

VARIATION OF VALGUS ANGLE IN PATIENTS PRESENTING FOR TOTAL KNEE ARTHROPLASTY

Abhinav Bhatnagar¹, Sonu Mehta², Danish Mohammad³

¹Consultant, Department of Orthopaedics, Fortis Hospital, Mulund, Mumbai.

²Senior Resident, Department of Orthopaedics, Fortis Hospital, Mulund, Mumbai.

³Junior Resident, Department of Orthopaedics, Fortis Hospital, Mulund, Mumbai.

ABSTRACT

BACKGROUND

Total Knee Arthroplasty (TKA) nowadays is a commonly used treatment for patients suffering from severe osteoarthritis. The success of TKA is influenced by a complex interaction between the bony anatomy, the geometry of the components and the soft tissue balancing. Valgus angle subtended between the mechanical and anatomical axis of femur is one of the major factors influencing the alignment of implants. The objective of this study is to determine the variation of this valgus angle using a scannogram in patients with severe osteoarthritis presenting for TKA.

MATERIALS AND METHODS

150 consecutive patients of osteoarthritis of the knee joint presenting for total knee arthroplasty participated in our study. All patients underwent a preoperative scannogram, the mechanical and anatomical axis were drawn and the valgus angle was measured on the PACS (picture archiving and communication system) software.

RESULTS

The mean age of patients undergoing TKA was 63.62 ± 8.38 years. Although, the mean valgus angle for the patients was 6.009 ± 0.89 degrees, only 45 (30%) of 150 had valgus angle between 6-7 degrees. 72 (48%) had valgus angle in the range of 5-6 degrees and 9 (6%) had valgus angle in the range of 4-5 degrees. In 21 (14%) knees, valgus angle was more than 7 degrees, while in 3 (2%) knees, it was less than 4 degrees.

CONCLUSION

Fixed valgus angle resection is not reliable in restoring mechanical axis in total knee arthroplasty. A proper preoperative planning to determine the accurate valgus angle is a must to maintain alignment while performing total knee arthroplasty and thereby improve the long-term results. Scannogram is an easy, reliable and cost-effective method to determine the valgus angle.

KEYWORDS

Valgus Angle, Total Knee Arthroplasty, Scannogram.

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BACKGROUND

Total Knee Arthroplasty (TKA) has become regular treatment for patients suffering from osteoarthritis of knee from a number of causes.¹ It is a commonly used treatment for relieving pain, correcting distortion and maintaining movement.² The primary concern of any total knee arthroplasty is to endow with the near typical functional result for the patient.³ The success of any total knee arthroplasty is influenced by a complex interaction between the bony anatomy, the geometry of the components and the soft tissue envelope that surrounds this articulation.⁴ The angle subtended between the

mechanical axis and the distal femoral anatomical axis is the valgus angle,⁵ which is one of the major factors in determining the alignment of implants. In uncomplicated cases, most surgeons routinely use a fixed Valgus Cut Angle (VCA) of 6° . The valgus angle is usually measured using a CT imaging, which is costly and time consuming. The objective of this study is to determine the variation of valgus angle in a random population with osteoarthritic knees presenting for total knee arthroplasty using a scannogram and to determine its implications on the preoperative planning for total knee arthroplasty.

MATERIALS AND METHODS

150 consecutive patients of osteoarthritis of the knee joint presenting for total knee arthroplasty participated in our study. It included 40 males and 110 females. Eligible patients had no surgical procedure on either of the lower extremity and had no physical impairment related to the knee that would prevent safe participation in the study. All the patients were informed regarding the study and duly consented to include their information in the study. Ethical

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Corresponding Author:

Dr. Danish Mohammad,

Junior Resident, Department of Orthopaedics,

Fortis Hospital, Mulund, Mumbai.

E-mail: drdanish.ortho@gmail.com

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committee approval was taken before commencement of the study.

Technique of measuring valgus angle-

The valgus angle was determined on a scannogram with patient standing straight with both patellae facing forwards, Axis of which is perpendicular to an imaginary line parallel to the floor. The scannogram includes both lower limbs from the pelvis to the ankle joint. First, the centre of head was determined by drawing a perfect fit circle on the femoral head using the PACS (picture archiving and communication system) software. The mechanical axis (a line joining the centre of head to the condylar notch) and anatomical axis (a line from the condylar notch to the centre of medullary canal) were drawn and the valgus angle formed by the intersection of these two lines was determined. The valgus angle was then measured on PACS software to determine accurate valgus angle (Figure 1-3).

RESULTS

The study involved 150 patients with 40 males and 110 females in the age range of 46 to 80 years. The mean age

of patients undergoing TKA was 63.62 ± 8.38 years. The proportion of women in the study was significantly higher (73.3%) as compared to males (26.7%). The mean valgus angle for the patients was 6.009 ± 0.89 degrees. Out of 150 cases, 126 (84%) cases were within the range of 4-7 degrees. In 21 (14%) knees, valgus angle was more than 7 degrees, while in 3 (2%) knees, it was less than 4 degrees. Only 45 (30%) of 150 had valgus angle between 6-7 degrees, 72 (48%) had valgus angle in the range of 5-6 degrees and 9 (6%) had valgus angle in the range of 4-5 degrees (Figure 4). The smallest valgus angle was of 3.89 degrees and largest valgus angle was 8.98 degrees. The mean valgus angle for males was 7.16 ± 0.37 degrees, while that of females was 5.59 ± 0.62 degrees (Figure 5). The difference in the two means was statistically insignificant with p-value of 0.6452 using t-test for independent samples. Further, the correlation of valgus angle and age of patients was determined using Pearson's correlation coefficient. The correlation obtained was -0.003 with a p-value of 0.9727 indicating insignificant relationship between the two as also revealed through (Figure 6).



Figure 1

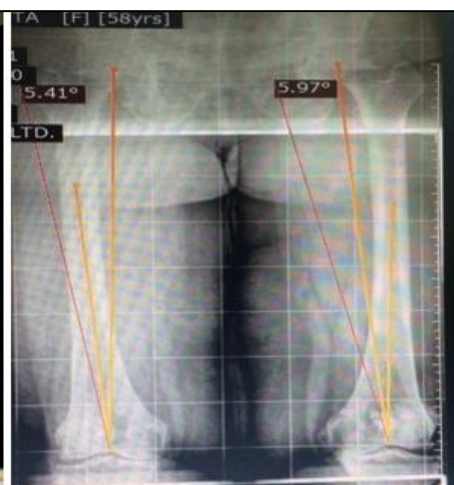


Figure 2



Figure 3

Figure 1-3. Scannogram Showing Both Femur with Mechanical and Anatomical Axis. The Valgus Angle Subtended is Measured Using PACS Software

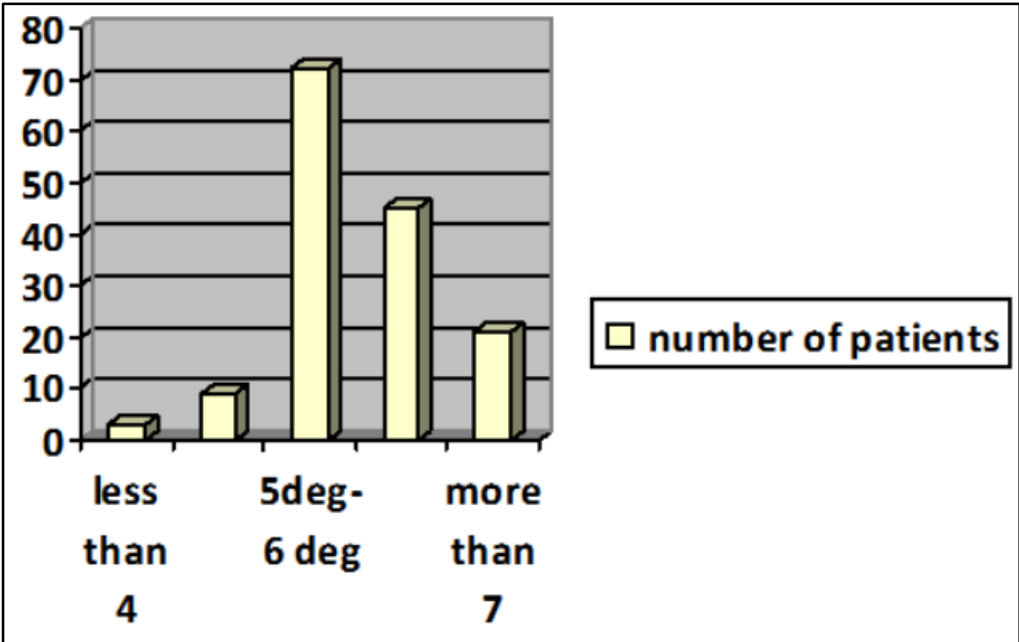


Figure 4. Graph Representing Number of Patients in Each Range of Valgus Angle

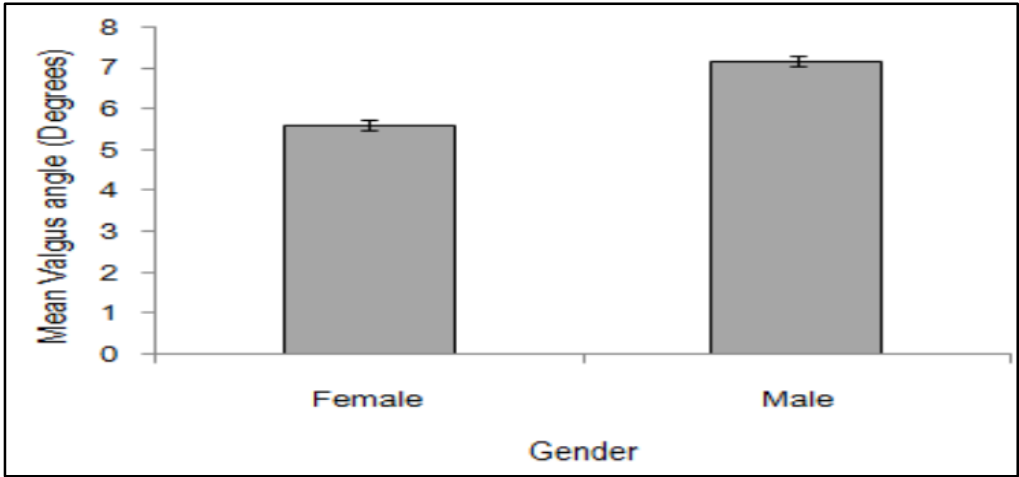


Figure 5. Bar Chart Showing the Mean Valgus Angle for Males and Females

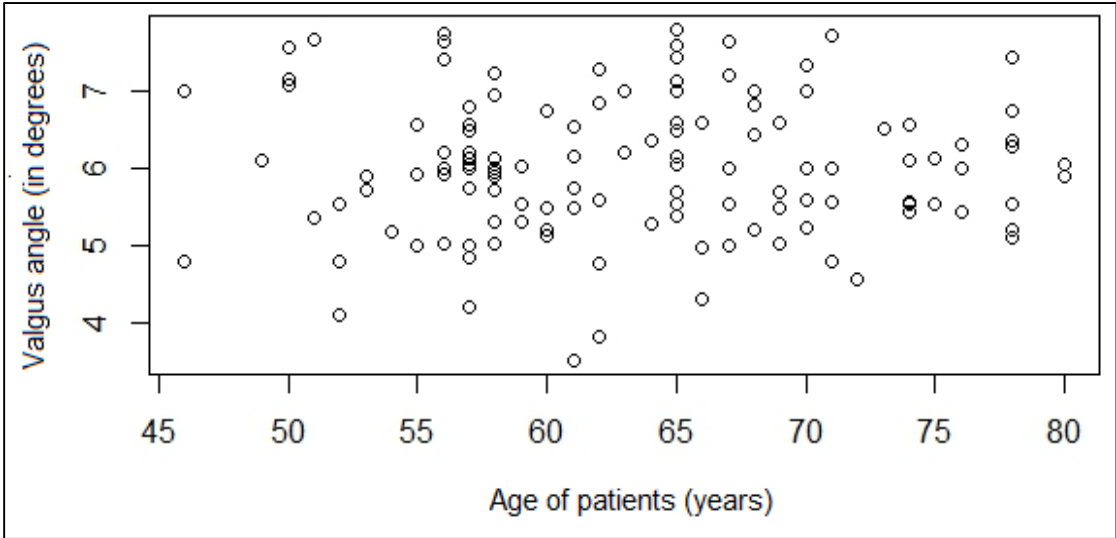


Figure 6. Scatter Plot Showing the Relationship between Age of Patients and Valgus Angle

DISCUSSION

The knee is the largest joint in the body consisting of two articulations- one between the femur and tibia and one between the femur and patella. The majority of the body's weight is supported by the knee joint and as a consequence it is often affected by acute injury or microtraumas with the development of osteoarthritis in later life.⁷ Primary Total Knee Arthroplasty (TKA) is a precisely difficult surgery, if performed with prudent technique can provide considerable pain relief and satisfaction to patient. The accomplishment of this method is influenced by many factors, the most prominent of which comprise implant design, component alignment and ligament balancing.⁸ Although, there is a routine practice of selecting 6 degrees of the distal femoral cut for an uncomplicated primary total knee arthroplasty.⁶ The variation of valgus angle cannot be overlooked. J.T. Kailathuvalapil and Binu Sasidharan⁵ in their study observed that the average valgus angle calculated was 7.41 degrees. 14 knees out of 40 (35%) were lying within the range of 4-7 degrees. In 25 knees (65%), valgus angle was more than 7 degrees. In one case, the valgus angle was less than 4 degrees, which is a significant deviation from the routine angle considered. S. Hakkalamani et al⁹ in their study observed the valgus angle ranged from 4 to 9.5 degrees (with a mean of 6.8 and SD 1.11) and only 66 (53%) knees had the valgus angle between 6 and 7 degrees. In our study, although the mean valgus angle for the patients was 6.009 ± 0.89 degrees, only 30% were in the range from 6-7 degrees, which is a significant deviation. 21 (14%) patients had an angle more than 7 degrees and 84 (66%) patients had a valgus angle less than 6 degrees. The mean valgus angle for males and females was statistically insignificant and also there was no significant correlation found between the mean valgus angle and age of the patients (Figure 7).

CONCLUSION

Total Knee Arthroplasty (TKA) is frequent and successful surgical procedure for end-stage knee arthritis. In last decade, this surgical procedure has doubled in younger and more active group.¹⁰

Fixed valgus angle resection is not reliable in restoring mechanical axis in total knee arthroplasty. A proper preoperative planning to determine the accurate valgus angle is a must to maintain alignment while performing total knee arthroplasty and thereby improve the long-term results. The technique used to determine valgus angle in

our study with scannogram is easy to perform, cost-effective and reproducible even for patients with gross deformities. It is less time consuming and can be done at setups where a CT scan machine is not readily available.

Approval and Consent

All the patients were informed about their participation in the study for which they duly consented. Ethical committee approval was taken prior to the commencement of the study.

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