RAB-plate vs Richards CHS plate for unstable trochanteric hip fractures

A randomized study of 233 patients with 1-year follow-up

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We prospectively randomized 233 patients with unstable trochanteric hip fractures for treatment with a 120° fixed angle blade-plate having a buttress rod (group A, n 111) or a 135° compression hip screw (group B, n 122). The minimum follow-up time was 1 year. The ratio of technical failure was 9% in group A and 19% in group B (p = 0.06). 79 (87%) fractures in group A and 65 (68%) fractures in group B healed without any complication (p = 0.003). Malunion occurred in 2 cases in group A and in 15 cases in group B (p = 0.002).

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Treatment failure of unstable trochanteric fractures has been related to the type of internal fixation (Laros and Moore 1974, Jensen 1981, Andersson et al. 1984, Møller et al. 1984, Paaschburg Nielsen et al. 1985), instability after fixation (Flores et al. 1990), inadequate reduction, osteoporosis and poor placement of the screw in the femoral head (Laros and Moore 1974, Wolfgang et al. 1982, Davis et al. 1990). Currently, the compression hip screw (CHS), which allows impaction of the fracture, is commonest (Meislin et al. 1990, Kyle et al. 1994). However, the failure rate for sliding devices is unsatisfactory and ranges from 6% to 25% (Simpson et al. 1989, Davis et al. 1990, Bridle et al. 1991, Medoff and Maes 1991, Aune et al. 1994). Here, we report our experiences in a randomized series of 233 patients where a 120° fixed angle blade-plate with a buttress rod was compared to a CHS.

Patients and methods

Between August 1991 and January 1994 we treated 289 nonpathologic trochanteric hip fractures by internal fixation. Using Jensen's (1981) modification of Evans classification, 233 fractures were classified as unstable. These fractures were randomized to treatment with a RAB-plate (Gambro Engström, Stockholm, Sweden, group A) or Richards CHS (Smith & Nephew, Memphis,TN, group B). The study was approved of by the Linköping University Ethics Committee.

Group A comprised 111 fractures and group B 122 fractures (Table 1). All fractures were operated on within 24 hours of admission. 35 patients died before the required minimum (1 year) follow-up time (group A 13 and group B 22). Another 12 patients were lost to follow-up (group A 7, group B 5). The mean follow-up time for the remaining 186 patients was 2 (1–3) years.

Design of the RAB-plate

The RAB-plate (Rigidity Augmentation Baixauli) is a one-piece, cannulated blade plate, with an angle of 120° and a buttress rod supporting the lower surface of the proximal portion of the blade (Figure). The blade is of variable length (65–95 mm), and has a rectangular profile in a cross section. The buttress rod (diameter 6.0 mm) is inserted through a hole in the plate and when seated, engages a groove on the underside of the blade. The head of the proximal, cortical plate screw blocks an eventual distal migration of the buttress rod.

Table 1. Patient data

Type of fracture	Group A n 111	Group B n 122
3-part, medial fragment	60	39
3-part, lateral fragment	16	28
4-part, complex	30	44
Associated subtrochanteric	5	11
Age	82 (47–96)	80 (52–97)
Women	78	91

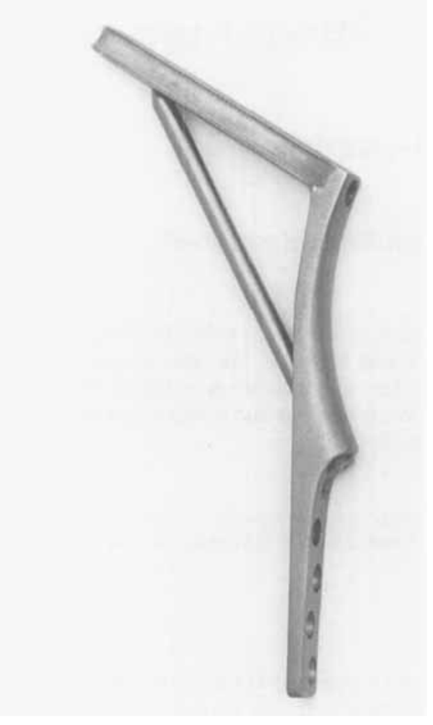

Table 2. Failures

	A n 91	B n 95	P-value
Penetration of femoral head [a]	5	5	1.0
Cutting-out [b]	0	5	0.06
Implant failure	2	2	1.0
Varus dislocation > 10°	1	6	0.1
Total	8	18	0.06

[a] Reoperated with a total hip arthroplasty (group A 1, group B 2) and with implant removal (group A 1, group B 1)
[b] Reoperated with a total hip arthroplasty

Table 3. Complications

	A n 91	B n 95	P-value
Malunion	2	15	0.002
Nonunion [a]	1	3	0.6
Femoral head necrosis [a]	0	1	1.0
Deep infection	2	1	0.6
Total	5	20	0.002

[a] Reoperated with a total hip arthroplasty

Operative technique

With the patient in the supine position on a traction table, the fracture was reduced under fluoroscopic control and exposed through a standard lateral incision.

We used a 120° angle guide for the *RAB-plate* when the guide-pin had been inserted through the lateral cortex and centered in the frontal and lateral planes of the neck and head of the femur. The channel for the blade was prepared with cannulated hand reamers. The blade-plate was then inserted, using an impactor, and secured to the shaft of the femur with cortical screws. The most proximal screw hole was left empty for later use for the buttress rod stop screw. The channel for the buttress rod was prepared with a 7.5 mm-drill bit. Finally, the buttress rod was inserted and secured to the plate laterally by its threaded portion and medially in the groove on the underside of the blade.

The *CHS plate* was inserted using a standard technique (Richards Technical Publication). No complementary procedures—e.g., cerclage, screw fixation or bone grafting—were done in any of the patients.

Postoperative mobilization was supervised by a physiotherapist. All patients were encouraged to bear full weight from the first postoperative day. Serial radiographs were taken until union was complete.

Cutting-out, penetration of the femoral head by the implant, a varus angulation of more than 10°, and a mechanical failure of the implant were defined as technical failures. Shortening with medial displacement of the femoral shaft more than 2.5 cm (malunion), nonunion, femoral head necrosis and deep infection were defined as complications. The radiographic assessment of the implant's position in the femoral head was done according to Gibson and Espley (1987).

Statistics

The unpaired t-test and two-tailed Fisher's exact test were used for statistical analysis.

Results

The median peroperative blood loss in group A was 0.4 (0.1–1.3) L and in group B 0.4 (0.1–1.2) L. The median operation time in group A was 64 (30–120) min and in group B 63 (30–135) min. 79 (87%) fractures in group A and 65 (68%) fractures in group B healed without any complication (p = 0.003). Technical failures and complications occurred in 13 cases in group A and in 38 cases in group B (Tables 2–4).

There were 17 patients (group A 2 and group B 15; p = 0.002) who reported significant problems due to

Table 4. Technical failures (RAB / CHS) related to type of fracture

	A	B	C	D
Cutting-out	0 / 0	0 / 1	0 / 2	0 / 2
Penetration of femoral head	2 / 1	0 / 0	3 / 4	0 / 0
Implant failure	0 / 1	0 / 0	0 / 0	2 / 1
Varus angulation >10°	1 / 1	0 / 1	0 / 3	0 / 1
Total	3 / 3	0 / 2	3 / 9	2 / 4

A 3-part medial fragment
B 3-part lateral fragment
C 4-part complex
D Associated subtrochanteric

leg-length discrepancy after the fracture healed. In group B, this sample consisted of 7 patients with 4-part fracture, 7 patients with 3-part fracture and 1 with fracture having a subtrochanteric extension. In group A, both patients had a 4-part fracture. Because of local discomfort, the implant was removed after the fracture had healed in 20 cases (group A 9 and group B 11).

Discussion

Previously used one-piece nail-plate devices were not sufficiently strong to withstand the stress of an unstable trochanteric fracture and had a high failure rate (Holt 1963, Jensen et al. 1980, Jensen 1981, Heyse-Moore et al. 1983, Paaschburg Nielsen et al. 1985).

The biomechanical behavior of the RAB-plate is different from other fixed nail-plate devices. The buttress rod serving as an artificial calcar, combined with the rectangular cross-section of the blade, enhances rotational rigidity and thereby reduces rotational movement and subsequent cranial or medial migration of the plate (Uhlin et al. 1995).

In our study, the total number of failures and complications was lower in the RAB-group ($p = 0.0001$). However, the difference in failures ratio was only marginally significant ($p = 0.06$). The rate of cutting-out was higher in group B ($p = 0.06$). It is noteworthy that we found no cutting-out complication in group A. The number of varus dislocations of the head-neck fragment more than 10 degrees during fracture healing was also higher in group B ($p = 0.1$). It seems to confirm previous observations that telescoping movement of the CHS due to fracture impaction does not prevent such complications (Simpson et al. 1989, Davis et al. 1990, Flores et al. 1990).

There were 16 cases of fractures classified as "associated subtrochanteric" (group A 5 and group B 11), all type III A according to the Seinsheimer classification (Kelly 1993). The RAB-plate failed in 2 cases just below the distal end of the buttress rod, immediately above the lowest point of the fracture line. The mechanical function of the buttress rod was lost when the fracture extended beyond the lateral end of the rod. There was one implant failure when the CHS was used in such fractures. However, the number of fractures with subtrochanteric extension in this study is too small to allow any definitive conclusions. Therefore, until proven otherwise, we would not recommend the use of the RAB-plate in trochanteric fractures with an associated subtrochanteric extension below the lateral end of the buttress rod.

The telescoping of the sliding screw and impaction of the fracture fragments during weight bearing that leads to limb-shortening is usually a minor problem (Heyse-Moore et al. 1983, Flores et al. 1990). However, substantial limb-shortening occurred in 16% of patients treated with the CHS. All of them reported walking problems and required a shoe-raise due to leg-length discrepancy. There were no such problems in patients treated with the RAB-plate. The 2 patients in group A, where malunion was observed, had in fact a limb-lengthening due to overcorrection of femoral length during surgery.

There were 4 cases of nonunion (group A 1, group B 3). This may indicate that the RAB-plate provides stable fixation and prevents rotation of the head-neck fragment, which may occur when a CHS is used (Den Hartog et al. 1991).

Penetration of the femoral head in both groups was an effect of imperfect operation technique rather than the mechanical behavior of the implant. Radiographs revealed that the RAB-plate was positioned too close to the subchondral line and the CHS was inserted too high in the femoral head in all cases where femoral head penetration was observed (Laros and Moore 1974, Doppelt 1980, Paaschburg Nielsen et al. 1985, Davis et al. 1990).

In our experience, the RAB-plate did not require additional screw fixation or cerclage wiring of fracture fragments or bone grafting to compensate for bone loss, which is recommended under certain circumstances when a CHS is used (Chang et al. 1987, Apel et al. 1989, Kyle et al. 1994).

Our findings suggest that the RAB-plate is a safe implant for fixation of unstable trochanteric fractures and can be regarded as a good alternative to the compression hip screw.

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