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ORIGINAL ARTICLE

Trochanteric locking nail versus arthroplasty in unstable intertrochanteric fracture in patients aged over 75 years☆

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Summary
Introduction: In trochanteric fracture, whatever its anatomic type, internal fixation is currently the standard attitude, with arthroplasty as a relatively unusual option.
Hypothesis: Hip implants are an excellent alternative to osteosynthesis in unstable trochanteric fracture in patients aged over 75 years.
Patients and methods: A non-randomised prospective multicenter study compared osteosynthesis by trochanteric nailing ($n = 113$) to hip arthroplasty ($n = 134$) in unstable trochanteric fracture (AO types 31 A2.2 and 3 and A3.3) in 247 patients over the age of 75 years. The series was recruited during 2007 in seven centres, four of which included only arthroplasties, two only osteosyntheses and one both. The two groups were comparable in age, sex, preoperative Parker score, pre-fracture place of residence, fracture type, time to surgery and preoperative comorbidity. The sole difference was in operators, with more senior surgeons in arthroplasty (62% versus 27%).

☆ The GETRAUM and SFHG, two SoFCOT affiliate societies, met to discuss a shared topic of interest at the interface between the elective orthopaedics and traumatology. The present article is the result of this study.

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Results: Three-month mortality was identical in the two groups (21.2% versus 21%). General complications did not differ, although mechanical complications were more frequent in the nailing group (12.5% versus 2.8%). Functional results (Parker and PMA scores) were better in the implant than in the nail group.
Discussion: The present study validated hip arthroplasty in these indications. Cemented stems associated to a dual-mobility acetabular component gave the best results.
Type of study: Prospective, level of evidence III.

In elderly subjects, fractures, and proximal femoral fractures in particular, are becoming more frequent in France, in parallel with life-expectancy [1,2]. Prognosis is poor, in as much as associated general health status is impaired by numerous comorbidities [3]. The usual attitude in trochanteric fracture is resolutely conservative, as this spares head vitality and osteogenesis ensures repair as long as the osteosynthesis assembly is secure; a large majority of traumatologists adopt this option [4]. Given, however, the rate of early mechanical failure and the necessary caution in resuming weight-bearing, several authors both in France [5—8] and elsewhere [9—15] in the 1980s and 1990s recommended hip arthroplasty as in cervical fracture. The few comparative studies of the two techniques fail to come down definitively in favour of any one method [16]. The present study compared short-term results in a prospective multicenter series of unstable trochanteric fracture managed by locking nail or arthroplasty in subjects aged over 75 years. The hypothesis was that arthroplasty may perfectly well be indicated in proximal femoral extracapsular fracture, while osteosynthesis admittedly remains the reference treatment.

Patients and methods

Seven teams prospectively pooled observations of unstable trochanteric fracture with or without associated osteoarthritis of the hip in patients aged over 75 years treated between January and December 2009 (i.e., 1 year of inclusion; Table 1). Each centre was free with regard to surgical indications and postoperative prescription. The unstable fractures were A2 and A3 (31 A2.2 and 3, and 31 A3.3) on the AO classification [17]. Trochanteric fracture with evolved osteoarthritis and of whatever anatomic type was also included: i.e., types 31 A1.2 and 3 and 31 A2.1. Each patient file was entered on a common Excel spreadsheet, detailing the classical demographic data and results expressed by Parker [18] and Postel Merle d'Aubigné (PMA) scores. Statistical analysis used JMP7® software. Quantitative data were analysed by Wilcoxon/Kruskal-Wallis test to compare means and Levene test to compare scatter; qualitative data were analysed by Chi^2. The significance threshold was set at 0.05.

The study recruited 50 male (20.2%) and 197 female (79.7%) patients, with mean and median age of 86 years (SD, 5.6 yrs; range, 75—100 yrs). Mean preoperative Parker score was 5.7; median, 6; SD, 2.4; 21% of patients scored 9. Table 2 shows preoperative comorbidities. Among the patients, 10.5% were living in medical retirement homes and 15.5% in non-medical retirement homes; the majority (74%) were living at home.

The distribution of fracture types was as follows: 3% type A1 with associated osteoarthritis; 76.5% type A2 and 20% type A3. Other than the eight type-A1 fractures meeting the inclusion criteria, 11 type A2 and three type A3 had associated osteoarthritis, for a total rate of 9.9%. Mean time to surgery was 1.7 days (SD, 1); 17% of patients were operated on the day of admission. In three centres (4, 6 and 7), 113 underwent intramedullary nailing with a short ($n = 107$) or long ($n = 6$) locking nail (Gamma; Stryker, Pusignan, France). Nailing was performed by a junior surgeon in 73% of cases. In five centres (1, 2, 3, 4 and 5), 134 patients underwent arthroplasty: 27 intermediate (20%) and 107 total implants (80%) with dual-mobility acetabular insert; the stem was standard in 83 cases (62%) and ''revision type'' in 51 (38%). The femoral component, of whatever design, was cemented in 82 cases (66%) and non-cemented in 45 (34%). The approach was posterolateral in 91% of cases.

Table 1 Distribution of surgical techniques according to study centre.

	Center	Nail (*n*)	Arthroplasty (*n*)
1	Clinique des Cèdres (Dr Prudhon and Dr Steffann)		36
2	Grenoble Nord Regional University Hospital Center (Pr Tonetti et al.)		6
3	Grenoble Sud University Hospital Center (Pr Saragaglia et al.)		26
4	Lille Regional University Hospital Center (Pr Chantelot, Dr Marchetti and Dr Maisse)	21	50
5	Montbrison Regional Hospital Center (Dr Girardin)		16
6	Strasbourg Regional University Hospital Center (Pr Bonommet et al.)	42	
7	Toulouse-Purpan University Hospital Center (Pr Bonnevialle et al.)	50	
Total	Global Series	113	134

Table 2 Preoperative comorbidity (247 patients).

Type	Frequency (%)
Cardiac	56
Vascular	52
Pneumological	17
Renal	16.5
Neurological	27
Associated contralateral osteoarthritis of the hip	16
Associated osteoarthritis of the knee(s)	20

Arthroplasty was performed by a senior surgeon in 62% of cases and by a junior surgeon in 38%. In one centre (4), the various surgeons performed 21 osteosyntheses and 50 arthroplasties, whereas the other centres specialized in one or the other technique. Weight-bearing was decided by the surgeon; in centre 4, it was not allowed until the 45th day after nailing, but was immediate in the other two centres using this technique and was immediate in all centres after arthroplasty.

Results

Patients in both the nailing ($n = 113$) and arthroplasty ($n = 134$) groups had a minimum 6 months' follow-up and did not significantly differ in age, sex, preoperative Parker score, pre-fracture place of residence, fracture type, associated osteoarthritis or time to surgery (Table 3). Fifty-six percent of the 130 patients whose records included the information had received 2.4 ± 1 units of perioperative transfusion; 45% of the osteosynthesis and 69% of the arthroplasty patients were transfused (mean 2.47 ± 1.1 and 2.29 ± 0.9 units, respectively).

At 6 months' follow-up, 24 of the 113 osteosynthesis patients had died (21.2%). In the other 89, there were 19 general complications (21.5%), including one thromboembolism, six cardiorespiratory and seven neurological complications. Eleven patients (12.5%) showed surgical complications, requiring revision, including six disassemblies (managed by revision arthroplasty) and three infections. Mean Parker score at follow-up was 4.3 points (range, 0—9), mean PMA score 11.6 points (range, 3—18), mean pain score 4.4, motion 4.46, and gait 2.7. Weight-bearing was authorized at a mean 13.8 days, mean effective weight-bearing was at 28.6 days and recovery of walking distance at 46 days; recovery of free gait without cane was at a mean 96 days (median, 90 days).

Table 3 Main demographic and clinical data by treatment group.

	Nail $n = 113$	Arthroplasty $n = 134$
Mean age	85.5 years	85.9 years
Female sex	73.5%	81.6%
Mean preop Parker score	5.5	5.9
Living at home	74.3%	73.8%
Fracture type 31 A2.2	74.3%	78.3%
Associated ipsilateral osteoarthritis of the hip	7%	10.4%
Time to surgery	1.73 days	1.76 days

At 6 months' follow-up, 28 of the 134 arthroplasty patients had died (21%). In the other 106, there were 15 general complications: eight neurological, six cardiorespiratory and one venous thrombosis; local complications included two dislocations (1.9%) and one sepsis for a total 2.8% cases of surgical revision. Mean Parker score at follow-up was 5.1 points (range, 0—9), mean PMA score 13.9 points (range, 4—18), mean pain score 5.2, motion 5, and gait 3.6. Mean effective weight-bearing was at 11.1 days and recovery of walking distance at 21 days; recovery of free gait without cane was at a mean 117 days (median, 90 days).

Thus, clinical results were significantly in favour of arthroplasty in terms of final Parker score, overall PMA score and all three PMA items (Table 4). Within the arthroplasty group, final Parker score, overall PMA score and the PMA pain item showed no significant difference between intermediate implants conserving the acetabulum and dual-mobility acetabular inserts (Parker: 4.8 versus 5.1; PMA: 13 versus 14; pain: 5.1 versus 5. 3). The same comparison on the same criteria was made for cemented versus uncemented fixation: overall PMA score was significantly in favour of cemented fixation (14.7 versus 13.3 points), and the Parker score approximated significance (5.4 versus 4.8).

At 6 months' follow-up, 52 patients in all had died, with records for 47: two died within 10 days postoperatively, 28 between days 10 and 90, and 17 later than day 90. Deceased patients had significantly greater mean age (87.4 versus 85.3 years; $P = 0.002$), lower preoperative Parker score (4.7 versus 6; $P = 0.0005$), and a higher rate of renal comorbidity. On the other hand, mortality was independent of surgical technique (26.9% nailing and 26.4% arthroplasty), time to surgery and fracture type, but correlated with general complications rate ($P = 0.03$) and postoperative sepsis ($P = 0.05$).

Parker scores fell by 1.27 and 1.21 points following nailing and arthroplasty, respectively (non-significant difference).

Separate analysis of the 22 trochanteric fractures associated with pre-existing osteoarthritis of the hip found this group to be older (m = 88 versus 86 years), but without specific lesion type or more severely impaired pre-fracture autonomy. Eight of these fractures were treated by nailing and 14 by arthroplasty, including only six with acetabular insert, the others being intermediate implants. Associated osteoarthritis did not impact final Parker (0.78 versus 1.22 point fall) or PMA score (mean, 12.28 versus 13). Sample size precluded demonstrating any correlation between final Parker score and acetabular insert, although the trend was favourable: 1-point fall after nailing or implant without acetabular insert versus 0.5-point rise in case of dual-mobility acetabular component.

Discussion

The present study showed better results with arthroplasty than with nailing in unstable trochanteric fracture in over-75 year-olds, in terms both of associated complications

Table 4 Comparative Parker and Postel Merle d'Aubigné scores for patients surviving beyond 6 months.

	Nail $n = 89$	Arthroplasty $n = 106$	Wilcoxon test	Levene test
Mean postop Parker	4.3	5.1	0.0257	0.0632
Mean Postel Merle	11.6	13.9	< 0.001	0.006
Pain score	4.4	5.2	< 0.0001	< 0.0001
Motion score	4.46	5	< 0.0049	< 0.001
Gait score	2.7	3.6	0.0005	0.092

Wilcoxon and Levene tests compared means and scatter, respectively.

(2.8% versus 12.5%) and of Parker and PMA functional scores (Table 4). However, this prospective observational study of the two patient groups has certain limitations, affecting the conclusions to be drawn. The various centres differed in prescription regarding postoperative weight-bearing and/or type of arthroplasty. Despite the prospective design, data were not recorded on all items with the same regularity in all centres, doubtless affecting the statistical impact. There was also a difference in skills related to operator seniority: 62% of arthroplasties versus only 27% of osteosyntheses were performed by senior surgeons ($P < 0.01$). Finally, osteosynthesis and arthroplasty quality was not assessed. Even so, it can be underlined that arthroplasty was not associated with greater postoperative mortality than osteosynthesis, and that the general complications rate was similar between the two groups (21.5% in nailing versus 14.1% in arthroplasty). Nevertheless, PMA scores for arthroplasty in these indications were much lower than in osteoarthritis of the hip (mean, 13.9 versus 17); this score is probably not suited to this kind of procedure in the age-group studied here.

One major technical problem in trochanteric fracture arthroplasty is to restore lower-limb length (20). In unstable and therefore, complex fracture (31 A2.2 and 3, and 31 A3.3), the usual anatomic landmarks are disturbed (fracture of the lesser trochanter, pulled forward by the psoas tendon; fracture of the greater trochanter, pulled forward by the medial gluteal tendon), so that rigorous pre- (and per-) operative planning is mandatory to avoid discrepancy, which is badly accepted by active subjects (Parker 8 or 9). Another problem is the primary stability of the prosthetic stem, lacking metaphyseal support in case of fracture, and possibly also lacking diaphyseal support in case of osteoporosis or of uncemented implant. In the present series, cemented implants (82 (66%) versus 45 (34%)) gave better PMA scores (14.7 points versus 13.3 for uncemented implants), and it therefore seems preferable (in the absence of major anesthesiologic contra-indication) to cement the femoral component.

Osteoarthritis of the hip is relatively rarely associated with trochanteric fracture (9.9% in the present series), and is an indication for arthroplasty, especially in case of elevated initial Parker score. A dual-mobility acetabular insert is to be preferred, although sample size (14 cases including six dual-mobility cups) precluded statistical demonstration here.

Parker and Handoll's recent meta-analysis [16] highlighted the weaknesses of the literature comparing the two techniques in first-intention management of trochanteric fracture. Several non-comparative retrospective studies were published over the last 10 years [19—22] and are reviewed in Table 5. Results with arthroplasty and osteosynthesis were comparable, with elevated 6—12 months morbidity/mortality directly correlated with advanced age and comorbidity. Each technique involves specific complications of variable severity and frequency: dislocation rates in arthroplasty are around 4%, having significantly fallen since the introduction of dual-mobility cups. Osteosynthesis disassembly rates are around 15%, with mandatory surgical revision. Over the same period, non-randomised comparative studies [23,24] were published. Lyman et al. [23] stressed that arthroplasty is heavy surgery, with poorer clinical results in fracture than in a matched series of total hip replacement for osteoarthritis. Dobbs et al. [24] reported identical overall postoperative mortality in arthroplasty and osteosynthesis, but a higher perioperative rate in arthroplasty due to the frequency of cardiorespiratory complications. This was not confirmed by Geiger et al. [25], who in contrast stressed the high rate of disassembly in screw-plate and locking nail osteosynthesis, which, at 10%, was identical to that of dislocation following arthroplasty; this mechanical complication, however,

Table 5 Main recent literature series for arthroplasty in fresh trochanteric fracture.

References	*n*	Age (yrs)	FU (mo)	Mortality %	Normal gait (%)	Infection (*n*)	Dislocation (*n*)
Chan et Gill [19]	55	84 (73—99)	m = 14 (6—24)	22	50	—	—
Rodop et al. [20]	54	75—6 (64—91)	m = 22 (4—48)	13	36	1	—
Grimsrud et al. [21]	39		> 22			1	1
Berend et al. [22]	34	80	m = 35	26		1	4

did not occur with dual-mobility acetabular inserts. The non-randomised prospective study by Haenjens et al. [12] is dated, and the solid implant used is no longer available; the two methods involved almost identically elevated 1-month and 1-year mortality and similar infection rates, with 14% mechanical complications in osteosynthesis. There are two randomised comparative studies, which should be of greater scientific value [26,27]. Stappaerts et al. [26] prospectively compared 43 intermediate arthroplasties and 47 dynamic screw-plate osteosyntheses; postoperative medical complications rates were comparable; surgery time, bleeding and transfusion rates were greater in arthroplasty; mortality was identical. Surgical revision, however, was more frequent following osteosynthesis (26% versus 4.5% with arthroplasty) and functional results were slightly better with arthroplasty. Kim et al.'s series [26] was smaller than Stappaerts et al.'s, and compared arthroplasty and locking nail; results favoured the latter for surgery time and bleeding, to which the authors attributed the higher 1-year mortality observed (28% for arthroplasty versus 14% for osteosynthesis); arthroplasty showed no functional benefit.

In the osteosynthesis group, the implanted material was in all cases the most recent version of the locking nail developed by the Strasbourg team. Assessment criteria for nailing were: anatomically optimal reduction confirmed on two incidences; and optimal cervical screw positioning under the neck axis frontally and centered laterally [28]. According to Parker and Handoll's recent meta-analysis [29], locking nails are not the only means of trochanteric fracture fixation: there are also screw-plates, and indeed locking nails suffer from local complications. In the present study, the local complications rate was relatively high, at 10%, perhaps partly due to the inexperience of the junior surgeons to whom this delayed emergency procedure is generally entrusted in university hospital centres (centres 4, 6 and 7). In certain reports from reference centres in which rigor of implantation thanks to operator experience is a determining factor [30—32], mechanical complications rates were lower. To confirm the present findings, both the osteosynthesis and arthroplasty studies should be replicated with experienced operators, obviously using the same inclusion criteria (age > 75 years, and AO fracture types 31 A2.2 and 3 and 31 A3.3). However, it must be conceded that it is not always easy to classify fractures correctly and assess stability and/or osteoporosis on plain X-ray (usually AP) taken in emergency, and that misjudgements are bound to occur.

Conclusion

The present prospective comparative observational study validated the indication of arthroplasty in unstable trochanteric fracture in over-75 year-olds. Perioperative mortality and general complications rates were no higher than with nailing, despite elevated bleeding. Clinical results were better and earlier, and mechanical complications rates lower. Arthroplasty, however, should be performed by experienced operators, better able to avoid the pitfalls induced by loss of anatomic landmarks. Indications for arthroplasty should be made with care as, whatever the procedure, there is around 2 points' loss of autonomy on Parker score. A preoperative Parker score of 4 or 5 is probably not a good indication for arthroplasty, the prime objective of which is gait recovery, which is unlikely to be achieved. The use of cemented stems, dual-mobility inserts and acetabular implantation is confirmed by the present results and by the literature.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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References

[1] Baudoin C, Fardellone P, Thelot B, Juvin R, Pottard V, Bean K, et al. Hip fractures in France: the magnitude and perspective of the problem. Osteoporosis Int 1996;suppl3:1—10.
[2] Singer B, Mac Laauchlan GL, Robinson CM, Christie J. Epidemiology of fractures in 15000 adults. The influence of age and gender. J Bone Joint Surg Br 1998;80:243—8.
[3] Bonnevialle P, Feron JM. Les fractures du sujet âgé de plus de 80 ans. Rev Chir Orthop 2003;89(Suppl 2):S129—82.
[4] Rosencher N, Vielpeau C, Emmerich J, Fagnani F, Samama CM, ESCORTE group. Venous thromboembolism and mortality after hip fracture surgery: the ESCORTE study. J Thromb Haemost 2005;3:2006—14.
[5] Vidal J, Allieu Y, Buscayret C, Paran M. Treatment of various cervical-trochanteric fractures in the very old by extensive prosthesis of the upper end of the femur. Acta Orthop Belg 1976;42:25—30.
[6] Lord G, Marotte JH, Blanchard JP, Guillamon JL, Hannoun L. Role of neck-head arthroplasty in the treatment of pertrochanteric fractures after the age of 70. A propos of 140 cases. Rev Chir Orthop 1977;63:135—48.
[7] Saragaglia D, Carpentier E, Gordeeff A, Legrand JJ, Faure C, Butel J. Les fractures de la région trochantérienne du vieillard: clous de Ender, prothèses ou ostéosynthèse directe. À propos d'une série continue de 265 cas. Rev Chir Orthop 1985;71:79—86.
[8] Saragaglia D, Carpentier E, Gordeeff A, Faure C, Butel J. Place des prothèses intermédiaires scellées dans le traitement des fractures du massif trochantérien du vieillard. J Chir 1985;122:255—60.
[9] Elberg JF, Peze W. The diacephalic prosthesis. A new approach to fractures of the cervicotrochanteric region in the elderly. Acta Orthop Belg 1982;48:823—30.
[10] Stern MB, Angerman A. Comminuted intertrochanteric fractures treated with Lienbach prosthesis. Clin Orthop 1987;218:75—80.
[11] Green S, Moore T, Proano F. Bipolar prosthetic replacement for the management of unstable intertrochanteric fractures in elderly. Clin Orthop 1987;224:169—77.
[12] Haentjens P, Casteleyen PP, De Boeck H, Handelberg F, Opdecam P. Treatment of unstable intertrochanteric and subtrochanteric fracture in elderly patients. Primary bipolar arthroplasty compared with internal fixation. J Bone Joint Surg Am 1989;71:1214—25.
[13] Harvin SF, Stern RE, Kulick RG. Primary Bateman-Lienbach Bipolar prosthetic replacement of the hip in the treatment of

unstable intertrochanteric fractures in the elderly. Orthopedics 1990;13:1131—6.
[14] Broos PL, Rommens PM, Geens KH, Stappaerts KH. Pertrochanteric fractures in the elderly. Is the Belgian VDP prosthesis the best treatment for unstable fractures with severe comminution? Acta Orthop Belg 1991;13:242—9.
[15] Haentjens P, Casteleyen PP, Opdecam P. Primary bipolar arthroplasty or total hip arthroplasty for the treatment of unstable intertrochanteric and subtrochanteric fractures in elderly patients. Acta Orthop Belg 1994;60(Suppl 1):124—8.
[16] Parker MJ, Handoll HH. Replacement arthroplasty versus internal fixation for extracapsular hip fractures in adults. Cochrane Database Syst Rev 2006;19:CD00086.
[17] Muller ME, Nazarian S, Koch S, Koch P. Classification des fractures des os longs. Berlin Heidelberg New York: Springer-Verlag; 1990.
[18] Parker MJ, Palmer CR. A new mobility score for predicting mortality after hip fracture. J Bone Joint Surg Br 1993;75: 797—8.
[19] Chan KC, Gill GS. Cemented hemiarthroplasties for elderly patients with intertrochanteric fractures. Clin Orthop 2000;371:206—15.
[20] Rodop O, Kiral A, Kaplan H, Akmaz I. Primary bipolar hemiprosthesis for unstable intertrochanteric fractures. Int Orthop 2002;26:233—7.
[21] Grimsrud C, Monzon RJ, Richman J, Ries MD. Cemented hip arthroplasty with a novel cerclage cable technique for unstable intertrochanteric hip fractures. J arthroplasty 2005;20:337—43.
[22] Berend KR, Hanna J, Smith TM, Mallory TH, Lombardi AV. Acute hip arthroplasty for the treatment of intertrochanteric fractures in the elderly. J Surg Orthop Adv 2005;14:185—9.
[23] Lyman JR, Kelley SS, Lachiewicz PF. Hip arthroplasty after extracapsular hip fracture: a matched pair cohort analysis. J Surg Orthop Adv 2004;13:38—41.
[24] Dobbs RE, Parvizi J, Lewallen DG. Perioperative morbidity and 30-day mortality after intertrochanteric hip fractures treated by internal fixation or arthroplasty. J Arthroplasty 2005;20:963—8.
[25] Geiger F, Zimmerman-Stenzel M, Heisel C, Lehner B, Daecke W. Trochanteric fracture in the elderly: the influence of primary hip arthroplasty on 1 year mortality. Arch Orthop Trauma Surg 2007;27:959—66.
[26] Stappaerts KH, Deldycke J, Broos PL, Staes FF, Rommens PM, Claes P. Treatment of unstable peritrochanteric fractures in elderly patients with a compression hip screw or with the Vandeputte (VDP) endoprosthesis: a prospective randomised study. J Orthop Trauma 1995;9:292—7.
[27] Kim SY, Kim YG, Hwang JK. Cementless calcar-replacement hemiarthroplasty compared with intramedullary fixation of unstable intertrochanteric fractures. A prospective, randomized study. J Bone Joint Surg Am 2005;87:2186—92.
[28] Kempf I, Grosse A, Tagland G, Favreul E. Le clou Gamma dans le traitement des fractures trochantériennes. Résultats à propos de 121 cas. Rev Chir Orthop 1993;79:29—40.
[29] Parker MJ, Handoll HH. Gmn and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults. Cochrane Database Syst Rev 2010;8:CD000093.
[30] Kukla C, Heinz T, Gebler C, Heinze G, Vecsei V. The standard Gamma nail: a critical analysis of 1000 cases. J Trauma 2001;51:77—83.
[31] Utrilla AL, Reig JS, Munoz FM, Tufanisco CB. Trochanteric Gamma nail and compressive hip screw for trochanteric fractures: a randomised prospective comparative study in 210 elderly patients with a new design of the gamma nail. J Orthop Traum 2005;19:229—33.
[32] Bojan AJ, Beimel C, Seitlig A, Tagland G, Ekllom C, Jonsson A. 3066 consecutive Gamma nails. 12 years experience at a single centre. BMC Musculoskeletal Dis 2010;11:133—43.