Treatment of Nonunion of Supracondylar Femoral Fractures in Elderly Patients by Cemented Rotating-hinge Total Knee Replacement

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ABSTRACT

Background: Non union of supracondylar fractures of the femur in old age patients is difficult to treat because of limited bone stock for fixation and marked osteoporosis of the distal fragments and if nonunion occur in osteoarthritic knee treatment will be more difficult and all methods of treatment associated with many complications.

Patients and methods: Using cemented rotating-hinge total knee replacement. The cemented, long-stemmed Endo-model rotating-hinge TKR (Waldemar Link GMBH & Co, Hamburg, Germany), thirteen total knee replacement were done between 2002 and 2007 for 12 nonunited supracondylar fractures and one nonunited supracondylar osteotomy, The time interval between the fracture and performance of TKR ranged from 24 to 62 month, the mean age of the patients was 69 years (59 to 85). The mean follow up of 50 months (35 to 92 months). Clinical rating system of the Hospital for Special Surgery and the clinical and radiological scoring systems of the Knee Society. For patellofemoral status we used the Outerbridge grading system and we used the scale of Stern and Insall to assess anterior knee pain.

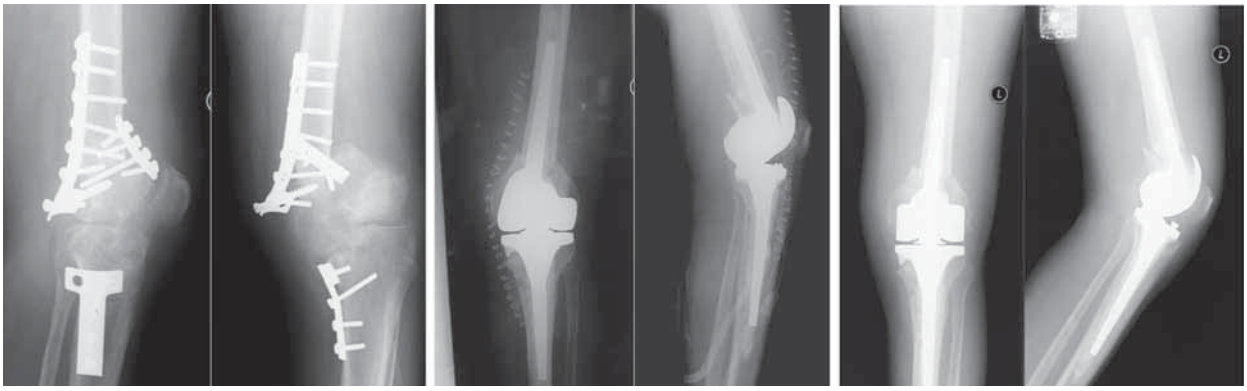
Results According to the clinical rating system of the Hospital for Special Surgery excellent results in two patients, good in six patients, fair in four patients and poor results in one patient, In nine patients, the knee flexion ranged from 70° to 110, three patients ranged from 30° to 60° in one patient, the knee flexion was only 20° .

Conclusion The Endo-model rotating hinge knee replacement is a good option for those elderly arthritic patients with fractures of the supracondylar femur that fail to unite with early weight bearing and expected good and excellent results for most of the patients.

Key words nonunion - supracondylar femoral fractures - total knee replacement.

Introduction

Although the worldwide incidence of supracondylar femoral fracture nonunion is less than 9% According to Graves et al., but if a nonunion occurs in the supracondylar area, union can be difficult to obtain[1]. The supracondylar area is defined as the area from the most distal portion of the femur extending 9 cm proximally. According to Kevin and Cleveland treatment of a short supracondylar fragment can be by one of five methods but arthroplasty is not one of the five. One of the five methods is fusion and it



(a) (b) (c)

Fig. 1:
(a) AP and lateral view for 67 years old man, with a previous history of corrective osteotomy femoral and tibial, years ago ended with united tibia and supracondylar nonunion.
(b) Immediate postoperative x-rays.
(c) X-rays after two years

is indicated when the knee joint has been so damaged that painless weight bearing and a useful range of motion are impossible and usually fusion not accepted by the patients.[2] If the fracture occur in osteoarthritic knee the problem will be more difficult to be treated as the fracture and immobilization of the knee will increase the articular cartilage damage and even if the nonunion is treated the painful knee will necessitate arthroplasty later on, another problem associated with this type of nonunion is the marked osteoporosis of the distal fragments and its small size making it very difficult to be fixed by any ordinary osteosynthesis. On the other side one of the methods of treatment non union of fractures of the proximal femur is arthroplasty either hemiarthroplasty or total arthroplasty but for distal part of the femur arthroplasty still not widely accepted. If unconstrained total knee replacements are used in such cases, a number of problems may occur. First and the most important is existence of nonunion plus inadequate alignment[3-5], poor soft-tissue balance,[6,7] post-operative instability[8] and other longer term complications.[9-11]

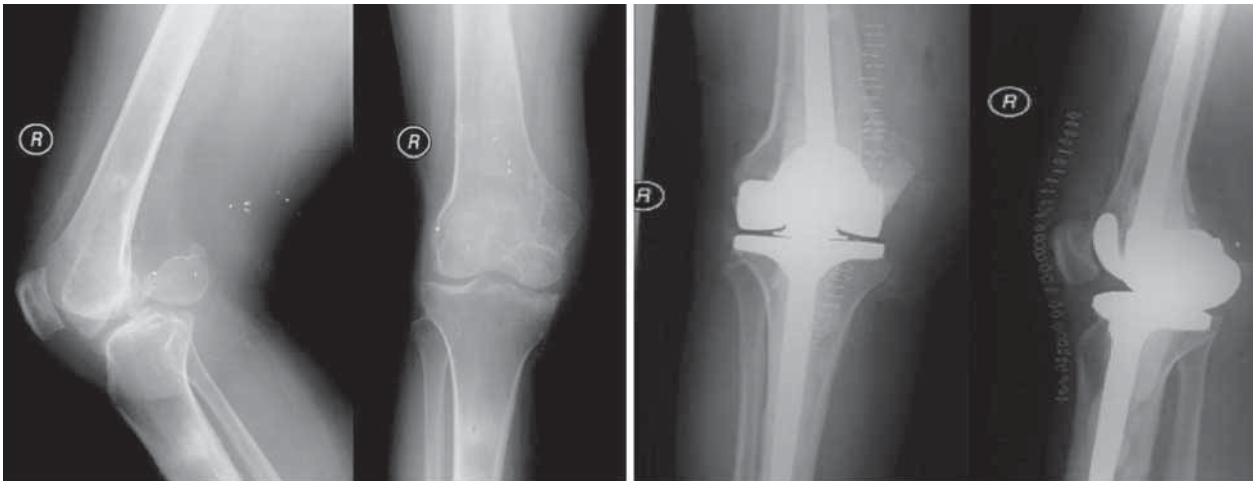
A fixed hinge design with intramedullary rode can be used but it is associated with high incidence of infection and loosening.[12,13]

Wolfgang (1982) first described a single case of total knee replacement in a patient with rheumatoid arthritis who suffered an intercondylar fracture of the femur.[14]

Because of the problems associated with a fixed hinge design, a rotating system which aims to avoid the torsional stresses that may lead to loosening of the prosthesis is a good option. We have used the cemented, long-stemmed Endo-model rotating-hinge TKR (Waldemar Link GMBH & Co, Hamburg, Germany) for treatment of such patients and present our result.

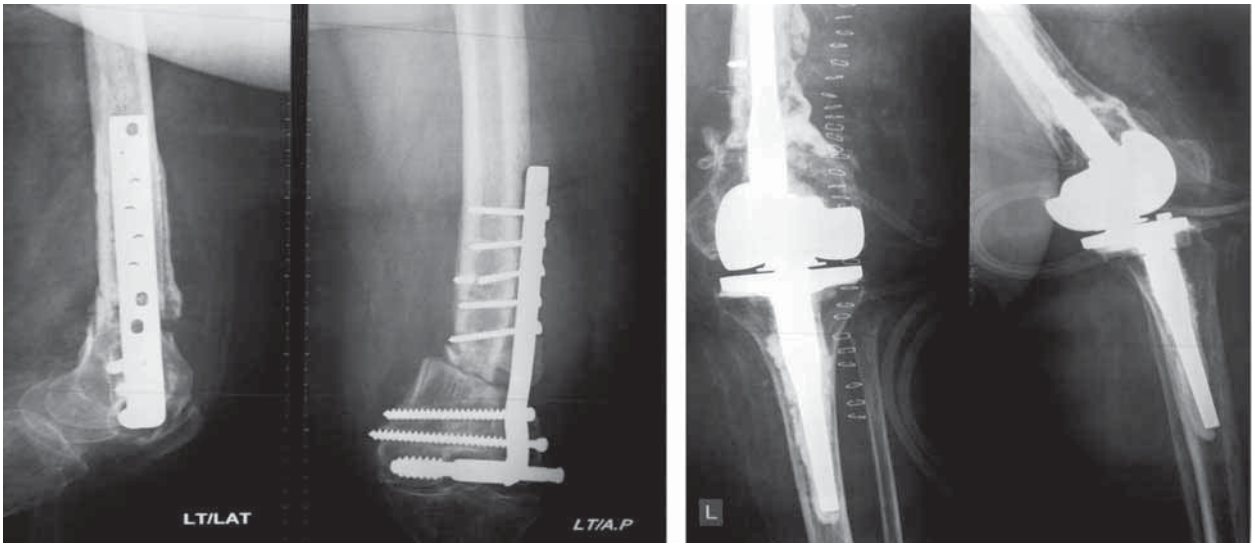
Patients and Methods

Between 2002 and 2007, we performed 13 TKRs using rotating-hinge prosthesis for treatment of nonunited fractures or osteotomy of the distal femur, the fractures was either neglected or treated conservatively or treated by open reduction and internal fixation, and in all non union occur, in one patient there was osteotomy of the distal femur which was fixed by plate and screws associated with osteotomy of the upper tibia fixed also by plate and united but nonunion of the distal femur occurred (Fig. 1). There was eight supracondylar fractures (AO type A1), three supracondylar intercondylar fractures (AO type C1) and in two patients medial condyle fracture (AO type B3) (Fig 2). Eight patients were treated by previous open reduction and



(a) (b)

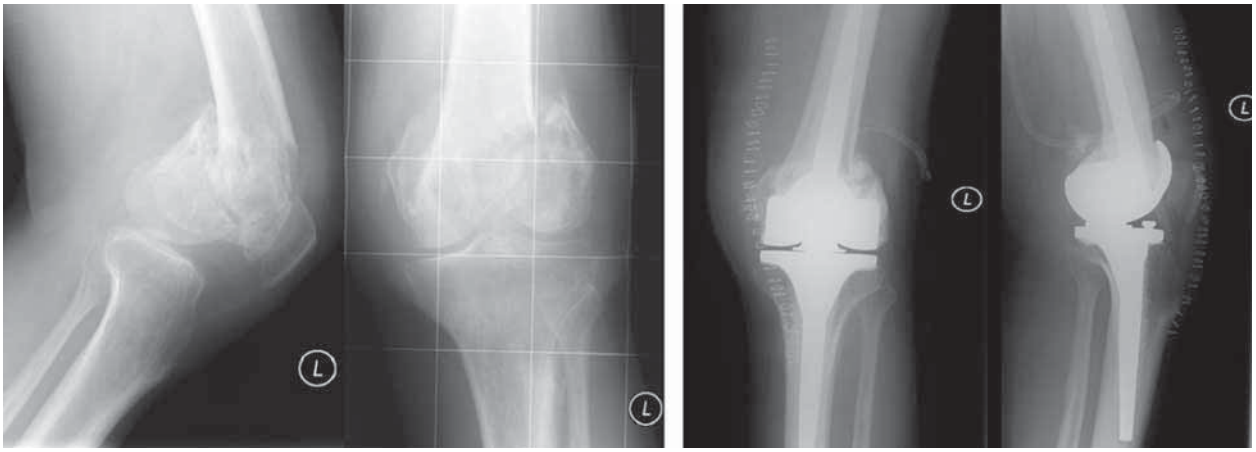
Fig. 2:
(a) AP and lateral view for 65 years old man, with a previous history of neglected medial femoral condyle fracture (AO type B3) two years prior to arthroplasty.
(b) Iimmediate postoperative x-rays.



(a) (b)

Fig. 3:
(a) AP and lateral view for 72 years old women, with a previous history of supracondylar fracture treated by DCS plate blade four years prior to arthroplasty
(b) Immediate postoperative x-rays

internal fixation using DCS (Fig. 3), plates and screws or screws alone, in one patient osteotomy of the distal femur fixed by plate and screws, three patients were treated conservative (Fig. 4) either by casting or traction or combination of both and in one patient nothing was done and the patient was neglected. The diagnosis of nonunion was confirmed at the time of the operation by motion at the site of the fracture or osteotomy with no evidence of bone bridging the affected area. The preoperative diagnosis was based on clinical symptoms and physical findings, including pain at the site of the fracture or osteotomy that was aggravated



(a) (b)

Fig. 4:
(a) AP and lateral view for 70 years old man, with a previous history of supracondylar intercondylar fracture treated conservative by traction two years prior to arthroplasty.
(b) Iimmediate postoperative x-rays.

by stress and the demonstration of motion at the site of the fracture. Radiographic criteria included the absence of bone bridging the site of the fracture or osteotomy and no evidence of progression of healing over a period of three months The time interval between the fracture and performance of TKR ranged from 24 to 62 months, in all the patients there were osteoarthritic changes either primary OA, preexisting before the occurrence of the fracture, or secondary to rheumatoid arthritis or secondary degenerative changes from longstanding intraarticular displaced fractures with nonunion. So primary osteoarthritis diagnosed in 8 patients, rheumatoid arthritis in two patients and degenerative changes secondary to the fracture and immobilization in 3 patients.

Of the 13 TKRs 8 were in women and 5 in men, with a mean age of 69 years (59 to 85). We were able to review the whole patients at a mean follow up of 50 months (35 to 92 months).

In the design of rotating hinge which we used; an anterior femoral flange was used for all the patients. The femoral and tibial components are connected through a tibial guide pin and a femoral bushing. The patella was not replaced and a lateral release only undertaken when necessary but patelloplasty done for all the patients (removal of all osteophyte and making the patella smaller) plus denervation by diathermy all around the patella. A standard operating theatre was used. A prophylactic, second-generation cephalosporin was used perioperatively and for two days post-operatively. Thromboprophylaxis was done by using low-molecular-weight heparin administered peri- and post-operatively for two weeks. A tourniquet was used and spinal rather than general anaesthesia was preferred.[15] A suction drain was retained until the second post-operative day. The mean volume of blood transfusion was 800 ml and the mean duration of operation was 120 minutes. A standard midline incision with a medial Para patellar arthrotomy is used. The patella is not everted to avoid possible avulsion of the patellar tendon, scarring and adhesions are taken down and an assessment of bone quality, fragment union and bone loss is made, removal of the previous fixation metals were done through the same ordinary anterior approach used for arthroplasty with proximal extension when needed. Full weight-bearing, supported by crutches, was allowed on the third post-operative day as the patient can tolerate. The patients were discharged soon after the second week. We used the clinical rating system of the Hospital for Special Surgery[16] and the clinical[17] and radiological[18] scoring systems of the Knee Society. For patellofemoral status

we used the Outerbridge grading system[19] and we used the scale of Stern and Insall to assess anterior knee pain[20]. The patients were seen at a regular follow up visits every 4 weeks for the first 3 months and then every 3 months for the first year and then every 6 months.

Results

In eleven patients, wound healing occurred without complications, and no patients developed deep infection, one patient developed superficial infection which was treated by intravenous antibiotics and repeated wound dressing until complete healing after 4 weeks, for the other patient the wound continue to discharge serosanginous fluid for 3 weeks, and repeated cultures of the fluid were negative and repeated dressing ended with closure of the wound. Deep-vein thrombosis developed in one patient, subcutaneous hematoma in one patient, intra-operative femoral condyle fracture in two patients, the mean inpatient time at the hospital was 11 days (range, 7 - 16 days). All patients were encouraged to bear weight as soon after surgery as possible. Regarding the knee score of The Knee Society Clinical Rating System, eight patients were free of pain and 5 patients reported mild or occasional pain at follow-up evaluation, the Mean (range) Knee Society scores for the patients were improved from 15.2 preoperative to 91.3 postoperative follow up. All patients regained full extension, except one lack 10 degree of extension. In nine patients, the knee flexion ranged from 70° to 110° , in one patient, the knee flexion was only 20° in this 75-year-old woman, the preoperative knee flexion was10° with previous ORIF and longstanding non union and non weight bearing, the knee flexion for the other three patients ranged from 30° to 60° . All patients had stable knees either anteroposterior or mediolateral. As regard the clinical rating system of the Hospital for Special Surgery excellent results in two patients, good in six patients, fair in four patients and poor results in one patient. There was no evidence of post-operative tibiofemoral instability, the ability of patients to use stairs after surgery which is correlated to patellofemoral joint (PFJ) symptoms was recorded according to the scale of Stern and Insall, seven patients can use stairs without symptoms (grade 0), four patients can use stairs but with mild pain (grade I) and two patients unable to use stairs due to sever symptoms (grade II), one of them was able to use stairs after 2 years follow up. The tibiofemoral alignment of all knees was corrected at surgery to the built-in prosthetic angle of 7° of valgus and there was no evidence of any change in this alignment with time, from the plain post-operative radiographs we could find no evidence of migration of the prosthesis.

Discussion

Nonunion of supracondylar fractures or after osteotomies of the femur seem to be rare,[21] little has been published on the treatment of supracondylar femoral nonunion, but the complications of treatment of such nonunited fractures is high. Review of the literature supports the use of fixed-angle devices such as a blade-plate for the treatment of nonunion of the supracondylar region of the femur.[22-26] Moore et al.[27] reported on a series of thirty patients who had complications after operative treatment of a supracondylar fracture of the femur. Sixteen patients had a nonunion. Ten had an aseptic pseudarthrosis, which was treated with a 95-degree blade-plate and iliac crest bone graft in seven patients and with electrical stimulation and a cast-brace in three. In his series two patients required an above-the-knee amputation for treatment of infected nonunion. Union was achieved eventually in thirteen of the fourteen remaining patients. However, there were serious postoperative complications, such as residual axial malalignment in seven patients and a decreased range of motion of the knee, which was treated with quadricepsplasty, in six patients. Although locking intramedullary nails have been used successfully for the treatment of acute fractures of the distal femur, it is inadequate for rigid fixation of nonunions in the supracondylar region of the femur because of its wide medullary canal, thin cortices, poor bone quality from disuse and limited bone stock for screw purchase[28].

Most of the older designs of hinged TKR prostheses yielded unacceptably poor results, but those of the second-generation (St Georg and the Blauth prosthesis) are equal to, or better than, the outcomes of resurfacing prostheses.[29-31] Other authors have published excellent long-term results with the Endo-model rotating-hinge TKR which we used in our series[32,33]. Our results with this prosthesis appear to be less than those using so-called 'gold standard' unconstrained components in which good and excellent results have been reported in 83% to 94% of patients[34-38] as eight patients from our series rated as excellent and good results (61.5%) as all of our patients have previous fracture, most of them operated before, immobilized and non weight bearing for months or even years plus the mean age of our series was high so we expect lower results than resurfacing prostheses. We do not replace the patella, although we do regularly patelloplasty making it smaller and denervation of the patella using diathermy probe, and we do pay attention to correct patellofemoral alignment and patellar tracking, we agree with Petrou et al.[39] that subvastus approach is essential in order to retain an early dynamic quadriceps balance, this avoids the need for a subsequent lateral retinacular release in our series we did lateral release for only one patient.

Although review of the literature reveal higher rate of infection for constrained knee prosthesis[12-13] in our series no patients developed deep infection, although lowheparin administered peri- and post-operatively for two weeks for all patients one patient developed DVT and required a therapeutic doses of low-molecularheparin followed by oral anticoagulant for months. The bone quality in those patients is weak with marked osteoporosis and the design of the prosthesis is bulky and need aggressive reaming to accommodate the bulky distal part of the prosthesis and these results in intra-operative femoral condyle fracture in two patients, which reduced and fixed temporally by reduction clamp until the insertion of the cemented prosthesis. The range of flexion in our patients was lower than published data for resurfacing knee arthroplasty we explain this by the time interval between the fracture and the performance of TKR (from 24 to 62 months) with previous surgery and immobilization of the knee and soft tissue adhesions and muscle weakness and atrophy.

Summary

The Endo-model rotating hinge knee replacement proved to be a good option for those elderly arthritic patients with fractures of the supracondylar femur that fail to unite with early weight bearing and expected good and excellent results for most of the patients.

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