DOI: https://doi.org/10.54393/pbmj.v8i9.1106

PAKISTAN BIOMEDICAL JOURNAL
https://www.pakistanbmj.com/journal/index.php/pbmj/index
ISSN (E): 2709-2798, (P): 2709-278X
Volume 8, Issue 09 (September 2025)

Original Article

OPEN ACCESS

Prevalence of Genu Varum and Genu Valgum in Osteoarthritis, Association with BMI, Age, Gender and Grade 3, 4 of Osteoarthritis

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ARTICLE INFO

Keywords:
Osteoarthritis, Genu Varum, Genu Valgum, Deformity

How to Cite:
Ghaffar, E., Waqar, R., Hanif, N., Mazhar, F., Tariq, R., Aqdas, A., Javed, T., Shahid, S., Ibrahim, M., & Ali Syed, F. (2025). Prevalence of Genu Varum and Genu Valgum in Osteoarthritis, Association with BMI, Age, Gender and Grade 3, 4 of Osteoarthritis: Genu Varum and Genu Valgum in Osteoarthritis. Pakistan BioMedical Journal, 8(9), 07–11. https://doi.org/10.54393/pbmj.v8i9.1106

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Received Date: 15th January, 2025
Revised Date: 30th August, 2025
Acceptance Date: 12th September, 2025
Published Date: 30th September, 2025

ABSTRACT

A joint disease known as osteoarthritis is a degenerative disease in which cartilage breakdown, leading to pain, stiffness, and reduced joint function, especially in weight-bearing joints like the knees. Skeletal deformities, such as bandy leg and knock-knees, can worsen the symptoms and limitations of OA in the lower extremities. **Objective:** To evaluate the relationship between angular deformities (Genu Varum and Genu Valgum) and osteoarthritis (OA) in individuals between the ages of 35 and 80, with an emphasis on OA grade, age, and BMI. **Methods:** A cross-sectional survey of 163 male and female patients with grade 3 and 4 OA from different hospitals in Lahore, ranging in age from 35 to 80 years, was conducted. Intercondylar and intermalleolar distances were measured with a scale, and the Q angle was determined with a goniometer using non-probability convenient sampling. The BMI was computed by dividing weight by the square of height in meters. **Results:** In this study out of 163 individuals, genu varum and valgum were diagnosed by Q angle, intercondylar distance, and intermalleolar distance. Data analysis using SPSS 27 revealed 52% of OA patients had genu valgum and 47% had genu varum. A strong association was found between these deformities and OA, particularly with increasing age and advanced OA grades. **Conclusions:** The study indicated that individuals aged 40 to 60 with grade 3 OA are at higher risk of developing genu valgum than genu varum. A significant association between these deformities and OA was found, with a p-value of less than 0.05. A strong correlation between age and angular deformities shown, while BMI and gender were less correlated.

INTRODUCTION

With an estimated 302 million cases globally, osteoarthritis is the most prevalent kind of arthritis and a major contributor to disability in older persons. Joints including the hands, hips, and knees are frequently impacted. Joint-wide pathology, such as bone remodeling and cartilage deterioration, is a hallmark of osteoarthritis [1]. Osteoarthritis (OA) is a degenerative joint disease characterized by bone and cartilage degradation. The articular cartilage thins and becomes fibrillated in knee OA due to a variety of reasons. Sections of sclerosis and cysts develop deeper within the bone structure. The fact that knee OA also affects other tissues, including the synovium, ligaments, and menisci, has now been recognized. For many persons, these total joint modifications ultimately result in pain, stiffness, deformity, and impairment [2, 3]. Urban living, decreased physical activity, increased caloric intake, and a sedentary lifestyle. Because of its scope and complications, accurate measurement of Body Mass Index (BMI) is important [4]. MRI and ultrasound may be utilized to visualize and assess for features of bone for OA such as cartilage loss, synovial inflammation etc. Biomarkers may be measured in serum or synovial fluid to aid in diagnosing and monitoring disease activity [5]. If distal most lateral, this is called valgus; when the points are medially shared,

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the resulting deformity is called valgus. The varus and valgus angles are related to the angle, which is the value of the bone or joint's closeness [6]. Adults between the ages of 45 and 65 participated in this study. People sixty years of age and older are considered "elderly" for the purposes of this statistical analysis. By 2050, it is anticipated that there will be 117.4 million senior people in SSA [7]. For this demographic, primary care healthcare services are mostly provided by the public health system [8]. The majority of primary care doctors in SSA have little to no geriatric training, increasing the number of older individuals in need of primary care [9]. The majority of health interventions for older folks are grounded upon data gathered from individuals in wealthy nations. Lower extremity deformities such as tibial varus and tibial valgus represent specific bone diseases that can affect the patient's musculoskeletal system and overall quality of life [10]. Tibia Vara and Valga can result from congenital factors, genetic predisposition. Tibia Vara in children is often caused by rickets, leading to knee pain, deformity and walking difficulties. It may be congenital or acquired, causing knee pain, gait abnormalities and associated symptoms. Both deformities can increase the risk of OA, especially in the elderly. This research aims to examine the prevalence and clinical implications of these deformities in geriatric patients with OA, highlighting the challenges they pose in patient care [11]. By elucidating these relationships, healthcare providers can better tailor treatment strategies, potentially enhancing the well-being of this vulnerable demographic.

This study explained the importance of these skeletal abnormalities in OA management, with the potential to improve the lives of countless elderly individuals.

METHODS

This study employed a cross-sectional design, utilizing non-probability convenient sampling technique [12]. This study was conducted at Hajvery University from July 2024 to December 2024, after taking ethical approval (HU-ECRB-DPT-2024-44). Data were collected from various hospitals in Lahore for six months. The sample size of 163 participants, determined using Raosoft sample size calculator, based on a population size of 280 [13]. The inclusion criteria encompassed patients aged 35 to 80 with a diagnosis of grade 3 or 4 OA, able to communicate and comprehend study instructions, and in stable medical condition. Exclusion criteria included patients with prior lower extremity orthopedic surgery, systemic or localized infections, neurological disorders, severe limitations in passive lower extremity range of motion, non-standard metabolic therapy for rickets, non-idiopathic coronal knee deformity, and obesity [14, 15]. Data collection involved a self-administered questionnaire, adhering to ethical standards and Helsinki Declaration. Informed written consent was obtained from all participants. The Q angle, intercondylar distance, and intermalleolar distance were being measured using non-radiographic techniques. The patient was placed in a supine posture to measure the Q angle, which is the angle produced by the lines from the tibial tubercle through the patella and from the patella to the ASIS. Genu varum was denoted by an angle larger than 20 degrees, and genu valgum by an angle smaller than 12 degrees. The patient was standing with their legs closed when the intercondylar distance was measured. Both the presence and severity of the patient's knee deformity and BMI were noted. The patient was measured for height while standing flat against a stadiometer. IBM SPSS version 27.0 was used to analyze the data, and descriptive statistics were used to show the categorical data. Any significant difference is indicated by a p-value of less than 0.05.

RESULTS

Out of 163 participants, the maximum falls within the 51-65 age range, with 68 people, while the minimum is aged in the group of 35-50 with 40 people. The Mean and SD of given data is 53.64 ± 8.414. There were males 84 (51.4%) and females 89 (48.5%). Q angle of Right side affected knee. There were total 105 patients with right side OA. Out of 105 patients 73 were diagnosed with genu valgum and 22 patients were diagnosed with genu varum. Total 163 participants 74 have intercondylar distance less than 3cm hence they have genu valgum and 48 participants have more than 5cm which means they have genu varum. The correlation between age and intercondylar distance show negative correlation. The relationship between age and intermalleolar distance show slight negative correlation. The relationship in between gender and right knee Q-angle. The trend line showed a negative correlation line, indicating that as the Q angle increases, the grade of OA tends to decrease. Intercondylar distance increases, the grade of OA tends to decrease (Table 1).

Table 1: Descriptive Statistics of Study Variables

Variables	N	Minimum	Maximum	Mean ± SD
Gender	163	0.00	1.00	0.484 ± 0.501
Age	163	35.00	78.00	53.644 ± 8.413
BMI (Kg/m)	163	22.00	84.00	26.344 ± 4.807
Grade of Osteoarthritis	163	3.00	4.00	3.380 ± 0.486
Right Knee Q Angle	163	10.00	26.00	14.423 ± 2.234
Left Knee Q Angle	163	12.00	25.00	15.932 ± 2.073
IntercondylarDistance	163	1.10	11.00	4.254 ± 1.416
Intermalleolar Distance	163	1.90	19.00	9.764 ± 2.429

A substantial negative correlation between intercondylar distance and age (r = -0.158, p-value < 0.05) and intercondylar distance and intermalleolar distance (r = -0.350, p < 0.01) was found in table 2. Age and the right knee Q angle also showed a strong positive link (r = 0.211, p-value < 0.01) (Table 2).

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Table 2: Correlation between Measured Orthopedic Parameters and Age

Variables	Categories	Intercondylar Distance	Intermalleolar Distance	Right Knee Q Angle	Age
Intercondylar Distance	Pearson Correlation	1	-0.350**	-0.099	-0.158*
	Significant (2-Tailed)	-	0.000	0.207	0.044
	N	163	163	163	163
Intermalleolar Distance	Pearson Correlation	-0.350**	1	-0.126	-0.130
	Significant (2-Tailed)	0.000	-	0.110	0.098
	N	163	163	163	163
Right Knee Q-angle	Pearson Correlation	-0.099	-0.126	1	0.211**
	Significant (2-Tailed)	0.207	0.110	-	0.007
	N	163	163	163	163
Age	Pearson Correlation	-0.158*	-0.130	0.211**	1
	Significant (2-Tailed)	0.044	0.098	0.007	-
	N	163	163	163	163

** Correlation is significant at the 0.01 level (2-tailed)

*Correlation is significant at the 0.05 level (2-tailed)

Intercondylar distance was significantly correlated negatively with both intermalleolar distance ($r = -0.350$, p-value < 0.01) and osteoarthritis grade ($r = -0.236$, p-value < 0.01), according to table 3's analysis. The grade of osteoarthritis also showed a strong positive link with the right knee Q angle ($r = 0.285$, p-value < 0.01)(Table 3).

Table 3: Correlation between Measured Orthopedic Parameters and Grade 3, 4 of Osteoarthritis

Variables	Categories	Intercondylar Distance	Intermalleolar Distance	Right Knee Q Angle	Grade of OA
Intercondylar Distance	Pearson Correlation	1	-0.350**	-0.099	-0.236**
	Significant (2-Tailed)	-	0.000	0.207	0.002
	N	163	163	163	163
Intermalleolar Distance	Pearson Correlation	-0.350**	1	-0.126	0.151
	Significant (2-Tailed)	0.000	-	0.110	0.055
	N	163	163	163	163
Right Knee Q-Angle	Pearson Correlation	-0.099	-0.126	1	0.285**
	Significant (2-Tailed)	0.207	0.110	-	0.000
	N	163	163	163	163
Grade of OA	Pearson Correlation	-0.236**	0.151	0.285**	1
	Significant (2-Tailed)	0.002	0.055	0.000	-
	N	163	163	163	163

**Correlation is Significant at the 0.01 Level (2-Tailed)

The right knee Q-angle and BMI showed a substantial but unfavorable connection in figure 1, suggesting that the Q-angle tends to decrease as BMI rises. This suggested that individuals with higher BMI may exhibit altered knee alignment, which could have implications for joint mechanics and osteoarthritis progression.

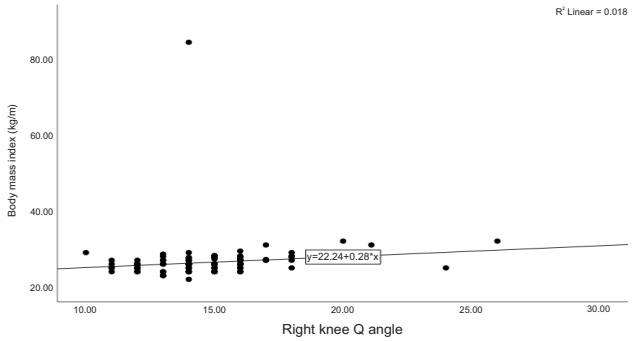

Figure 1: Correlation between BMI and Right Knee Q-Angle

Age and the right knee Q-angle were shown to be significantly positively correlated in figure 2 ($r = 0.211$, $p = 0.007$). This indicated that as age increases, the Q-angle tends to widen, which may contribute to age-related changes in knee alignment and potentially impact joint stability and function.

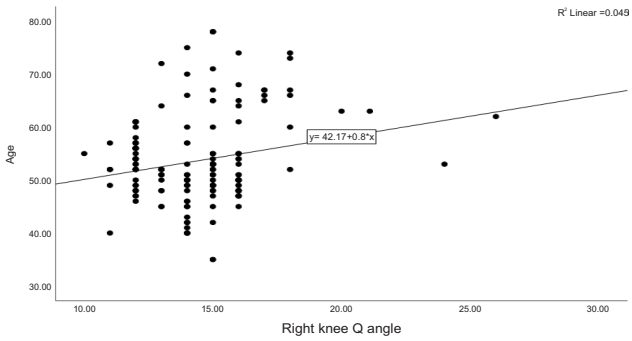

Figure 2: Correlation between Age and Right Knee Q-Angle

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DISCUSSION

There is a strong link between OA and knee abnormalities, particularly genu varum and genu valgum. In patients with Grade 3 OA, genu varum was least common while genu valgum was very prevalent. This showed that between knee deformities and advanced OA is independent of gender and age. These findings are novel, as no previous studies have specifically investigated the incidence of these knee angular deformities in the advanced stages of OA in geriatrics. Ciaccia MC *et al.*, 2017 study is one of several studies that have found the prevalence of knee deformity in children [16]. Genu valgum was 7.1% common in elementary school children and adolescents, greater in overweight and obese pupils, and did not correlate with age or gender [16]. While other research concentrate on other traits like BMI, these studies differed in how common genu varum and genu valgum were in children and the elderly. Furthermore, in a 2020 study by Soheilipour F *et al* [17]. Evaluating the association between body mass index and knee angular deformities in people who are overweight or obese and the prevalence of genu varum and genu valgum [17]. According to a study by Smith TO *et al.*, a higher prevalence of genu valgum was seen in obese children ages 11 to 12 whose musculoskeletal state was assessed [18]. Additionally, Schoenau E *et al.*, found that obese women had a higher prevA. According to Samma L *et al.*, obese women were more likely to have knee deformities, while this was not verified for obese men [19]. Finding the knee deformity that was related to the grade of OA in finding the association between knee deformity and OA grade in grades 3 or 4 was an intriguing aspect of this study. In this study, there is a weak positive correlation as compare to other factor like age. In study Yoon JR *et al.*, relationship between angular deformity and primary OA of the knee.This study is different from this study as it specifies two knee deformities and their measurement accuracy was found by three methods and this study focused on two stages of OA [20].

CONCLUSIONS

The conclusion of the study showed that people with Grade 3 OA especially at age of 40 to 60 years were at higher risk of developing Genu Valgum Deformity than Genu Varum. The age and knee angular deformity were significantly and strongly correlated. Knee deformity in elderly adults can occur regardless of a patient's gender or level of obesity.

Authors Contribution

Conceptualization: EG, RT
Methodology: SS, TJ, MI, NH
Formal analysis: FM
Writing, review and editing: RW, AA, SFAS

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

All the authors declare no conflict of interest.

Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

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