

Correlation of Fragility Fractures of Hip with Vitamin D Levels

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Abstract:-

➤ Introduction

Vitamin D plays a role in optimization of the skeletal function. Vitamin D helps in calcium homeostasis which further helps in bone mineralization and preventing osteomalacia, hence older individuals with low vitamin D levels (<30ng/ml) must be prone to fragility fractures of the hip.

➤ Methodology

- Study design – Prospective observational study.
- Study population Patients at Justice K. S. Hegde Charitable Hospital with closed fractures of the hip involving the proximal femur diagnosed by a physical examination and plain radiography in the pelvis with both hips Anteroposterior View(AP) and lateral view of the involved hip.
- Study setting - Justice K. S. Hegde Charitable Hospital attached to K. S. Hegde Medical Academy, a unit of Nitte (Deemed to be University), Deralakatte, Mangaluru – 575018 (Hospital-based study).
- Study Duration - Study was conducted from February 2021 till October 2022.
- Sample size – Sample size was calculated using nMaster software (version 2.0). Based on the alpha level of 5% SD of vitamin D in hip fragility fractures is 8.05(12), for the estimation error of 1.5, sample size was decided as 111. This was calculated using master version 2 software.

➤ Methods

All patients over 45 with hip fractures from minor trauma, such as a slip and fall while standing or walking, were clinically and radiologically assessed. A patient history and injury information were documented using a predesigned proforma. The history consists of accidents/trauma, fractures in the past, surgeries, drug/supplement use history, and co-morbid conditions. The pelvis and affected limb were radiographed. Boyd and Griffin for intertrochanteric fractures and Garden for neck of femur fractures, Russel-Taylor classification for Subtrochanteric fracture to classify the kind, comminution pattern, and grade of fracture. A biochemist evaluated 25-hydroxyvitamin D (25-OH Vit.D) levels in venous blood samples taken after admission. Our laboratory tested serum vitamin D levels using

electrochemiluminescence Immuno Assay (ECLIA) on an automated analyzer.

Vitamin D values <20ng/ml were judged inadequate, while 20–20ng/ml were considered insufficient. 30–100mg/ml vitamin D was typical. Finally, vitamin-D levels correlated with fracture comminution. Data Analysis: On statistical analysis, the data was expressed in mean SD, frequency & percentage. Chi-square test was used for the analysis of the data. RESULTS In the present study, 111 patients were evaluated with X-ray radiographs to investigate the comminution pattern of hip fractures and the presence of hypovitaminosis D in patients diagnosed with hip fractures. The mean age of patients was 70.40 ± 11.29 years. Out of 111 patients, 19 patients (17%) belonged to the age group of 46 to 60 years, 60 patients (53.6%) belonged to the age 61 to 75 years. 33 patients (29.5%) belonged to the age group of >75 years. Out of 111 patients, patients (71.4%) were females and 32 patients (28.6%) were males. Based on symptoms, 45 patients (40.17%) presented with left Hip/Groin pain with inability to bear weight and 66 patients (59.82%) presented with right Hip/Groin pain with inability to bear weight. Based on comminution, 59 patients (52.7%) had comminution. The mean vitamin D levels was 20.98 ± 13.11. 46 (41.1%) of the 111 patients had deficiency 20ng/dL, 4 (3.6%) had insufficient 21-29ng/dL, 6 (5.4%) had optimal 40-60ng/dL, and 3 (2.7%) had sufficient 30-39ng/dL. The correlation between comminution and Holick's classification was statistically significant. (p=0.001). The findings of the study conclude that Vitamin D have a significant effect on the presence of comminution and fracture site pattern.

➤ Conclusion

According to our study, osteoporosis, vitamin D deficiency, and fracture site comminution are all coexisting conditions. Early identification and treatment with vitamin D for osteomalacia and anti-osteoporotic regimens for osteoporosis will enhance bone, muscle, and general health, reducing falls and the associated fractures. Incorporating findings from bigger research into Indian hip fracture prevention recommendations is necessary.

I. INTRODUCTION

Hip fracture may cause disability, reduced quality of life, and early mortality, making it the most significant osteoporosis complication.¹ Vitamin D supplementation, with or without calcium, is advised for fracture prevention.^{2,3} Previous meta-analyses of randomized controlled trials concluded that vitamin D has no effect on fracture risk or that 700-800 IU/day or "received dosages" of 400 IU/day are required to prevent fracture.⁴⁻⁷ However, critically excessive dosage studies in these later meta-analyses were placebo vs. combined vitamin D and calcium supplementation, and calcium supplementation now protects against fracture independently.⁸⁻¹² This casts doubt on the supplementation of Vitamin D without calcium.

In 2000, 1.6 million hip fractures occurred globally, and 20-30% of hip fracture survivors died.^{13, 14} Due to aging populations, particularly in developing nations, hip fractures will have a greater social and economic impact in 50 years.¹⁵ Vitamin D is an intriguing therapeutic to prevent hip fractures, a research priority.

In addition to randomized data, observational studies and the historical association between vitamin D and osteomalacia may influence academics, doctors, and communities. An up-to-date, quantitative analysis of vitamin D and fracture data is needed to guide practice in the face of ambiguity.

Low vitamin D levels (<30ng/ml) may lead to hip fragility fractures in elderly people because vitamin D promotes calcium homeostasis, bone mineralization, and osteomalacia. The study aims to find the presence of hypovitaminosis amongst the older population with fragility fractures of the hip and to correlate the presence of fracture comminution in such patients, as there is a lack of such data amongst the population .

➤ Aim

To study the presence of hypovitaminosis D in patients with osteoporotic hip fractures and the comminution pattern of these fractures using X-ray radiographs.

➤ Objectives

- To assess the vitamin-D levels in patients with fragility hip fractures.
- To evaluate the fracture comminution pattern in patients with fragility hip fractures.
- To evaluate patients with hypovitaminosis D who present with fragility hip fractures

II. MATERIALS AND METHODS

- Study design – Prospective observational study.
- Study population Patients at Justice K. S. Hegde Charitable Hospital with closed fractures of the hip involving the proximal femur diagnosed by a physical examination and plain radiography in the pelvis with both hips Anteroposterior View(AP) and lateral view of the involved hip.

- Study setting - Justice K. S. Hegde Charitable Hospital attached to K. S. Hegde Medical Academy, a unit of Nitte (Deemed to be University), Deralakatte, Mangaluru – 575018 (Hospital-based study).
- Study Duration - Study was conducted from February 2021 till October 2022.
- Sample size – Sample size was calculated using nMaster software (version 2.0). Based on the alpha level of 5% SD of vitamin D in hip fragility fractures is 8.05(12), for the estimation error of 1.5, sample size was decided as 111. This was calculated using master version 2 software.

➤ Inclusion criteria:

- Patients older than 45 years
- Patients with femoral neck fractures, trochanteric fractures and subtrochanteric fractures.

➤ Exclusion criteria:

- Patients with bone metastasis.
- Patients with fractures secondary to road traffic accidents.
- Patients with previous history of an operative procedure to the hip.

➤ Study Procedure:

All patients over 45 with hip fractures from minor trauma such slip and fall while standing/walking were clinically and radiologically assessed. A patient history and injury information were documented using a predesigned proforma. The history includes falls/trauma, fractures, surgeries, drug/supplementation history, and medical comorbidities.

The pelvis and affected limb were radiographed. Boyd and Griffin for intertrochanteric fractures and Garden for neck of femur fractures, Russel-Taylor classification for Subtrochanteric fracture to classify the kind, comminution pattern, and grade of fracture.

A biochemist evaluated 25-hydroxyvitamin D (25-OH Vit.D) levels in venous blood samples taken after admission. Our laboratory tested serum vitamin D levels using electrochemiluminescence Immuno Assay (ECLIA) on an automated analyzer. Based on Holicks classification, vitamin D values <20ng/ml were judged deficient, while 20–29ng/ml were considered insufficient.

30-39ng/ml vitamin D was considered sufficient and 40-60 ng/ml vitamin D was considered optimal. Finally, vitamin-D levels was correlated with fracture comminution.

III. RESULTS

- Out of 111 patients, 19 patients (17%) belonged to the age group of 46 to 60 years, 60 patients (53.6%) belonged to the age 61 to 75 years. 33 patients (29.5%) belonged to the age group of >75 years.
- Out of 111 patients, patients (71.4%) were females and 32 patients (28.6%) were males.
- 31 patients (27.7%) had type 1 fracture, 30 patients (26.8%) had type 2 fracture, 30 patients (26.8%) had type 3 fracture and 20 patients (18.8%) had type 4 fracture.

- 56 patients (50.9%) were classified according to Boyd & Griffin, 53 patients (47.3%) were classified according to Gardens and 2 patients (1.8%) were classified according to Russel- Taylor.
- 45 patients (40.17%) had left sided fracture and 66 patients (59.82%) had right sided fracture.
- Based on comminution, 59 patients (52.7%) had comminution.
- Based on Holicks classification, 71 patients (63.4%) were deficient <20ng/dl, 19 patients (17%) were insufficient 21-29ng/dl, 9 patients (8%) had optimal 40-60ng/dl and 13 patients (11.6%) had sufficient 30-39 ng/dl.
- The mean vitamin D levels was 20.98 ± 13.11 .
- 46 patients (41.1%) had deficiency <20ng/dl, 4 patients (3.6%) had insufficient 21-29ng/dl, 6 patients (5.4%) had optimal 40-60ng/dl and 3 patients (2.7%) sufficient 30-39 ng/dl. The correlation between comminution and Holicks classification was statistically significant. ($p=0.001$)

IV. CONCLUSION

According to our study, vitamin D deficiency, osteoporosis and fracture site comminution are coexisting conditions. Early identification and treatment with vitamin D for osteomalacia and anti-osteoporotic regimens for osteoporosis will enhance bone, muscle, and general health, reducing falls and the associated fractures.

REFERENCES

- [1]. Working Group of the Australian and New Zealand Bone and Mineral Society, Endocrine Society of Australia and Osteoporosis Australia: Vitamin D and adult bone health in Australia and New Zealand: a position statement. *Med J Aust.* 2005, 182 (6): 281-285.
- [2]. Bischoff-Ferrari HA: How to select the doses of vitamin D in the management of osteoporosis. *Osteoporos Int.* 2007, 18 (4): 401-407. 10.1007/s00198-006-0293-9.
- [3]. Qaseem A, Snow V, Shekelle P, Hopkins R, Forciea MA, Owens DK: Pharmacologic treatment of low bone density or osteoporosis to prevent fractures: a clinical practice guideline from the American College of Physicians. *Ann Intern Med.* 2008, 149 (6): 404-415.
- [4]. Avenell A, Gillespie WJ, Gillespie LD, O'Connell DL: Vitamin D and vitamin D analogues for preventing fractures associated with involutional and post-menopausal osteoporosis. *Cochrane Database of Systematic Reviews.* 2005, CD000227-3
- [5]. Avenell A, Gillespie WJ, Gillespie LD, O'Connell D: Vitamin D and vitamin D analogues for preventing fractures associated with involutional and post-menopausal osteoporosis. *Cochrane Database Systematic Reviews.* 2009, CD000227-2
- [6]. Bischoff-Ferrari HA, Willett WC, Wong JB, Giovannucci E, Dietrich T, Dawson-Hughes B: Fracture prevention with vitamin D supplementation - A meta-analysis of randomized controlled trials. *JAMA.* 2005, 293 (18): 2257-2264. 10.1001/jama.293.18.2257.
- [7]. Bischoff-Ferrari HA, Willett WC, Wong JB, Stuck AE, Staehelin HB, Orav EJ, Thoma A, Kiel DP, Henschkowski J: Prevention of nonvertebral fractures with oral vitamin D and dose dependency: a meta-analysis of randomized controlled trials. *Arch Intern Med.* 2009, 169 (6): 551-561. 10.1001/archinternmed.2008.600.
- [8]. Chapuy MC, Arlot ME, Delmas PD, Meunier PJ: Effect of Calcium and Cholecalciferol Treatment for 3 Years on Hip-Fractures in Elderly Women. *Br Med J.* 1994, 308 (6936): 1081-1082.
- [9]. Dawson-Hughes B, Harris SS, Krall EA, Dallal GE: Effect of calcium and vitamin D supplementation on bone density in men and women 65 years of age or older. *N Engl J Med.* 1997, 337 (10): 670-676. 10.1056/NEJM199709043371003.
- [10]. Chapuy MC, Pamphile R, Paris E, Kempf C, Schlichting M, Arnaud S, Garnero P, Meunier PJ: Combined calcium and vitamin D-3 supplementation in elderly women: Confirmation of reversal of secondary hyperparathyroidism and hip fracture risk: The Decalys II study. *Osteoporos Int.* 2002, 13 (3): 257-264. 10.1007/s001980200023.
- [11]. Jackson RD, LaCroix AZ, Gass M, Wallace RB, Robbins J, Lewis CE, Bassford T, Beresford SAA, Black HR, Blanchette P, et al: Calcium plus vitamin D supplementation and the risk of fractures. *Engl J Med.* 2006, 354 (7): 669-683. 10.1056/NEJMoa055218.
- [12]. Tang BMP, Eslick GD, Nowson C, Smith C, Bensoussan A: Use of calcium or calcium in combination with vitamin D supplementation to prevent fractures and bone loss in people aged 50 years and older: a meta-analysis. *Lancet.* 2007, 370 (9588): 657-666. 10.1016/S0140-6736(07)61342-7.
- [13]. Johnell O, Kanis JA: An estimate of the worldwide prevalence and disability associated with osteoporotic fractures. *Osteoporos Int.* 2006, 17 (12): 1726-1733. 10.1007/s00198-006-0172-4.
- [14]. Johnell O, Kanis J: Epidemiology of osteoporotic fractures. *Osteoporos Int.* 2005, 16 (Suppl 2): S3-7. 10.1007/s00198-004-1702-6.
- [15]. Cooper C, Campion G, Melton LJ: Hip-Fractures in the Elderly - a Worldwide Projection. *Osteoporos Int.* 1992, 2 (6): 285-289. 10.1007/BF01623184.