

A Prospective Analysis of Effect of Teripratide on Fracture Healing in Osteoporotic Pterochanteric Fractures



Medical Science

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Dr. Sriram Thanigai

Associate Professor, Dept. of Orthopaedics, SRM Medical College, Chennai. Consultant-Orthopaedician, Arjun Nursing Home,

Dr. Dilip Kumar Naidu

Associate Professor, Dept. of Orthopaedics, SRM Medical College, Chennai.

Dr. Rajkumar

Assistant Professor, Mahatma Gandhi Postgraduate Institute of Dental Sciences, Pondicherry.

ABSTRACT

We prospectively analyzed the radiographic and clinical outcomes of osteoporotic pterochanteric fractures in 20 patients who underwent fixation with Cephalomedullary Device-Proximal Femur Nailing (PFN) and compared the results with 20 patients who received teripratide in addition to PFN fixation. A significantly shorter time for fracture healing was recorded in the teripratide-treated group than in the control group. Rates of Implant failure were significantly reduced in the teripratide-treated group. There were no significant differences with regard to superficial wound infection, Respiratory complications, Mortality. The mean overall mobility scores were significantly better in the teripratide-treated group at 3 and 6 months. The pain scores were also significantly better in the teripratide-treated group at 3 and 6 months. Teripratide improves radiographic outcomes and yields better clinical outcomes at 3 and 6 months postoperatively. The improvement in union time may be important for elderly populations with unstable pterochanteric fractures to enable them to return to daily activities and reduce morbidity and mortality.

INTRODUCTION:

Pterochanteric fracture is a relatively common and serious clinical issue in geriatric trauma. The injury contributes to high mortality and adverse outcomes in the geriatric population. Osteoporotic hip fracture has a tremendous impact on the health-care system and on society in general. Surgery is usually indicated, but bringing about pain relief, early weight-bearing, and an early return to the pre-injury functional level, which is of critical importance to avoiding complications in geriatric patients, remains a challenge for orthopaedic surgeons.^{1,2}

Osteosynthesis with an extramedullary or intramedullary device is the standard treatment for these fractures^{3,4}, but fixation stability depends on the quality of bone. Osteoporotic bone and fracture comminution are critical for bone anchorage of the implants and subsequent motion between fragments. The poor bone stock decreased pull-out strength of implants and reduced bone regenerative capacity.⁵ Despite achieving perfect reduction and optimal positioning of the implant, failure rate in poor bone stock is higher than those in normal bone.^{6,7} The dynamic hip screw (DHS) has been used widely in osteoporotic pterochanteric fractures. However, lag screw cutting out and excessive sliding with varus and shortening deformity limit its use in such osteoporotic fractures. To avoid such complications, Cephalomedullary devices such as a Proximal Femur Nail is a better option. For unstable pterochanteric fractures, the orthopaedic community is divided between those using a DHS for these fractures and those who choose a cephalomedullary device. By strictly adhering to surgical principles involving a tip-to-apex distance (TAD) index and quality of reduction, many unstable pterochanteric fractures can be successfully managed by DHS.⁸ However, treatment failure rates for osteoporotic pterochanteric fractures using a DHS are too high to recommend its use.

Even with the improvement in implant design, implant choices, and surgical techniques, pterochanteric fractures still carry a mortality rate ranging from 2.49% to 33% at one month to one year and constitute a major socioeconomic problem.^{9,10} The orthopaedic surgeon is often the first physician to address these fragility fractures and is in a unique position to make every effort to treat, prevent future fractures, and minimize the need for subsequent revision surgeries.¹ In addition to surgical intervention, many pharmacologic agents have demonstrated anti-fracture efficacy and may play a valuable role in the treatment of fractures.^{11,12} Among them, the anabolic agent, teripratide

(parathyroid hormone [PTH1-34]), was approved by the US Food and Drug Administration in 2002 and promotes the active building of bone mass by stimulation of proliferation and differentiation of chondrocytes and osteoprogenitor cell.^{11,12} Recent animal studies have demonstrated an acceleration of fracture healing, and the fracture callus in teripratide-treated animals formed more rapidly, remodeled more quickly, and possessed superior biomechanical properties compared with placebo-treated animals.¹¹⁻²⁷ Teripratide proved to be an attractive agent to enhance fracture healing and limit the risk of nonunion when human trials on fracture healing were performed.^{11,12} Little has been published regarding the role of teripratide in osteoporotic pterochanteric fractures that were managed by PFN. This study aims to assess whether adding teripratide postoperatively would enhance the success rate of DHS in osteoporotic pterochanteric fractures using a prospective analysis of 2 groups of elderly patients with osteoporosis: one that received teripratide and another that received only calcium replacement therapy.

MATERIALS AND METHODS:

Patients who underwent Proximal Femur Nailing for Osteoporotic Pterochanteric fractures during the period-may2012 to may2013 were selected for the study.

The different osteoporosis medications, the advantages and disadvantages of osteoporosis treatment based on the guidelines for osteoporosis treatment²⁸ were explained to the patients and chosen by the patients themselves. The clinical and radiographic data and functional outcomes were reviewed retrospectively.

Inclusion criteria were adult patients older than 65 years who had suffered an pterochanteric fracture and received follow-up for a minimum of 24 months. Subjects with an unacceptable reduction of fractures, multiple fractures, pathologic fractures, previous ipsilateral hip or femur surgery, fracture of the opposite hip, developmental abnormality, and use of any antiosteoporotic medications before injury were excluded. Patients were prescribed teripratide as suggested by the guidelines for osteoporosis treatment.²⁸ Teripratide was subcutaneously administered with 20 mcg/day for 18 months. Teripratide was prescribed from the day of surgery.

Patients who met the inclusion criteria and were without exclusion criteria were divided into 2 groups: group A, patients who had PFN fixation and had received calcium replacement therapy.

py; group B, patients that had postoperatively received teriparatide in addition to PFN fixation and calcium replacement therapy.

This prospective study was approved by the hospital ethics committee.

All patients had radiographic examinations including an anteroposterior (AP) view of the pelvis and AP and lateral views of the affected hip preoperatively and at 1 day, 2 weeks, and 4 weeks postoperatively and monthly until the healing of the peritrochanteric fracture.

Radiographic union of the fracture was defined as recanalization of the trabeculae or bridging callus visible on both radiograph views; delayed union was defined as no sign of fracture healing after 6 months; nonunion was defined as the absence of bone union after 9 months postoperatively; malunion was defined as femoral shortening of more than 20mm or varus collapse of more than 15 degrees after comparison with the opposite side.

Postoperative functional scores were obtained using the mobility score of Parker and Palmer.²⁹ Hip pain was graded on a 4-point scale: (1) no pain; (2) mild pain not affecting walking or requiring regular analgesic medication; (3) moderate pain affecting walking and/or requiring regular medication; (4) severe pain. Assessment was performed at 3, 6, and 12 months postoperatively and at the last follow-up.⁴

RESULTS:

There were 40 patients with Osteoporotic Peritrochanteric fractures during the above-mentioned period. All were treated with Closed Reduction and Proximal Femur Nailing.

There were 28 women and 12 men. Mean age is 78.3 (64 to 87 years).

Mean Follow-Up time was 20.1(16-24) months.

With regard to Post-Operative complications, there was no implant failure in either of the groups at the end of final follow-up. There were 3 superficial wound infections in Group A and 1 in Group B which ultimately healed within 2 months of surgery. There were 3 Respiratory complications in Group A and 1 in Group B which resolved with treatment. There was 1 case of delayed union in Group A and None in Group B. There were 7 cases of Mal-union in Group A and 3 cases in Group B. These are listed in Table-I.

Mean time to union was 14.3 weeks in Group A and 11.8 weeks in Group B, which is markedly significant. (listed in Table-II)

Clinical outcome measures of patients in the control and teriparatide groups at last follow-up are listed in Table-III. There is a marked difference in Two Groups with regard to Mobility and Pain reduction, especially at 3 and 6 months Post-Operatively.

TABLE 1 : Postoperative complications of patients in the control and teriparatide groups.

PARAMETERS	GROUP A(N=20)	GROUP B(N=20)
WOUND INFECTION	3	1
RESPIRATORY COMPLICATIONS	3	1
DELAYED UNION	1	0
MAL-UNION	7	3
IMPLANT FAILURE	0	0
OVERALL COMPLICATIONS	14	5

TABLE 2 : Mean Union Time In Weeks For Both Groups

Group A(N=20)	Group B(N=20)
14.3±2.1	11.3±1.8

TABLE 3 : Clinical outcome measures of patients in the control and teriparatide groups at last follow-up.

	Three months postoperatively		Six months postoperatively		12 months postoperatively		Last follow-up	
	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
Mobility	= 20	= 20	= 20	= 20	= 20	= 20	= 20	= 20
Able to get about the house (0-3)	1.2	1.9	2.1	2.7	2.8	2.9	3.0	3.0
Able to get out of the house (0-3)	0.8	1.3	1.4	1.8	2.1	2.2	2.2	2.4
Able to go shopping (0-3)	0.2	1.2	0.8	1.4	1.4	1.7	1.5	1.8
Total mobility score (0-9)	2.2	4.4	4.3	5.9	6.3	6.8	6.7	7.2
Pain score (1-4)	2.7	2.2	1.8	1.4	1.6	1.3	1.2	1.0

DISCUSSION:

The key finding of this study is that teriparatide improves fracture healing, reduction of surgical and fracture healing complications, and better clinical outcome at 3 and 6 months postoperatively in elderly patients with unstable peritrochanteric fracture.

Fragility fractures are frequent injuries affecting patients with osteoporosis and are a burden for the individuals and their family, as well as the health-care system.^{9,10} Peritrochanteric fractures in this population often contribute to pain and immobility and lead to a loss of functioning in daily activities and a loss of quality of life and are associated with high morbidity and mortality.^{1,2} The primary goals in treating peritrochanteric fractures in elderly patients are pain relief, improvement of mobilization, and prevention of complications associated with comorbidities.

The use of anabolic agents to accelerate fracture healing and enhance bone formation is of interest to orthopaedic surgeons. In a number of studies, recombinant PTH has been demonstrated to have efficacy in treating osteoporosis and reducing subsequent fracture risk, but its benefit in fracture healing remains controversial.^{1,11,12} Recent studies have found an acceleration of fracture healing with improved biomechanical properties in the fracture callus using recombinant PTH-treated animals.¹¹⁻²⁷ Positive effects were also reported for implant fixation, bone-implant contact, and callus distraction osteogenesis in a rat model.³⁰ Recombinant PTH may prove to be an attractive agent to enhance fracture healing and limit the risk of nonunion when human trials on fracture healing are performed.^{11,12}

The beneficial effects of recombinant PTH on fracture healing have been demonstrated recently in case reports³¹⁻³⁴ and prospective randomized controlled trials.³⁵⁻³⁷ Aspenberg et al.^{35,36} prospectively studied 120 postmenopausal women and reported an acceleration of fracture healing of the distal radius with the use of PTH1-34. Peichl et al.³⁷ reported on a prospective randomized controlled study of 65 postmenopausal women with unilateral pelvic fracture and concluded that PTH1-84 accelerates healing in pelvic fractures and improves functional outcome.

In this study, we prospectively analyzed the effect of teriparatide [PTH1-34] on fracture healing in patients with osteoporotic peritrochanteric fractures and found that it significantly reduced the time of fracture healing compared with that in a control group of patients given calcium replacement therapy only.

CONCLUSION:

In conclusion, the present study showed improvement with regard to radiographic fracture healing and reduction of surgical

and fracture healing complications in elderly patients with osteoporotic pertrochanteric fracture who were treated with PFN and teriparatide, compared to treatment with PFN alone. This study also demonstrated better mobility in the patients who received teriparatide in addition to surgical fixation with a PFN. The improvement in union time and better clinical outcome at 3 and 6 months postoperatively may be important for an elderly population with unstable pertrochanteric fractures, allowing them to return to daily activities sooner, reducing morbidity and mortality.

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