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RESEARCH ARTICLE

Assessment of the Patellar Height Ratios in Normal Adult Nigerians

Udoaka, A. I,* Bienonwu E. O.

Department of Anatomy, University of Port Harcourt, Port Harcourt, Nigeria

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ABSTRACT

Background: Patella bone is the largest sesamoid bone in the human body, it lies in the quadriceps tendon. The height of the Patella has been found to vary in some disease conditions. Ratios are therefore formulated to determine the normal values using various parameters related to the Patella bone. The aim of this study was therefore to determine the normal Patella height ratios in Nigerians from the different methods.

Method:A total of 500 normal radiographs of the knee joint from different regions of Nigeria were utilized for this study. The ratios calculated were from:-

(a) The Blumensaat's line method (LP / WCBL)
(b) The Install and Salvati method (LT / LP)
(c) The Blackburn Peel method (A / B)

Results: The mean Male Patella height ratios for the three different methods were as follows: LP / WCBL (0.97± 0.01), LT / LP (1.04 ± 0.07), A / B (0.87 ± 0.01) while that of the females were as follows: LP / WCBL (0.97± 0.01), LT / LP (1.04 ± 0.08), and A / B (0.87 ± 0.02). There was no significant differences in all the ratios (P>0.05).

Conclusion: The study has re-evaluated the different methods at arriving at Patella height ratios in Nigerians. The findings are in keeping with earlier authors that irrespective of sex and race, the normal Patella height ratios do not vary and can be used for restoring knee function and kinematics in diseased states.

Keywords*:* Patella, Blumensaat's line, Sesamoid, Radiographs, Kinematics.

1. INTRODUCTION

The Patella is a sesamoid bone in the Quadriceps tendon and rolls freely on the articular surface of the femur (1 – 3). Blumensaat (4) in his study described a method of determining patella height using the lateral radiograph of the knee. In a normal state the patella should lie on or just above a line projected forward from the intercondylar notch. A ratio of the length of the Patella to the maximum width of the femoral condyle was recorded as 0.95 ± 0.07. Other researchers also found both parameters as statistically almost equal to each other in dimension (5). This became the Blumensaat's line ratio.

In 1971, another method was described by Install and Salvat (6) in which when the Patella tendon was under pressure the ratio of the length of the Patella to the length of the Patella tendon was also about 1.0. Their result showed that the length of the Patella tendon and the Patella are appropriately equal and normal variation did not exceed 20%. This became the Install and Salvati ratio and has also been corroborated by other authors (7, 8).

Blackburn and Peel (9) also brought forward another Patella height ratio in 1977. They proposed another ratio for cases that the Patella tendon can not be measured because of a not prominent tibial tubercle. Their method requires slightly flexing the knee to 30^0 before the radiograph is taken and measuring the both the articulating upper part of the Patella and the non-articulating lower part, a ratio is now known which is fairly constant. This is the Blackburn Peel ratio. Indeed the ratios in the different methods have been found not to be affected by change of knee flexion from 30^0 to 50^0 (10).

Height ratio estimation has been applied in pathological cases and it was seen that the patients had lower ratio or

*Corresponding author: Udoaka, A. I, Department of Surgery, L. N. Medical College & J. K. Hospital, Kolar Road, Bhopal, India | Email: swagatabrahmachari@yahoo.in

higher ratio, depending on the disease state whereas in Chondiomalacia, the ratio is lower than normal called Patella baja or in Osgood Shlatter's disease in which the ratio is significantly greater termed Patella alta (11). This work has been re-investigated using MRI of the knee and it was observed that Patella height ratio more than 1.3 indicates a high-riding Patella (Patella Alta) which is a risk factor for recurrent Patella dislocations (12). A high Patella in athletes with chronic tendinoapathy was also reported (13). Agletti et al (14) had earlier reported that even in patients who do not practice sporting activities, intrinsic factors considered conducive to injury include changes in Patella height from normal.

The reliability and interobserver variability of the different Patella height ratios using the different methods were once again tested and the Blackburn Peel method appeared to have the least interobserver variability and so recommended (15). Indeed the results of the Patella height measurement obtained by Blumensaat method do not agree with widely used Patella Height indices (16). The import of using ratios is that magnification, physical size and flexion angle are eliminated as factors that affect the values. In this paper, we will examine the three different methods of determining the Patella position with regards to the femur and the tibia.

The aim of this study is to examine all the Patella height ratios recorded in texts and find out the values for Nigerians. We shall also do a comparison study with recorded values for other populations.

2. MATERIALS AND METHODS

A total of five hundred normal lateral radiographs for the adult knee joint were utilized for this study. The radiographs were collected from the Radiology departments of different hospitals in Nigeria namely, University of Port Harcourt Teaching Hospital, Port Harcourt, Brithwaite Memorial Specialist Hospital, Port Harcourt, University of Nigeria Teaching Hospital, Enugu, Lagos University Teaching Hospital, Lagos and the University of Benin Teaching Hospital, Benin. For this study, all the parameters were measured directly from the lateral radiographs of the knee. The Patellar height radios include:-

(i) Blumensaat's line Radio: Length of Patellar to width of femoral condyle at Blumensaat's line – (LP / WCBL).

(ii) Instal and Salvati Ratio: The length of Patella tendon to the length of Patella ratio (LT / LP). LT is measured as the length of the Patellar tendon at its insertion in the notch. LP is the longest diagonal length of the Patella.

(iii) Blackburn Peel Radio: Perpendicular length of the distal non- articular part of the Patella with the line targent to the tibial plateau to the length of the articular surface of the Patella (A / B).

The age and sex on each radiograph were recorded. The data was processed using 2007 Microsoft Excel Analysis programme. Test of significance done at P = 0.05.

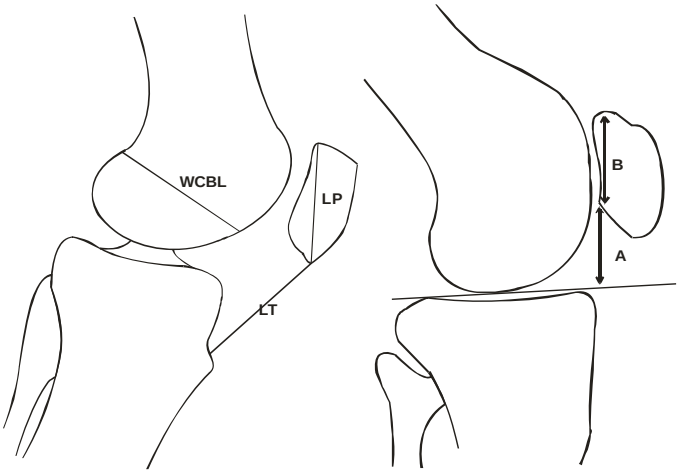

Figure 1(a and b): Schematic drawing to illustrate the following ratios

- The length of Patella to width of femoral condyle at Blumensaat's line ratio - Blumesaat's ratio (LP / WCBL).
- The length of Patella tendon to length of Petalla - Instal and Salvati ratio (LT / LP).
- Length of lower non-articular surface of Patella to upper articular surface of Patella - Blackburn-Peel ratio (A / B).

3. RESULTS

From the tables, the different ratios show no significant differences in gender and age. In comparison to the Caucasian values, the values are also similar.

	Males			Females		
Age groups	LP/WCBL	LT/LP	A/B	LP/WCBL	LT/LP	A/B
20 – 24	0.96	1.03	0.85	0.96	1.03	0.85
24 – 29	0.97	1.04	0.85	0.96	1.04	0.85
30 – 34	0.98	1.05	0.87	0.97	1.03	0.86
35 – 39	0.98	1.05	0.88	0.99	1.04	0.88
40 – 44	0.99	1.04	0.88	0.98	1.05	0.89
45 – 49	0.98	1.04	0.87	0.97	1.04	0.88
50 – 54	0.97	1.05	0.89	0.98	1.05	0.89
55 – 59	0.96	1.03	0.88	0.96	1.05	0.88
60 – 64	0.96	1.04	0.88	0.98	1.04	0.88

Table 1: Showing the age groups and the mean values of the different Patella height ratios in males and females.

Parameters	Males	Females	Significance
LP / WCBL	0.97 ± 0.01	0.97 ± 0.02	Not significant
LT /LP	1.04 ± 0.07	1.04 ± 0.08	Not significant
A / B	0.87 ± 0.01	0.87 ± 0.02	Not significant

Table 2: Showing mean Patella height ratios in males and females

	Present study		Keats et al (1966)	
	M	F	M	F
LT/WCBL	0.97± 0.01	0.97± 0.02	0.95± 0.07	0.95± 0.07
LT/LP	1.04± 0.07	1.04± 0.08	1.02± 0.13	1.02± 0.13
A/B	0.87± 0.01	0.87± 0.02	0.80± 0.14	0.80± 0.14

Table 3: Comparison of the Patella Height ratios in present study with that of the Caucasians (5).

4. DISCUSSION

Patella height is evaluated in this study with ratios that have been derived from measurements made on lateral radiograph of the knees. The patella based on its height can be described as Patella Baja if smaller than normal, Patella Norma if normal and Patella or Alta if greater than normal. In all our measurements in the Nigeria subjects we got values close to already established references for other races.

The mean values of Blumesaat ratio (LP / WCBL), Install and Salvati ratio (LT / LP) and Blackburn ratio (A / B) as described were 0.97 ± 0.01, 1.04 ± 0.07 and 0.87 ± 0.01 respectively for males. The females values were 0.97 ± 0.02, 1.04 ± 0.08 and 0.87 ± 0.02 respectively. There was no significant difference in the mean patellar height ratio compared. This means there is no sexual dimorphism in the patellar ratios of Nigerians. This is in keeping with earlier authors (8, 10).

This study has re-evaluated the ratios in Nigerians and is our belief that these ratios irrespective of racial differences are relatively simple, practical and reproducible. Restoring Patellar height is important in knee function and kinematics and knowledge of the normal Patella Height will be useful for restoration during surgery (17).

In conclusion, the average values of various Patellar height indices in Nigeria do not differ significantly from other races, hence no statistically significant variation exists in the normal Patella height anatomy. This study has recorded the values for all the methods for easy diagnosis of pathologies of the Patella in Nigerians.

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