ORIGINAL ARTICLE

Atypical Femur Fracture and its Association with Bisphosphonate Therapy in Osteoporotic Women

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ABSTRACT

Aim: To evaluate the clinical outcome of atypical femoral fractures associated with bisphosphonate therapy in osteoporotic women.

Study Design: Retrospective/Observational

Place and Duration of Study: Department of Orthopaedics, Bolan Medical College Quetta from 1st January 2017 to 31st December 2018.

Methods: A total of 10 patients had been diagnosed with an atypical femoral fracture had been followed for at least 15 months. We also included 10 patients with typical femoral fractures as a control group. The patients who had multiple co-morbidities or diseases which could possibly affect bone union were excluded. All procedures were done on reduction table and under image intensifier with spinal or epidural anesthesia.

Results: Patients mean age was 70.5 years (57 to 89) years and the mean union of atypical femoral fractures was 10.1 months (6 to 16 months) and the mean medication was 64 weeks. Out of 10 cases 8 (80%) had subtrochanter fracture type. Revision surgery involving a bone graft was performed dueto nonunion in 1out of 10cases. This difference was statistically significant ($p<0.05$). The bisphosphonate administration duration was positively correlated with the union period($p<0.05$). In contrast, There was no statistically significant correlation between the bisphosphonate administration, duration and the incidence of bilateral atypical fractures ($p>0.05$).

Conclusion: Atypical femoral fractures required more time for union of bone as compared to typical femoral fracture. Bisphosphonate therapy led to a longer period of time required for bone union.

Keywords: Atypical femoral fracture, Bisphosphonate, Typical femoral fractures

INTRODUCTION

Osteoporosis, a condition associated with significant morbidity and mortality results in patients having an increased risk of fractures. Bisphosphonates are the 1st line therapy for osteoporosis and they have anti-fracture efficacy.[1] Approximately 50% of women over the age of 50 sustain an osteoporosis related fracture or a fragility fracture during their lifetime, and one in five patients die within 12months of the fracture.[2] Proximal femoral fractures are responsible for the most serious consequences of osteoporosis due to their elevated incidence, as well as the hospitalization costs and disability following these fractures, with a financial burden equivalent to cardiovascular disease.[3] The number of proximal femoral fractures is expected to increase worldwide due to ageing of the population.[4,5]

Bisphosphonates decreases the incidence of vertebral and non-vertebral fractures and suppress the loss of bone volume in patients with osteoporosis. However, bisphosphonates therapy is associated with adverse effects because bisphosphonates inhibit osteoclast function and induce apoptosis, resulting in suppression of the bone turnover rate. The prolonged use of BP therapy causes the accumulation of micro-damage in bone, reduced heterogeneity of the organic matrix and mineral properties, increased advanced glycation end products and a deterioration of bone quality, which can lead to atypical femoral fractures (AFFs). As AFFs occur even inpatients without history of bisphosphonates therapy the risk factors for the development of AFFs are not only taking bisphosphonates, but also various other factors that affect bone remodeling.

The first report of a possible link between bisphosphonates use and “atypical fractures” of the femoral shaft was published by Odvina et al. in 2005.[6] They suggested that long-term bisphosphonates therapy may lead to over suppression of bone remodeling, resulting in an impaired ability to repair skeletal microcracks and increased skeletal fragility.

The American Society for Bone and Mineral Research (ASBMR) task force summarized the published reports regarding AFFs, and defined the major and minor features of these fractures in 2009 to investigate this area and examine the evidence in a systematic manner.[7] In 2013, the case definition was revised by the ASBMR task force to clarify the features that distinguish AFFs from ordinary osteoporotic femur fractures.[8]

The aim of this study is to determine the time period required for union in AFFs, duration of bisphosphonate therapy and AFFs and their prognosis.

MATERIALS AND METHODS

This observational study was carried out at Department of Orthopaedics, Bolan Medical College Quetta from 1st January 2017 to 31st December 2018. A total 10 patients with a atypical femoral fractures had been followed for at least 15 months were retrospectively analyzed. The control group was also compose of 10 typical femoral fracture patients, taking into account, age, sex, mode of injury, BMI, fracture patterns and surgical procedures. The patients who had multiple comorbidities or disease which could possibly affect bone union were excluded from the control group. One out of 10 cases of atypical femoral fractures, one patient gone into non union and implant failure (proximal femoral locking plate) for which we did redo

surgery and used PFN, bone graft and BMPs. All patient's procedures done on reduction table and under image intensifier with spinal/ epidural anesthesia. The data was entered and analyzed through SPSS 20.

X-rays shows subtrochanteric fracture with non-comminuted short oblique fracture with medial spike, generalized diaphysial cortical thickness. Non union at fracture site with broken PFL plate. Removal of broken plate and PFN with BG, BMPs and circlage wire

RESULTS

Patients mean age was 70.5 years (57 to 89) years and the mean union of atypical femoral fractures was 10.1 months (6 to 16 months) and the mean medication was 64 weeks. Out of 10 cases 8 (80%) had subtrochanter fracture type, 1 had shaft and 1 case with mid shaft. As for bisphosphonate, alendronate was used in 9 cases and risedronate in 1 case. Revision surgery involving a bone graft was performed due to nonunion in 1 out of 10 cases. The bisphosphonate administration duration was positively correlated with the union period. In contrast, there was no statistically significant correlation between the bisphosphonate administration duration and the incidence of bilateral atypical fractures (p>0.05) [Tables 1-3).

Table 1: Demographical details of all patients

Variable	No.	%
Age (years)		
57 – 65	4	40.0
>65	6	60.0
Injury mode		
Slip Down	10	100.0
Fracture type		
Subtrochentric	8	80.0
Shaft	1	10.0
Midshaft	1	10.0
Implant used		
PFNA	9	90
IM Nail	1	10

Table 2: Mean values obtained from all the cases (n=10)

Variable	Mean±SD	Range
Age (years)	70.5+12.5	57-89
Medication (weeks)	64.2±9.3	12-86
Union of bone (months)	10.1±2.3	6-16

Table 3: Comparison of average union duration in atypical and typical fractures

Union (months)	Atypical	Typical	P value
Mean Union	10.1+5.8	3.6+1.58	0.007

DISCUSSION

With an increasingly aging population, the use of antiosteoporotic agents is on a gradual increase and atypical femoral fractures related to bisphosphonate administration are being reported. Now many researchers show that prolonged bisphosphonate administration may lead to a higher incidence of atypical femoral fractures.

The atypical femoral fracture group required statistically significantly more time for bone union than the typical femoral fracture group. While many researchers report the same result, the definite cause of which has not yet been found, impaired osteogenesis related to a severely suppressed bone turnover is seemingly associated with atypical femoral fractures or delayed union taking into account a lower bone turnover rate and impaired osteogenesis among the patients administered with bisphosphonate.[2,8]

In the present study, the mean age of patients was recorded as 70.5 years. These results shows similarity to some other studies in which patients ages were ranging from 55 years to 100 years.[9,10]

In our study we found that the mean union of bone after bisphosphonate therapy was 10.1 months (6 to 16 months). A study conducted by Joong sup et al reported the mean period of union of bone was 11.9 in 14 cases.[11] Some of other studies regarding atypical femoral fractures demonstrated that the period of bone union after bisphosphonate therapy was 5 to 30 months.[12-14] This study showed that 8 (80%) patients had subtrochanter fracture type. As for bisphosphonate, alendronate was used in 9 cases and risedronate in 1 case. Revision surgery involving a bone graft was performed due to nonunion in 1 out of 10 cases.

In this study we found that bisphosphonate administration duration was positively correlated with the union period. In contrast, there was no statistically significant correlation between the bisphosphonate administration duration and the incidence of bilateral atypical fractures (p>0.05). Multiple previous studies shows similarity to our study that reunion of bone with bisphosphonate therapy was positively correlated.[15-18] It is believed that parathyroid hormone agents can also help shorten the period of time required for bone union in atypical femoral fractures and further research should be conducted on this issue.

CONCLUSION

Bisphosphonates reduce the incidence of vertebral and non-vertebral fractures and suppress the loss of bone volume in patients with osteoporosis. In this study we concluded that atypical femoral fractures required more

time for union of bone as compared to typical femoral fracture. Bisphosphonate therapy led to a longer period of time required for bone union.

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