overall mode and median cup size was 62-mm outer diameter, with a range of 46 to 80 mm. The mode and median femoral head size used was 32 mm, with a range of 28-40 mm. Eighteen (29%) of the chronic case series had concurrent revision of the femoral component, with 13 of these being modular femoral components (ZMR; Zimmer). For each of the 3 reconstructive methods used, the percentage contact with the host bone was consistently low, with the mean for each method being between 25% and 28% (see Table 4). Of the 62 chronic pelvic discontinuity cases, 5 incorporated structural allograft for the acetabular reconstruction, with 57 having morselized allograft.

The reported postoperative complications after the acetabular reconstruction of chronic pelvic discontinuity are detailed in Table 3. Of the 7 reported dislocations, 3 cases required open reduction, during which one had augmentation of polyethylene liner and the other had a constrained liner inserted. The remaining 4 cases of dislocation were managed with a closed reduction. Two cases developed infection, both superficial to the fascia lata, and underwent debridement, washout, and a course of intravenous and then oral antibiotics. Both cases did not require further surgery and at the last follow-up, no infection was clinically evident.

The overall revision rate, at the last follow-up, was 9.5% for cup-cage acetabular reconstruction compared with 28.5% and 30.7%, respectively, for ZCA or Burch-Schneider ilioischial cage reconstruction (see Table 3).

The Kaplan-Meier survivorship analysis for the chronic pelvic discontinuity cases managed with cup-cage reconstruction is shown in Figs. 3 and 4. Using any acetabular revision as an end point, the 8-year survivorship was 86.3% (see Fig. 3). However, using revision for a failed pelvic discontinuity reconstruction as an end point, such as metalwork failure and excluding revisions for hip instability, the 8-year survivorship was 93.8% (see Fig. 4).

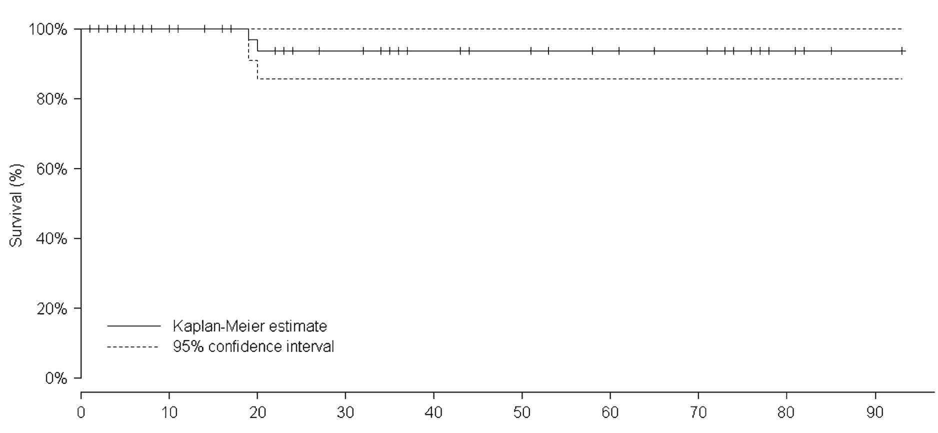

Fig. 3. Kaplan-Meier survivorship graph for chronic pelvic discontinuity patients treated with cup-cage reconstruction, with any revision as an end point.

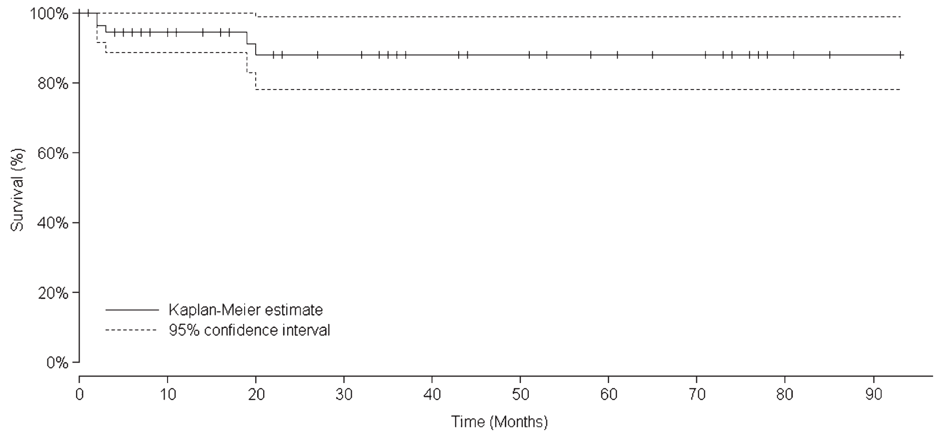

Fig. 4. Kaplan-Meier survivorship graph for patients with chronic pelvic discontinuity managed with a cup-cage reconstruction, with revision for a failed pelvic discontinuity reconstruction as an end point.

Radiographs are presented, demonstrating cup-cage reconstructions for failed ilioischial cage (see Figs. 5 and 6).

Discussion

Although the incidence of pelvic discontinuity has been reported at 0.9% of all revision total hip arthroplasties, the caseload is likely to increase with an aging and active population [1,3-5,25]. The inherent instability and lack of bone stock provide a challenge for acetabular revision surgery and risk factors including female sex, older patients, massive bone loss, osteoporosis, and rheumatoid arthritis [1]. Several surgical techniques have been advocated for treatment of periprosthetic pelvic discontinuity (or dissociation), including ilioischial cages [12], plate fixation of structural allografts [26], triflange cups [27], Steinmann pin fixation [13], acetabular revision with addition pelvic screws [2], acetabular reinforcement rings [28], oblong cups [29], and cup-cage reconstruction [8].

Despite numerous published studies reporting the case series of various treatment options (see Table 5), to date, no clear consensus to treatment has been proposed. In 2005, Sporer et al [30] suggested that the treatment of pelvic discontinuity is dependent on the remaining host bone, the potential for healing of the discontinuity, and the potential for biologic ingrowth of the acetabular components. The aim was to achieve cementless biologic fixation when possible, and an alternative reconstruction when insufficient stability was obtainable. If bone healing potential exists, some authors [31,32] proposed that compression of the posterior column should be achieved, either with a plate or trabecular metal cup acting as an "internal plate." Plate fixation achieved posterior column compression using the standard biologic principles of fracture fixation. A trabecular metal cup, augmented with acetabular screws above and below the discontinuity, may also afford sufficient biologic stability to afford bone union.

Alternatively, with insufficient host bone healing potential, they suggest that the discontinuity should be bridged and treated in distraction. The initial biomechanical stability of a modular acetabular reconstruction is substantially enhanced with distraction of the pelvic discontinuity compared with compression, particularly in an environment with minimal host bone healing potential. A large-diameter, trabecular metal, revision acetabular component provides the suitable biomechanical properties to both afford a stable initial distraction of a pelvic discontinuity and generate biologic stability by encouraging bone ingrowth [7,9,10,33-35].

However, the report by Sporer et al [30] did not provide supporting clinical evidence and concluded that "the long term clinical results of this treatment remain unknown." Insufficient bone healing may result from

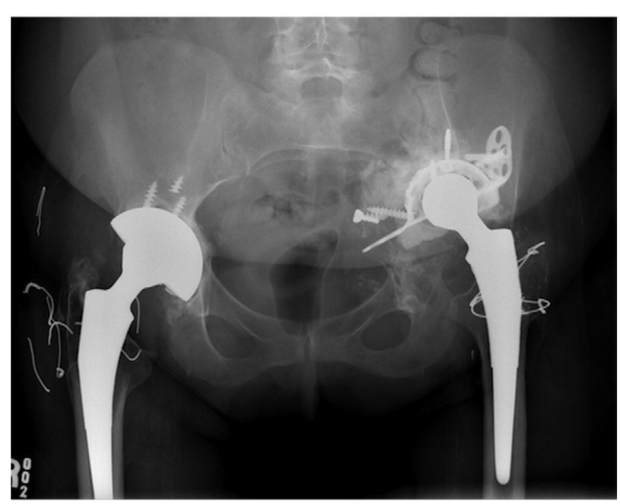

Fig. 5. Radiograph demonstrating a periprosthetic pelvic discontinuity secondary to a failed ilioischial cage reconstruction.

Fig. 6. Radiograph 32 months after a cup-cage reconstruction performed for periprosthetic pelvic discontinuity secondary to a failed ilioischial cage (see Fig. 5).

either quantitative (osteoporosis or severe osteolysis) or qualitative (infection or neoplastic) bone pathology.

Chronic Pelvic Discontinuity

The difficulty in achieving adequate stability with chronic pelvic discontinuity or major column defects was demonstrated in a case series reported by Stiehl et al [26]. Acetabular reconstruction with bulk allograft was supported with anterior and posterior column 3.5-mm AO reconstruction plates. With 10 cases of pelvic discontinuity, 6 required revision surgery, and with a further 7 cases with major column defects, the overall cases series of 17 had a revision rate of 47%. The authors conclude that because of these poor clinical results, this technique could not be recommended.

Several studies have shown that ilioischial rings afford a good clinical outcome for acetabular reconstruction bone defects that do not require bulk allograft or with coexisting pelvic discontinuity [36,37]. However, concerns regarding the high complication of standard ilioischial cages have led the senior author (A.E.G.) to develop the cup-cage technique [8,20]. Goodman et al [20] reported a consecutive series of 61 ilioischial reconstruction rings performed for severe acetabular bone loss, with 10 cases having pelvic discontinuity. Of these 10 cases, 4 needed revision surgery for failure of the ilioischial cage reconstruction, and the outcomes of this previously reported cohort have been incorporated into the data of this study. Figs. 5 and 6 demonstrate such a failed ilioischial cage, revised to a cup-cage acetabular reconstruction. Other studies have reported failure rates of up to 50% for ilioischial cage reconstructions of pelvic discontinuity [38].

The work of Bobyn and others [33] has highlighted the beneficial biomechanical properties of porous tantalum metal, including high porosity, high coefficient of friction, and a Young modulus similar to bone. These properties have made this biomaterial increasingly popular in revision hip arthroplasty [7,9,10,34,35]. The use of porous tantalum in the reconstruction of pelvic discontinuity is attractive because bone ingrowth can be achieved with less than 50% of bleeding host bone contact [8,24]. The results of this study demonstrate a consistently low percentage of contact between the cup and the bleeding acetabular bone for all of the reconstruction techniques used in chronic pelvic discontinuity (see Table 4; (available online at www.arthroplastyjournal.org). Therefore, we recommend the use of porous tantalum components in the reconstruction of such cases because of the ability of

Table 5. Literature Review of the Surgical Treatment of Pelvic Discontinuity

	N	Mean Follow-Up	Acute or Chronic	Journal	Year of Publication	Level of Evidence
Christie et al [27]	39	4.4 y	Chronic	*CORR*	2001	IV
Berry et al [1]	27	3 y	Chronic	*JBJS (Am)*	1999	IV
Koster et al [29]	4	3.6 y	Chronic	*J. Arthroplasty*	2006	IV
Paprosky et al [12]	16	2.6 y	Chronic	*CORR*	2006	IV
Bostrom et al [38]	6	30 mo	Chronic	*CORR*	2006	IV
Springer et al [14]	7	18 mo	Acute	*JBJS (Am)*	2005	IV
Kerboull et al [39]	12	10 y	Chronic	*CORR*	2000	IV
Peters et al [40]	15	29 mo	Chronic	J Arthroplasty	2004	IV
Lietman et al [41]	11	5 mo	Chronic	*Orthopedics*	2001	IV
Kosashvili et al [8]	26	44.6 mo	Chronic	*JBJS (Br)*	2009	IV
Eggli et al [28]	7	96 mo	Chronic	*CORR*	2002	IV
van Haaren et al [42]	6	7 y	Chronic	*JBJS (Br)*	2007	IV
Stiehl et al [26]	10	83 mo	Chronic	J Arthroplasty	2000	IV
Goodman et al [20]	10	3.3 y	Chronic	J Arthroplasty	2004	IV
This study	71	3 y	Acute (9) and chronic (62)	–	2011	IV

CORR indicates *Clinical Orthopedics and Related Research; JBJS Journal of Bone and Joint Surgery;* (Br), British Volume; (Am), American Volume.

bone ingrowth to be achieved with a low percentage of bleeding.

A large porous tantalum revision shell provides distraction that stabilizes the pelvic discontinuity while forming a bridging construct between the ilium and the ischium. A revision shell used in this manner is usually too vertical and retroverted to safely accommodate an acetabular liner. In addition, because of the inherent instability of pelvic discontinuity, additional protection is required to allow bone ingrowth, and this is achieved with a cup-cage reconstruction. By supplementing the construct with an ilioischial cage, a polyethylene liner can, thus, be cemented at the correct inclination and version, independent of the position and version of the acetabular shell.

Acute Pelvic Discontinuity

The results presented in this study demonstrate that acute periprosthetic pelvic discontinuity can be successfully treated with compression of the posterior column, principally using a plate supplementing a trabecular metal acetabular revision shell. This clinical evidence suggests that cases of acute periprosthetic pelvic discontinuity possess bone healing potential if compression is achieved, assuming normal bone metabolism (ie, no infective or neoplastic conditions). Compression of the posterior column may be provided via an "extra"-acetabular method, specifically a posterior column plate as principally demonstrated in this study. Alternatively, "intra"-acetabular compression can be provided by an uncemented shell augmented with screws above and below a pelvic discontinuity. The results of this study provide medium-term clinical evidence supporting the treatment principles outlined by Sporer et al [30].

Female patients and rheumatoid arthritis are significant risk factors for pelvic discontinuity, and excessive reaming should be avoided to maintain columnar support of the acetabulum [15]. This study, in addition to previous case series, demonstrates that transverse or T-pattern fractures are the commonest associated with acute pelvic discontinuity [14]. The relative stability of these fracture patterns probably differs. Low T-pattern fractures, commonly involving the inferior pubic ramus, are frequently significantly displaced and are likely to be unstable, necessitating open reduction and plate fixation before the insertion of an acetabular component. Currently, no published clinical evidence that quantifies the relative stability of different fracture patterns in acute periprosthetic pelvic discontinuity exists. Because of the massive bone loss seen with chronic pelvic discontinuity, the description of fracture patterns is not applicable, or indeed comparable, to the acute cases.

The contrast in reconstructive techniques used in cases of acute and chronic pelvic discontinuity supports the algorithmic treatment protocol initially proposed by Sporer and Paprosky [10] and Sporer et al [30], whereby the lack of the potential for bone healing in chronic cases dictates that initial stability is achieved with distraction, and biologic cementless fixation subsequently develops. Porous metal components currently provide the best characteristics for this. In comparison, adequate stability is produced in acute cases by compression of the posterior column in conjunction with an uncemented acetabular component.

In conclusion, this study, the largest reported series, demonstrates that stable reconstruction of chronic pelvic discontinuity is achievable with a cup-cage acetabular reconstruction owing to the inherent beneficial biologic and biomechanical properties of porous tantalum metal. This method provides stability by distraction. However, satisfactory stability of acute pelvic discontinuity can be achieved by providing compression using screw augmentation of the acetabular shell and/or posterior column plating.

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Table 2. Details of Management of Acute Pelvic Discontinuity

No.	Gender, Age (y)	Cause	Type of Reconstruction	Subsequent Revision	Prev Hip Surgeries*	Fracture to Surgery Time	Implant	Graft	Complications	Follow-Up
1	F, 56	Intraoperative	Plate, graft, cup	No	1	22 d	TM cup	Nil	Nil	46 mo
2	F, 83	Trauma	Plate, cup	No	1	8 d	TM cup + augment	Morselized allograft	Trendelenburg gait	56 mo RIP unrelated
3	F, 72	Trauma	Plate, cup with augment	No	2	32 d	TM cup	Morselized allograft	Nil	53 mo
4	F, 80	Intraoperative	Graft, cup	No	1	21 d	TM cup + augment	Morselized allograft	Nil	25 mo
5	F, 80	Intraoperative	Plate, cup	No	1	12 d	TM cup + augment	Nil	Nil	11 mo RIP unrelated
6	F, 80	Trauma	Plate, cup	No	1	14 d	TM cup	Morselized allograft	Abductor weakness	24 mo
7	F, 79	Trauma	Plate, cup with augment	No	1	2 y	TM cup	Nil	Asymptomatic ischial nonunion	
8	F, 30	Trauma	Plate, cup	No	1	6 d	TM cup	Morselized allograft	Trendelenburg gait	26 mo
9	F, 36	Intraoperative	Plate, graft, cup	No	1	16 d	TM cup	Morselized allograft	Nil	67 mo

TM indicates trabecular metal; RIP, patient deceased.
* Including intraoperative fracture if applicable.

Table 4. Mean, Mode, Median, and Range of Acetabular Cup Size and Percentage Contact With Bleeding Host Bone for the Reconstruction of Chronic Pelvic Discontinuity

		Cup Size (mm)				Percentage Host Bone Contact			
	N	Mean	Mode	Median	Range	Mean	Mode	Median	Range
Cup cage	47	63.6	62	63	48-80	25.9	0	22.5	0-60
ZCA	7	34.7	32	34	32-50	28.0	15	26.2	0-50
Burch-Schneider	13	59.6	64	62	46-64	25.0	30	25	20-30