Cable fixation in displaced fractures of the acetabulum

21 patients followed for 2–8 years

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ABSTRACT – We evaluated the outcome in 21 patients having acetabular fractures who had been treated with a 2 mm-braided cable, alone (n = 6), or together with plate and screws. Reduction with a fracture gap of less than 2 mm was achieved in 20 cases. The operation lasted an average of 3 (1.5–4.8) hours. The average blood loss was 1.4 (1.3–2.8) L. No intraoperative complication occurred in relation to surgery. Postoperative complications included 2 cases each of posttraumatic arthritis and avascular necrosis of the femoral head. After a mean follow-up of 4 (2–8) years, the clinical outcome was excellent in 13, good in 3, fair in 3 and poor in 2, and the radiographic outcome was excellent in 10, good in 6, fair in 1 and poor in 4.

We believe that cable fixation is a useful technique since the indirect reduction requires a limited exposure, avoids penetration of the screw into the joint, and improves fixation in patients with osteoporosis.

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In many cases, displaced fractures of the acetabulum are treated with open reduction and rigid internal fixation, commonly requiring an extensile exposure. Cerclage wire has been used for many years to reduce and fix an acetabular fracture and has resulted in good reduction in some selected cases (Schopfer et al. 1993, Chen et al. 2001). A new method that relies on multiple-braided 2 mm cables has been successfully used to stabilize certain cases of acetabular fracture in patients undergoing acute total hip arthroplasty (Mears and Shirahama 1998, Mears 1999). Since 1993, we have been using Dall-Miles cables (Howmedica, Rutherford, NJ, USA) which can be more easily adjusted to the irregular surface of the acetabulum for both the reduction and fixation of acute fractures. We have reviewed our initial experience with this technique.

Patients and methods

21 consecutive patients (mean age 34 (19–69) years, 5 women) with a displaced acetabular fracture were surgically treated between 1993 and 1996 using the cable alone (n = 6) or with an additional plate and screws (Table 1). The fractures were displaced at least 5 mm initially and the indications for the operation were instability and/or incongruity. 12 had at least one additional significant injury. Anteroposterior, oblique radiographs, and computed tomograms of the pelvis were obtained pre- and postoperatively.

All were operated on within 3 weeks of the fracture. Cables alone were used in simple transverse or posterior column fractures and sometimes T-shape or both column fractures. The maximum displacement seen on each radiograph was recorded in mm preoperatively. The maximal displacement of the fracture fragment before surgery was more than 5 mm in all cases and more than 10 mm in 18 (Matta 1996). Plates or screws were added in 15 cases, especially in those with comminuted fragments. In 5 patients, the cable was passed through the greater sciatic notch; in 4, the lesser sciatic notch cable was used and in the remaining 12, 2 cables were passed concomitantly through the greater and lesser sciatic notches. In all patients, the cable was used for reduction and fixation. The

Table 1. Patient data

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	BC	25	F	FH	KL	C+P	4.0	2100	22	A	65	E	E	N
2	BC	25	M	MVA	KL	C+S	3.0	2450	13	A	75	E	E	N
3	BC	36	M	MVA	I I	C+P	3.1	1750	15	A	99	E	E	N
4	BC	25	M	FH	KL	C	3.0	2450	22	A	24	G	F	N
5	BC	27	F	FH	I I	C+P	4.0	1750	13	P	45	P	P	OA
6	PC	23	M	MVA	KL	C	2.3	700	40	A	35	E	E	N
7	BC	43	M	MVA	KL	C+P	2.3	1250	9	A	49	F	G	N
8	TR	20	M	FH	KL	C	2.0	1050	9	A	39	E	E	N
9	BC	37	F	MVA	KL	C+P	3.5	1050	33	A	88	E	E	N
10	TS	36	M	MVA	KL	C+P	2.7	1000	14	A	12	G	G	N
11	TS	54	M	PA	KL	C	2.5	1050	27	A	12	P	F	AVN
12	BC	21	M	MVA	I I	C+P	4.8	2450	12	A	62	G	E	N
13	BC	27	M	PA	KL	C+P	3.2	720	27	A	40	G	E	N
14	TS	39	M	MVA	KL	C	3.7	1050	8	A	65	G	E	N
15	PC	19	M	PA	KL	C	2.3	2100	12	A	69	E	E	N
16	TR	35	M	MVA	KL	C+P	3.2	1050	15	A	12	E	E	N
17	TR+PW	43	M	PA	KL	C+P	2	1050	34	A	12	E	E	N
18	TR+PW	46	M	PA	KL	C+S	1.9	1100	60	A	36	G	G	N
19	TR+PW	37	M	MVA	KL	C+S	1.5	360	67	A	65	P	P	AVN
20	BC	33	F	PA	I I	C+P	4.2	2800	34	A	54	E	E	N
21	PC+PW	69	F	MVA	KL	C+P	3.3	1400	22	A	32	P	F	OA
P		34					3.0	1393	24.2		47.3			

A Case number
B Fracture type
  BC both columns
  PC posterior column
  PW posterior wall
  TS T-shape
  TR transverse
C Age
D Sex
  M male
  F female
E Mechanism of injury
  MVA motor vehicle accident
  PA pedestrian accident
  FH fall from height
F Operative approach
  KL Kocher-Langenbeck
  I I ilioinguinal
G Fixation method
  C cable
  P plate
  S screw
H Duration of operation (hours)
I Estimated blood loss (cc)
J Preoperative displacement (mm)
K Quality of reduction
  A anatomical
  P poor
L Follow-up (months)
M Radiologic result
N Clinical result
  E excellent
  G good
  F fair
  P poor
O Complication
  N none
  OA osteoarthritis
  AVN avascular necrosis of the femoral head
P Average

operation lasted an average of 3 (1.5–4.8) hours. The average blood loss was 1.4 (0.4–2.8) L. The reduction of the fracture was assessed by measuring the residual postoperative displacement (Matta 1996).

The radiographic and clinical criteria (Matta 1996) were used to evaluate the clinical and final radiographic results. Heterotopic ossification was assessed at the last follow-up (Brooker et al. 1973).

Surgical technique

On the basis of fracture configuration, a Kocher-Langenbeck approach with lateral decubitus position was used in 17 and the ilioinguinal approach with supine position in the remaining 4 patients.

With the Kocher-Langenbeck approach, the greater sciatic notch is easily accessible. In these cases, we needed a limited stab incision around the antero-inferior iliac spine (AIIS) to pass the cable. A long-handled, curved, tipped surgical clamp

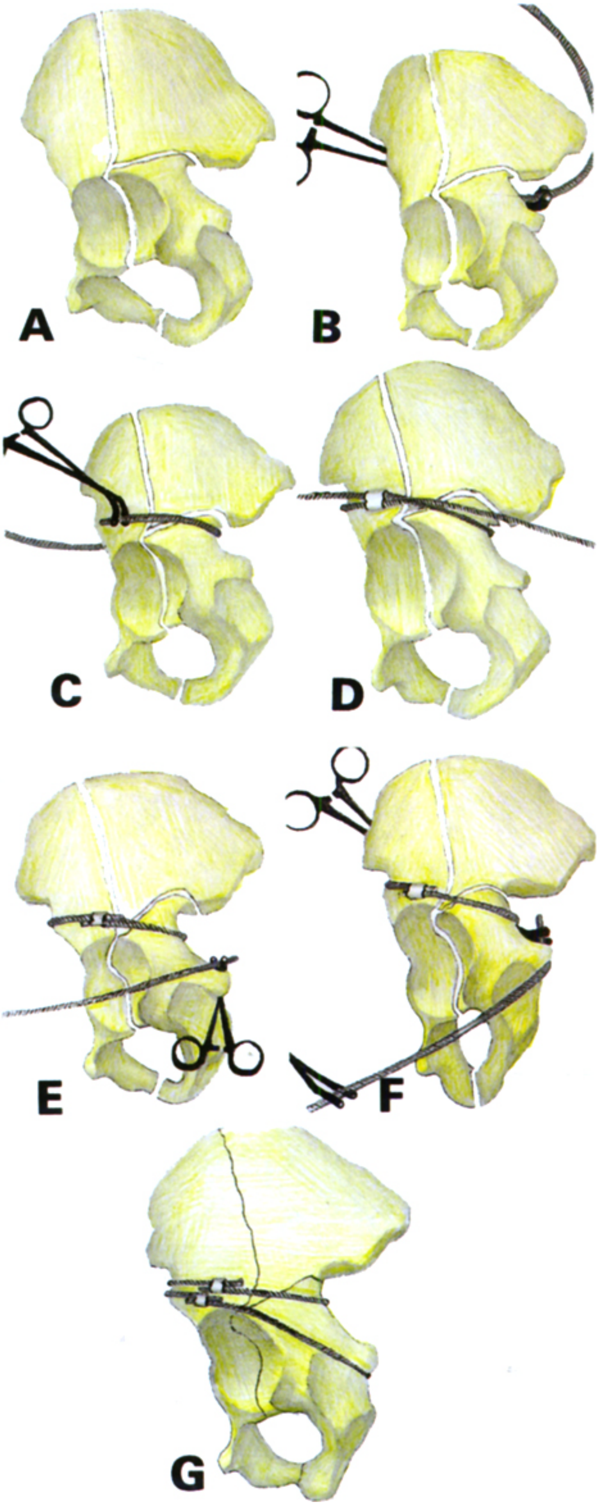


Figure 1. Use of cable for reduction and fixation with the posterior Kocher-Langenbeck approach.

is passed from the AIIS into the notch by minimal subperiosteal elevation of the iliac bone deep to the internal iliac fossa. Then the cable is grasped around the notch and retrieved from deep in the inguinal ligament and sartorius muscle origin immediately above the AIIS. Using a second clamp, the cable can then be passed under the tensor fascia lata and glutei muscles. The cable is tightened around the AIIS (Figure 1).

With the ilioinguinal approach, passing the cable requires a minimal subperiosteal elevation of the tensor fascia lata and glutei muscles on the outer table of the iliac wing. A surgical clamp holding the cable is then passed around the notch. With a second clamp, the cable can be grasped from inside the pelvis. While using the cable, constant care is needed to keep contact with the bone and protect the neurovascular structures. The cable may then be gradually tightened around the inner table of the iliac wing or around the AIIS that may provide the most accessible site in view of the bulk of the tightening and clamping tools (Figure 2).

If the cable fails to remain on the posterior column fragment, it is passed through a 2.5 mm drill hole below the fracture line of the posterior column. In some instances, particularly when the posterior column fracture is very low, it can be passed through the lesser sciatic notch in the same manner as in the posterior Kocher-Langenbeck approach. The passage through the lesser sciatic notch is difficult with the anterior ilioinguinal approach. An additional plate or screws may be used for comminuted fragments or more rigid fixation. All of the decisions for cable fixations are usually made before surgery according to the kind of fracture. However, the final decision is made during the opration as to whether cable fixation alone or additional plate fixation is needed. Postoperative immobilization or trac-

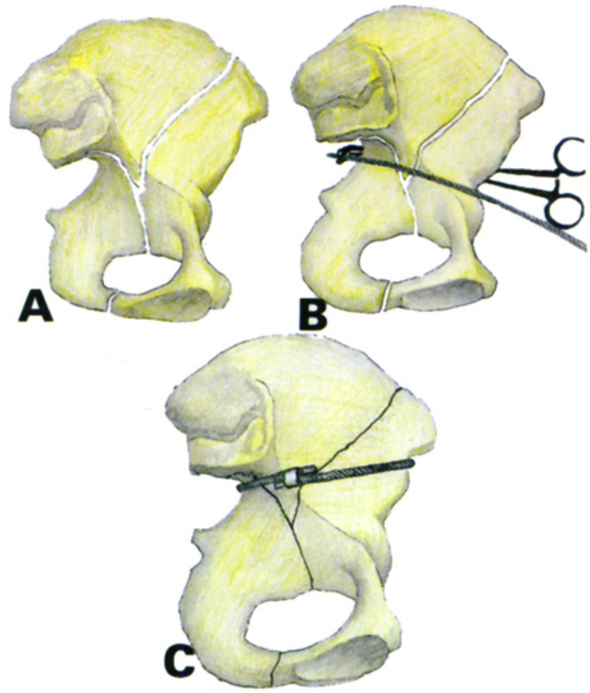


Figure 2. Use of cable for reduction and fixation with the anterior ilioinguinal approach.

tion is usually not required. Partial weight bearing usually begins the first week after the operation depending on the severity of pain and the stability of the fracture. No prophylaxis against heterotopic ossification was given because of the minimally invasive and limited dissection.

Results

Anatomical reduction was achieved in 20 cases. In 1 patient (case 5), the reduction was poor due to severe comminution of both column fractures although additional lag screw fixation was used.

All fractures healed within 3 months with no failure of fixation. Of the 21 patients, 10 had an excellent radiographic result, 6 a good result, 1 a fair result, and 4 a poor one. Among 4 patients with a poor radiographic outcome, anatomical reduction was achieved in 3 patients at surgery.

They were followed postoperatively for an average of 4 (2–8) months. At the latest follow-up, the clinical results were excellent in 13, good in 3, fair in 3, and poor in 2.

No intraoperative complication occurred, but postoperative complications included 2 cases each of posttraumatic arthrosis and avascular necrosis of the femoral head. 3 patients had Brooker I heterotopic ossification.

Discusson

Cable fixation resulted in a satisfactory indirect reduction, relatively firm fixation without difficulties lessened the frequency of failure of fixation in osteoporotic bone. Various methods (Letournel 1980, Letournel and Judet 1993) have been used, including a combination of several types of reduction tools. The complex anatomy and relative surgical inaccessibility of many kinds of acetabular fracture usually need an extensile approach, which is associated with the risks of heterotopic ossification, nerve palsy, and intraarticular penetration by screws (Letournel and Judet 1993, Kellam and Tile 1995).

Cerclage wire or cable is an effective and minimally invasive stabilization technique for an acetabular fracture (Table 2), especially in the elderly, and in cases complicated by extensive comminution with osteoporosis (Mears and Shirahama 1998). In 1 patient (case 21) who had osteoporosis in our series, the cable was used for reduction and fixation after fixation with the original plate and screws had failed. Our method was successful in achieving reduction and fixation in a second attempt.

With cerclage wiring, we have had easily broken wires, difficulty in handling, and technical problems, such as unequal loop tension and kinking of the wire. With the use of a 2 mm-braided cables, the kinking problem was reduced. In addition, blunted cable tips reduced the likelihood of glove penetration. Moreover, the cable could be clamped after tightening, and therefore the tension could be maintained after application, unlike cerclage wire.

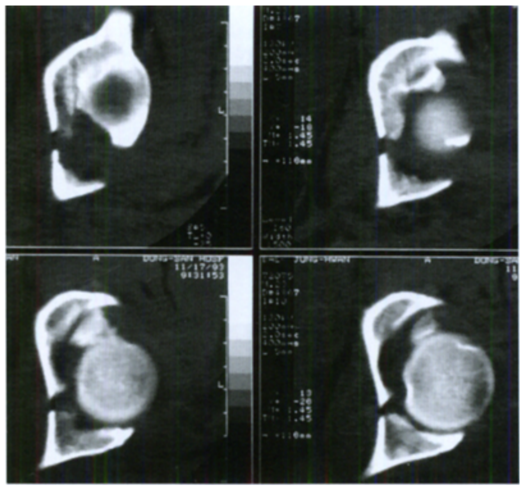
The cable fixation technique is usually indicated if the fracture line extends high into the greater sciatic notch; it is especially useful for high posterior

Table 2. Cable or wire fixation in acetabular fractures

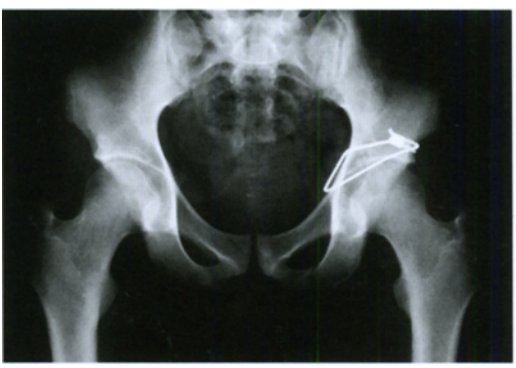
Reference	Material	Number (hip)	Average age (years)	Average follow-up (months)	Anatomical reduction	Fracture type
Chen et al.	Wire	35	43	40	35	Both column fractures
Schopfer et al.	Wire	14	34	6–54	14	Variable
Present study	Cable	21	34	47	20	Variable

Figure 3 (case 6)

A 23-year-old man with posterior column fracture.



CT scans.



Operation via the Kocher-Langenbeck approach.

At 3-year follow-up.

column fractures, transverse fractures with a high anterior or posterior limb, and both column fractures. Another indication is osteoporosis when the conventional plate and screw give poor fixation. In some instances, the cable fixation alone may be unsuccessful, especially in extensive comminution, whence plate or screw may be added. During insertion and tightening of the cable through the greater sciatic notch, the sciatic nerve and superior gluteal nerve and vessels should be protected by a sciatic nerve retractor or by blunt Hohmann retractors. In some cases, the cable may not remain in the lesser sciatic notch during the tightening process when the ischial spine is very small.

The level of the posterior fracture line limits the use of a wire in acetabular fractures (Schopfer et al. 1993). When using the cable for a low fracture in the posterior column, we tried to insert it through a drill hole made below the fracture line. When the posterior column fracture was very low, a cable could be passed through the lesser sciatic notch via the Kocher-Langenbeck approach.

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