International Journal of Medical and Pharmaceutical Research
Website: https://ijmpr.in/ | Print ISSN: 2958-3675 | Online ISSN: 2958-3683
NLM ID: 9918523075206676
Volume: 4 Issue:6 (Nov-Dec 2023); Page No: 14-17

Original Article

Clinical Correlation between Genu Varum and Knee Function in Primary Osteoarthritis Knee

Dr. Gowtham Singh[1], Dr. Inder Pawar[2], Dr Ramavtar[3], Dr Rohan Krishnan[4]*

[1] Senior Resident, Pgimsr & Esic Hospital, New Delhi
[2] Professor, Pgimsr & Esic Hospital, New Delhi
[3] Professor, Dept. of Orthopaedics, Pgimsr & Esic Model Hospital, New Delhi
[4] Asst. Professor, Dept. of Orthopaedics, Pgimsr & Esic Model Hospital

ABSTRACT

Background: To measure the degree of varus deformity in primary osteoarthritis knee and compare the various degree of varus deformity and knee function.

Method: The Mechanical axis of the femur (MAF) and the Mechanical axis of the Tibia (MAT) to measure angle of varus deformity The patient was clinically examined and assessed for the function of the knee using the American Knee Society function score (AKSS) [Excellent, Good and Poor].

Result: Among 41 patients with 0 to 10 degrees of varus deformity, 53.65% had excellent (80-100) and 46.34% had good (70-79) knee society function scores. Among 32 patients with 11 to 15 degrees of varus deformity, 50% had excellent (80-100), 31.25% had a good (70-79) knee society function score, and 18.75% had a fair (60-69) knee society function score. Among 16 patients with 16 to 20 degrees of varus deformity, 75% had a poor (60) knee society function score, 12.5% had a fair (60-69) knee society function score, and 6.25% had a good (70-79) and 6.25% had excellent (80-100) knee society function score. Among 11 patients with 20 degrees of varus deformity, 100% had poor (60) knee society function scores. Hence, there was a statistically significant difference in the proportion of knee society function scores according to the degree of varus deformity (p0.05). The correlation between the degree of varus deformity and the AKSS was found to be statistically significantly high and negative (Correlation coefficient: -0.880; $p<0.001$).

Conclusion: With the increase in the degree of varus deformity, there was a decrease in knee function score in primary osteoarthritis knee patients.

Key Words: *Genu Varum; Knee Function; Osteoarthritis*

***Corresponding Author**
Dr Rohan Krishnan*
Asst. Professor, Dept. of Orthopaedics, Pgimsr & Esic Model Hospital

INTRODUCTION

Knee Osteoarthritis (OA), is a progressive degenerative joint disease, as a result of wear and tear and progressive loss of articular cartilage. It is divided into two types, primary and secondary. Primary osteoarthritis is a progressive articular degeneration seen in the elderly age group without any underlying cause. Secondary osteoarthritis is the consequence of underlying pathologies like trauma, and inflammatory arthritis [1][2].Osteoarthritis is typically a progressive disease that hampers activities of daily living and eventually confines the patients to bed with joint effusion and deformities. The intensity of clinical symptoms may vary from person to person. However, they often become more severe, more common, and more debilitating over time the progression rate varies from person to person. The most common clinical symptoms include knee pain that begins slowly and worsen with activity like weight bearing exercise, knee stiffness, and swelling, that increases over a period of time [3]. Malalignment (varus/valgus) of the knee is assumed to correlate with uni-compartmental OA of the knee [4]. During gait in the neutrally aligned knee, the load is disproportionately transmitted to the medial tibiofemoral compartment [5][6]. Varus Malalignment further increases the total load passing medially during gait [7]. It very likely puts stress not only on articular hyaline cartilage but also on other joint tissue, e.g., menisci, subchondral bone, and ligaments, which may contribute to the development and progression of OA. Malalignment may participate in a vicious circle, with knee OA worsening (e.g., from Malalignment to worsening of OA to worse Malalignment) [4]. OA knee can be viewed as the clinical and pathological outcome of a range of disorders that result in structural and functional failure of synovial joints [8]. OA knee occurs when the dynamic equilibrium between the breakdown and repair of joint tissues is overwhelmed [9]. This progressive joint failure may cause pain, physical disability, and psychological distress [10], although many persons with structural changes consistent with OA are asymptomatic [11]. The reasons for this discrepancy between the severity of the disease and the level of reported pain and disability are unknown. In 1989, the "American Knee Society" group published an examiner-

dependent clinical evaluation system known as the "American Knee Society Score" (AKSS) scale, divided into two components. The first assesses the knee clinically through the physical examination (Clinical AKSS - "Knee Score"), and the second assesses the individual's functionality (Functional AKSS - "Function Score"), while both attain a total of 100 points each. The objective of this separation was to make the scoring of the 13 Clinical AKSS independent of the Functional AKSS, not being influenced by variables such as comorbidities and advanced age [12].

MATERIALS AND METHODS

Study Design: Observational Cross-sectional study. Duration of study is from December 2020 to April 2022.

Outcome Measures: The outcome measure was AKSS SCORE in patients with 0^0-10^0, 11^0-15^0, 16^0-20^0, $>20^0$varus deformity knee.

Inclusion Criteria: Patient of Age > 45 years both male and female with primary OA knee; Kellgren and Lawrence (K/L) grading 2, 3, 4.

Exclusion Criteria:

Patients with, Secondary OA (post-traumatic and post-septic, neuropathic arthropathy); Inflammatory arthritis, Gout, Pseudo gout; Patients underwent surgery to the knee joint; Any intra-articular injection in the knee within the previous 3 months; Neurological disorder; Patients not given consent for participation in the study.

Sample Size:

The study of Leena et. al, observed the prevalence of Varus Alignment in Knee Osteoarthritis patients as 0.51. Taking this value as reference, the Minimum Sample Size required is 96 with a 5% level of significance and 10% desired precision. The formula used is: $N >= Z^2_{\alpha/2} * p * (1-p)/d^2$, where p is prevalence, and ''d" is the desired precision or margin of error. Proportion of Varus Alignment = 117/230=0.51, Alpha = 0.05, Allowable Error or Desired Precision = .10. Required Sample Size =96.

METHODOLOGY

All patients were selected from the patients attending the outpatient department and the emergency department. A detailed history, examination (General, systemic and local examination) was done. A predesigned, tested, structured, interviewer-administered questionnaire shall be used to collect data from study participants. The participants were interviewed and explained about the study and they were asked to sign the information sheet and consent form. All good clinical practice (GCP) guidelines were followed after the Hospital medical research committee approves the study. Patients with a diagnosis of Primary osteoarthritis knee (K/L grade 2, 3, 4) who satisfied the inclusion and exclusion criteria were recruited from the orthopaedics OPD.

Radiographic analysis of the knee joint by taking a Full Limb Weight Bearing Anteroposterior X-ray of both lower limbs was used to diagnose OA knee. According to the above Radiographs, the OA knee was categorized according to the degree of varus deformity of the knee into 4 study groups (0^0-10^0, 11^0-15^0, 16^0-20^0, $>20^0$)

Varus deformity was measured using full limb anterior-posterior weight-bearingX-rays and was assessed for AKSS score.

OBSERVATION AND RESULTS:

A total of 100 patients were included in the study. The age of the study population ranged from 41 to 86 years with a mean (± SD) of 54.17 (± 8.44) years and a median (IQR) of 55(46, 58) years. 15% of the patients were between 40 to 50 years, 36% were between 51 to 60 years and 49% were >60 years.

Among 100 patients, 66% were females and 34% were males. According to K/L grade, 08% were grade II i.e., definite osteophytes and possible narrowing of joint space, and 31% were grade III i.e., moderate multiple osteophytes, definite narrowing of joint space, some sclerosis, and possible deformity of bony ends, and 61% were grade IV i.e., large osteophytes, marked narrowing of joint space, severe sclerosis, and definite deformity of bending. The degree of varus deformity of the study population ranged from 3 to 24 degrees with a mean (± SD) of 11.02 (± 4.15) degrees and a median (IQR) of 14.5(10.5, 18.5) degrees. The degree of varus deformity was 0 to 10 degrees for 41% of the patients, 11 to 15 degrees for 31% of the patients, 16 to 20 degrees for 16% of the patients, and >20 degrees for 11% of the patient Among 41 patients with 0 to 10 degrees of varus deformity, 53.65% had excellent (80-100) and 46.34% had good (70-79) knee society function scores. Among 32 patients with 11 to 15 degrees of varus deformity, 50% had excellent (80-100), 31.25% had a good (70-79) knee society function score, and 18.75% had a fair (60-69) knee society function score. Among 16 patients with 16 to 20 degrees of varus deformity, 75% had a poor (<60) knee society function score, 12.5% had a fair (60-69) knee society function score, and 6.25% had a good (70-79) and 6.25% had excellent (80-100) knee society function score. Among 11 patients with >20 degrees of varus deformity, 100% had poor (<60) knee society function scores. Hence, there was a statistically significant difference in the proportion of knee society function scores

according to the degree of varus deformity ($p<0.05$).The correlation between the degree of varus deformity and the American knee society function score was found to be statistically significantly high and negative (Correlation coefficient: -0.880; $p<0.001$). With the increase in the degree of varus deformity, there was a decrease in knee function score.

DISCUSSION

Osteoarthritis (OA) is the most common form of arthritis leading to disability due to increase in life expectancy, the rising prevalence of obesity, and the lack of definitive treatment to prevent or halt the progression of the disease. OA knee is a major health problem because of its high prevalence and substantial impact in declining functional ability [13-17]. Therefore, it is important to improve the performance of daily activities, such as walking, stair climbing, and reclining in such patients [15-17]. Functional ability in OA knee patients is characterized by inability to perform activities of daily living related to mobility such as walking, stair climbing and such as rising from a chair, rising from a bed [13-16]. Traditionally, reduced functional ability in knee OA patients has been attributed to degeneration of cartilage and bone. Dougados et al. showed an increased risk of functional deterioration associated with progressive cartilage degeneration [18], while Dieppe et al. showed no association. The relationship between articular degeneration and functional ability is found to be weak. Therefore, other determinants may also be involved in explaining the reduction in functional ability in OA knee patients [19]. We conducted a cross-sectional observational study on 100 primary OA knee patients with genu varum deformity. Study population data was collected for over a period of 01 year in which 66% were females and 34% were males. Of the 100 patients with genu varum deformity, the age of the study population ranged from 40 to 86 years with a mean (± SD) of 54.17 (± 8.44) years and a median (IQR) of 55(46, 58) years. 15% of the patients were aged between 40 to 50 years, 36% aged between 51 to 60 years and 49% aged >60 years. Most of our study population aged more than 50-year age with female predominance. Among 100 patients 08% were KL grade II i.e., definite osteophytes and possible narrowing of joint space, 31% were KL grade III i.e., moderate multiple osteophytes, definite narrowing of joint space, some sclerosis, and possible deformity of bony ends and 61% were KL grade IV i.e., large osteophytes, marked narrowing of joint space, severe sclerosis, and finite deformity of bone contour. Keenan OJ et al. conducted a prospective study on 300 consecutive patients undergoing unilateral total knee arthroplasty (TKA) for OA (mean age 69 years (44 to 91; standard deviation (SD) 9.5), 178 (59%) female). Two blinded examiners independently KL grade preoperative radiographs using five common systems: Kellgren-Lawrence (KL); International Knee Documentation Committee (IKDC); Fairbank; Brandt; and Ahlbäck. Interobserver agreement was assessed using the intraclass correlation coefficient (ICC). Radiological classification and FTCL were correlated and concluded that the Ahlbäck and KL systems had the highest correlation with confirmed cartilage loss at TKA. However, the IKDC system displayed the best interobserver reliability, with a favourable correlation with FTCL in medial and lateral compartments, although it was less discriminating in more severe disease [20]. The degree of varus deformity in our study population ranged from 3 to 24 degrees with a mean (± SD) of 11.02 (± 4.15) degrees and a median (IQR) of 14.5(10.5, 18.5) degrees. The degree of varus deformity was 0 to 10 degrees in 41% of the patients, 11 to 15 degrees in 31% of the patients, 16 to 20 degrees in 16% of the patients and >20 degrees in 11% of the patients.

From our study it was concluded that among 41 patients with 0 to 10 degrees of varus deformity, 53.65% had excellent (80-100) and 46.34% had good (70-79) knee society function scores. Among 32 patients with 11 to 15 degrees of varus deformity, 50% had excellent (80-100), 31.25% had a good (70-79) knee society function score, and 18.75% had a fair (60-69) knee society function score. Among 16 patients with 16 to 20 degrees of varus deformity, 75% had a poor (<60) knee society function score, 12.5% had a fair (60-69) knee society function score, 6.25% had a good (70-79) and 6.25% had excellent (80-100) knee society function score. Among 11 patients with >20 degrees of varus deformity, 100% had poor (<60) knee society function scores. Hence, there was a statistically significant difference in the proportion of knee society function scores according to the degree of varus deformity ($p<0.05$). Lim BW et al. [21] assessed anatomic radiographic knee alignment in 107 community volunteers with medial tibiofemoral OA knee. Impairments assessed included pain (Western Ontario and McMaster Universities Osteoarthritis Index [WOMAC]), quadriceps and hamstring isometric strength, and knee varus-valgus laxity. Participants were categorized into groups according to knee alignment (least, moderate, and most varus). Impairments and functional limitations between groups were compared using analyses of variance with and without adjustment for age, sex, and disease severity. Regression analyses were also performed in the entire cohort to further determine the relationship of varus malalignment and functional limitations. The most varus group (mean varus 7.7 degrees) did not demonstrate greater impairments or worse functional limitations compared with the moderate varus (mean varus 4.2 degrees) and least varus (mean varus 0.5 degrees) groups. In our study the American knee society function score was used to assess the knee function only considered the activities like walking, ability to climb up and down stairs and the usage of aid for walking. Our score that we used doesn't include the pain element but pain is indirectly related to the functioning of the knee. Knee function score being a subjective score has its own limitation. It was a time bound study due to which enrolled patients were less in number as compared to other relevant studies and this study was conducted during COVID 19 pandemic period during which number of patients visiting OPD were limited. So, it is not wise to conclude that result and we suggest further study is needed with larger sample size to make the conclusion

CONCLUSION

The correlation between the degree of varus deformity and the American knee society function score was found to be statistically significant and negative (Correlation coefficient: -0.880; $p<0.001$). Hence it can be concluded that, with the increase in the degree of varus deformity, there was a decrease in knee function score in primary osteoarthritis knee patients.

REFERENCES

1. Springer BD. (2019). Management of the Bariatric Patient. What Are the Implications of Obesity and Total Joint Arthroplasty: The Orthopedic Surgeon's Perspective? *The Journal of arthroplasty*. 34(7):S30-2.
2. Elsiwy Y, Jovanovic I, Doma K, Hazratwala K, Letson H. (2019). Risk factors associated with cardiac complication after total joint arthroplasty of the hip and knee: a systematic review. *Journal of orthopaedic surgery and research*. 14(1):15.
3. Lundgren-Nilsson Å, Dencker A, Palstam A, Person G, Horton MC,Escorpizo R, Küçükdeveci AA, Kutlay S, Elhan AH, Stucki G, Tennant A. (2018). Patient-reported outcome measures in osteoarthritis: a systematic search and review of their use and psychometric properties. *RMD open*. 4(2).
4. Brouwer GM, Tol AV, Bergink AP, Belo JN, Bernsen RM, Reijman M, Pols HA, Bierma- Zeinstra SM. (2007). Association between valgus and varus alignment and the development and progression of radiographic osteoarthritis of the knee. *Arthritis & rheumatism*. 56(4):1204-11.
5. Andriacchi TP. (1994). Dynamics of knee malalignment. *The Orthopedic clinics of North America*. 25(3):395
6. Morrison JB. (1970). The mechanics of the knee joint in relation to normal walking. *Journal of biomechanics*. 3(1):51-61.
7. HSU RW, Himeno S, Coventry MB, Chao EY. (1990). Normal axial alignment of the lower extremity and load-bearing distribution at the knee. *Clinical Orthopaedics and Related Research®*. 255:215-27.
8. Nuki G. (1999). Osteoarthritis: a problem of joint failure. *Zeitschrift für Rheumatologie*. 58(3):142-7.
9. Eyre DR. (2004). Collagens and cartilage matrix homeostasis. *Clinical Orthopaedics and Related Research®*. 427:S118-22.
10. Guccione AA, Felson DT, Anderson JJ, Anthony JM, Zhang Y, Wilson PW, Kelly Hayes M, Wolf PA, Kreger BE, Kannel WB. (1994). The effects of specific medical conditions on the functional limitations of elders in the Framingham Study. *American journal of public health*. 84(3):351-8.
11. Hannan MT, Felson DT, Pincus TH. (2000). Analysis of the discordance between radiographic changes and knee pain in osteoarthritis of the knee. *The Journal of rheumatology*. 27(6):1513-7.
12. Insall JN, Dorr LD, Scott RD, Scott WN. (1989). Rationale of the Knee Society clinical rating system. *Clinical orthopaedics and related research*. (248):13-4.
13. Miller ME, Rejeski JW, Messier SP, Loeser RF. (2001). Modifiers of change in physical functioning in older adults with knee pain: the *Observational Arthritis Study In Seniors (OASIS). Arthritis Rheum*. 45:331-9.
14. Van Dijk GM, Dekker J, Veenhof C, van den Ende CHM. (2006). Course of functional status and pain in osteoarthritis of the hip and knee: a systematic review of the literature. *Arthritis Rheum*. 55:779-85.
15. Felson DT, Lawrence RC, Dieppe PA, Hirsch R, Helmick CG, Jordan JM et al. (2000). Osteoarthritis: new insights. Part 1: the disease and its risk factors. *Ann Intern Med*. 133(8):635-46.
16. World Health Organization. (2001). International Classification of Functioning, Disability and Health: ICF. Geneva: WHO.
17. World Health Organization. (2002). Towards a common language for functioning, disability and health: ICF. Geneva: WHO.
18. Sharma L, Hayes KW, Felson DT, Buchanan TS, Kirwan-Mellis G, Lou et al. (1999). Does laxity alter the relationship between strength and physical function in knee osteoarthritis? *Arthritis Rheum*. 42:25-32. 20. Pai Y, Zev Rymer W, Chang RW, Sharma L. (1997). Effect of age and osteoarthritis on knee proprioception. Arthritis Rheum 40:2260-5.
19. Dieppe PA, Keen MC, Maciewicz RA, Watt I, Waterton JC. (2002). No loss of cartilage volume over three years in patients with knee osteoarthritis as assessed by magnetic resonance imaging. *Osteoarthritis Cartilage*. 10(12):929-37. doi: 10.1053/joca.2002.0849. PMID: 12464553.
20. Keenan OJ, Holland G, Maempel JF, Keating JF, Scott CE. (2020). Correlations between radiological classification systems and confirmed cartilage loss in severe knee osteoarthritis. *The Bone & Joint Journal*. 102(3):301-9.
21. Lim BW, Hinman RS, Wrigley TV, Bennell KL. (2008). Varus malalignment and its association with impairments and functional limitations in medial knee osteoarthritis. *Arthritis Rheum*. 59(7):935-42. doi: 10.1002/art.23820. PMID: 18576296.