EVALUATION OF TERIPARATIDE THERAPY IN JOINT REPLACEMENT SURGERY

Dr. Nitin Gupta[1]

1. Assistant professor, Department of Orthopaedics, National Institute of Medical Sciences and Research, NIMS University, Jaipur

***Email id of the corresponding author: nitingupta9@hotmail.com**

Received: 21/01/2016 **Revised: 10/03/2016** **Accepted: 23/03/2016**

ABSTRACT:

Background: Teriparatide acts by increasing the number and activity of osteoblasts, responsible for bone formation, and by modulating the activity of osteoclasts, involved in bone resorption. The success of joint replacement surgery relies heavily on integrating the implant with the surrounding bone tissue—a process known as osseointegration. **Material & Methods:** The present cross-sectional, prospective study was carried out at the Department of Orthopedics, at our tertiary care hospital. The study duration was of one year from January 2012 to December 2012. A sample size of 50 was calculated at a 90% confidence interval at 10% acceptable margin of error by Epi info software version 7.3. Only those patients who matched the inclusion and exclusion criteria were enrolled in the present study. **Results:** In the present study, out of the total study participants, based on the complications and adverse event profile, during the treatment period, all patients were administered a consistent dose of teriparatide (20 µg subcutaneously daily) for a duration of 90 days. No adverse events related to the teriparatide treatment were reported, indicating a well-tolerated intervention. There were no documented complications, such as infections or blood clots, during the course of teriparatide treatment. Importantly, none of the patients experienced complications related to periprosthetic fractures potentially induced by osteoporosis. These findings suggest a favorable safety profile and absence of treatment-related issues in the study group during the specified treatment duration. **Conclusion:** We concluded from the present study that Teriparatide therapy enhances osseointegration by stimulating bone formation around the implant site and increasing bone strength around the prosthesis. It improves the stability and durability of the implant and prevents post-surgical complications and poor outcomes.

Keywords: Teriparatide, Joint replacement surgery, Post-surgical complications.

INTRODUCTION:

Osteoarthritis (OA) is a prevalent chronic joint ailment that affects millions globally. When conservative treatments prove inadequate or are contraindicated, arthroplasty becomes a viable option for replacing the compromised joint **(1).** This surgical intervention is predominantly carried out on hip and knee joints, with total hip and knee replacements being standard procedures for individuals facing joint degeneration due to osteoarthritis, trauma, or other conditions **(2).** India is poised for significant growth in joint replacements in recent years, surpassing global trends. Arthroplasty can provide benefits such as pain relief and an enhanced quality of life; however, it is not without risks and complications, including bleeding, infection, blood clots, nerve or blood vessel damage, implant failure, or periprosthetic fracture. Osteoporosis, a prevalent and severe condition impacting bone metabolism, stands out

as a crucial risk factor associated with periprosthetic fractures **(3).**

Patients grappling with osteoarthritis and osteoporosis as comorbidities may seek joint replacements to enhance their mobility and overall quality of life. Nonetheless, a significant challenge in managing these patients lies in the restoration of bone mass density **(4)**. Commonly used osteoporosis treatments like bisphosphonates, denosumab, and testosterone can only slow down bone breakdown and preserve bone density; they do not promote new bone growth or improve bone strength **(5).** Hence, there is a pressing need for innovative therapies capable of enhancing bone anabolism and reducing fracture risks in osteoporotic patients **(6)**. Teriparatide emerges as one such therapy—an anabolic agent that mimics the physiological effects of endogenous parathyroid hormone (PTH) 1-34 on bone metabolism. **(7).**

Teriparatide acts by increasing the number and activity of osteoblasts, responsible for bone formation, and by modulating the activity of osteoclasts, involved in bone resorption **(8).** The success of joint replacement surgery relies heavily on integrating the implant with the surrounding bone tissue—a process known as osseointegration **(9).** However, osseointegration faces challenges in osteoporosis patients due to their low bone density and quality, elevating the risk of periprosthetic fractures and implant failure. Teriparatide therapy holds promise in enhancing osseointegration by stimulating bone formation around the implant site and bolstering bone strength in the vicinity of the prosthesis. The present study was conducted to evaluate the role of Teriparatide therapy in joint replacement surgeries at our tertiary care center.

MATERIALS & METHODS

The present cross-sectional, prospective study was carried out at the Department of Orthopedics, at our tertiary care hospital. The study duration was of one year from January 2012 to December 2012. A sample size of 50 was calculated at a 90% confidence interval at a 10% acceptable margin of error by Epi info software version 7.3. In this prospective study patients of both genders who underwent hip or knee arthroplasty and received injection teriparatide 20 µg S.C. daily for over three months were enrolled for the study. Only those patients who matched the inclusion and exclusion criteria were enrolled in the present study. Institutional Ethics Committee Clearance was obtained before the start of the study and written and informed consent for the procedure was obtained from all the patients. Strict confidentiality was maintained with patient identity and data and not revealed, at any point in time.

Patients having prior infection, fracture, implant loosening, and contraindications to teriparatide therapy were excluded from the study. The primary outcome measure was the incidence of any post-operative complications. All the adverse events (AEs) reported during the study were recorded as per the Clavien-Dindo classification. All data were entered in the MS Office 2010 spreadsheet and Epi Info v7. Data analysis was carried out using SPSS v22. Qualitative data was expressed as a percentage (%) and Pearson's chi-square test was used to find out statistical differences between the study groups and sensitivity, specificity, positive predictive value, and negative predictive value were calculated. All tests were done at an alpha (level significance) of 5%; which means a significant association was present if the p-value was less than 0.05 and highly significant if the p-value was less than 0.01.

RESULTS

In the present study, 50 patients of both genders who underwent hip or knee arthroplasty and received injection teriparatide 20 µg S.C. daily for over three months were enrolled in the study.

Only those patients who matched the inclusion and exclusion criteria were enrolled in the present study. Out of the total 56% were males and 44% were females. Study participants were aged from 51 years to 79 years of age with the mean age of the Study participants was 62.7 ± 4.3 years. (Table 1)

Table 1: Distribution of study participants according to study parameters.

Parameters	No. of patients
Male	56%
Female	44%
Mean age	62.7 ± 4.3 years

In the present study, out of the total study participants, total knee replacement was done in 72% of cases and hip replacement surgeries were done in 28% of patients. The mean duration of hospital stay was 7 ± 2 days. First, follow-up was conducted at 15± 2 days. There was no operative complications were reported. (Table 2).

Table 2: Distribution of study participants according to study parameters.

Parameters	No. of patients
Total knee replacement	72%
Total hip replacement	28%
Mean duration of hospital stay	7 ± 2 days
Avg first follow-up	15± 2 days

In the present study, out of the total study participants, based on the complications and adverse event profile, during the treatment period, all patients were administered a consistent dose of teriparatide (20 µg subcutaneously daily) for a duration of 90 days. No adverse events related to the teriparatide treatment were reported, indicating a well-tolerated intervention. There were no documented complications, such as infections or blood clots, during the course of teriparatide treatment. Importantly, none of the patients experienced complications related to periprosthetic fractures potentially induced by osteoporosis. These findings suggest a favorable safety profile and absence of treatment-related issues in the study group during the specified treatment duration. (Table 3)

Table 3: Distribution of study participants according to study parameters.

Parameters	No. of patients
Adverse events reported regarding the treatment with teriparatide	Nil
Complications, such as infections or blood clots, were reported during teriparatide treatment	Nil
Complications in terms of periprosthetic fractures caused by possible osteoporosis	Nil

DISCUSSION

In the present study, 50 patients of both genders who underwent hip or knee arthroplasty and received injection teriparatide 20 µg S.C. daily for over three months were enrolled in the study. Only those patients who matched the inclusion and exclusion criteria were enrolled in the present study. Out of the total 56% were males

and 44% were females. Study participants were aged from 51 years to 79 years of age with the mean age of the study participants was 62.7 ± 4.3 years. Similar findings were reported in a study conducted by T Kaneko et al among 40 patients with total knee arthroplasty and reported similar results to the present study **(10).**

In the present study, out of the total study participants, total knee replacement was done in 72% of cases and hip replacement surgeries were done in 28% of patients. The mean duration of hospital stay was 7 ± 2 days. First follow up was conducted at 15± 2 days. There was no operative complications were reported. Similar findings were reported in a study conducted by Yasuo Nakamura et al. In their study, there has been a data reported in favor of weekly teriparatide [hPTH (1-34)] administration due to its demonstrated ability not to escalate bone resorption. The use of weekly teriparatide has shown notable improvements in bone mineral density and robust efficacy in preventing fractures, all without the undesirable consequence of increasing bone turnover. The implementation of weekly teriparatide administration is anticipated to significantly contribute to the effective treatment of osteoporotic patients at high risk of fractures after joint replacement surgery **(11).**

In the present study, out of the total study participants, based on the complications and adverse event profile, during the treatment period, all patients were administered a consistent dose of teriparatide (20 µg subcutaneously daily) for duration of 90 days. No adverse events related to the teriparatide treatment were reported, indicating a well-tolerated intervention. There were no documented complications, such as infections or blood clots, during the course of teriparatide treatment. Importantly, none of the patients experienced complications related to periprosthetic fractures potentially induced by osteoporosis. These findings suggest a favorable safety profile and absence of treatment-related issues in the study group during the specified treatment duration. Similar findings were reported in a study conducted by Tsan-Wen Huang et al among 255 patients**(12).**

They reported that six months of teriparatide use following surgery correlated with accelerated fracture healing, improved Health-Related Quality of Life (HRQoL), and a reduction in complications. Nevertheless, to establish the efficacy of teriparatide specifically in osteoporotic intertrochanteric fractures, a prospective, randomized, and large-scale cohort study is deemed necessary. Such a study would provide more robust evidence and a clearer understanding of the impact of teriparatide in this specific context **(12).**

CONCLUSION

We concluded from the present study that Teriparatide therapy enhances osseointegration by stimulating bone formation around the implant site and increasing bone strength around the prosthesis. It improves the stability and durability of the implant and prevents post-surgical complications and poor outcomes. Despite the potential benefits of teriparatide therapy in enhancing surgical outcomes, furthermore research is required to generalize the results and long-term advantages and assess its impact on the longevity of implants.

REFERENCES

1.Goldring MB, Otero M. Inflammation in osteoarthritis. Curr Opin Rheumatol. 2011 Sep;23(5):471-8. PMID: 21788902. Available from: https://pubmed.ncbi.nlm.nih.gov/21788902/

2.Jones CA, Beaupre LA, Johnston DW, Suarez-Almazor ME. Total joint arthroplasties: current concepts of patient outcomes after surgery. Rheum Dis Clin North Am. 2007 Feb;33(1):71-

86. doi: 10.1016/j.rdc.2006.12.008. PMID: 17367693. Available from: https://pubmed.ncbi.nlm.nih.gov/17367693/#:~:text=Total%20hip%20and%20knee%20arthroplasties,after%20receiving%20total%20joint%20arthroplasty.

3.Bourne RB, Chesworth BM, Davis AM, Mahomed NN, Charron KD. Patient satisfaction after total knee arthroplasty: who is satisfied and who is not? Clin Orthop Relat Res. 2010 Jan;468(1):57-63.Available from: https://pubmed.ncbi.nlm.nih.gov/19844772/

4.Gallagher JC, Genant HK, Crans GG, Vargas SJ, Krege JH. Teriparatide reduces the fracture risk associated with increasing number and severity of osteoporotic fractures. J Clin Endocrinol Metab [Internet]. 2005 Mar ;90(3):1583–7. Available from: https://pubmed.ncbi.nlm.nih.gov/15613428/

5.Gambacciani M, Levancini M. Management of postmenopausal osteoporosis and the prevention of fractures. Panminerva Med. 2014 Jun;56(2):115-31. Available from: https://pubmed.ncbi.nlm.nih.gov/24942322/

6.Eriksen EF, Keaveny TM, Gallagher ER, Krege JH. Literature review: The effects of teriparatide therapy at the hip in patients with osteoporosis. Bone [Internet]. 2014 ;67:246–56. Available from: https://pubmed.ncbi.nlm.nih.gov/25053463/

7.Kleerekoper M, Greenspan SL, Lewiecki EM, Miller PD, Kendler DL, Maricic M, et al. Assessing the effects of teriparatide treatment on bone mineral density, bone microarchitecture, and bone strength. J Bone Jt Surg. 2014 Jun 4;96(11).

8.Keaveny TM, McClung MR, Wan X, Kopperdahl DL, Mitlak BH, Krohn K. Femoral strength in osteoporotic women treated with teriparatide or alendronate. Bone. 2012 Jan;50(1):165–70.

9. Isaacson B, Jeyapalina S. Osseointegration: a review of the fundamentals for assuring cementless skeletal fixation. Orthop Res Rev. 2014;6:55-65Available from: https://www. dovepress.com/osseointegration-a-review-of-the-fundamentals-for-assuring-cement less--peer-reviewed-fulltext-article-ORR

10. Kaneko T, Otani T, Kono N, Mochizuki Y, Mori T, Nango N, et al. Weekly injection of teriparatide for bone ingrowth after cementless total knee arthroplasty. J Orthop Surg (Hong Kong) [Internet]. 2016 Apr 1 ;24(1):16–21. Available from: https://pubmed.ncbi.nlm.nih.gov/27122506/

11.Nakamura Y. [Evidence in the treatment of osteoporosis using weekly teriparatide injections]. Clin Calcium. 2012 Mar;22(3):407-13. Japanese. PMID: 22370308.

12. Huang TW, Chuang PY, Lin SJ, Lee CY, Huang KC, Shih HN, Lee MS, Hsu RW, Shen WJ. Teriparatide Improves Fracture Healing and Early Functional Recovery in Treatment of Osteoporotic Intertrochanteric Fractures. Medicine (Baltimore). 2016 May;95(19):e3626. PMID: 27175673; PMCID: PMC4902515. Available from: https://pubmed.ncbi.nlm.nih.gov/27175673/