Original Article

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Morphometric Study of Lateral Menisci of the Adult Knee Joint in North Karnataka Population

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Abstract

Background: The largest articulation in the body is the knee joint. Shallow concave surface of the tibia lodges the condyles of femur in unequal manner. Semilunar cartilages called menisci lie in knee joint attached firmly to the intercondylar area of tibia. The menisci are liable to injury resulting from twisting strains applied to flexed weight bearing knee. The mean annual incidence of meniscal tears is about 60-70 per 100,000 with a male to female ratio ranging from 2.5:1 to 4:1. This study gives morphometric data for preparing meniscal allograft for people of this region so that accurate matching can be done in meniscal transplantation. *Objective:* To analyze peripheral and inner border lengths, thickness, width, distance between anterior and posterior horns of adult lateral menisci of right and left knee joints and to compare with that of meniscal parameters available in the literature. *Material and Methods:* For this study, 60 lateral menisci from 60 adult human knees available in the Department of Anatomy were studied and analyzed. *Results:* Paired t-test with $p<0.05$ significance was applied for values expressed as Mean±SD, all the parameters of left sided lateral menisci were higher but the difference was not statistically significant ($p>0.05$). *Conclusion:* This study is useful for the health professionals who work with treatment of meniscal injuries to create an awareness of the anatomical variations that may exist in the menisci facilitating the rehabilitation process.

Keywords: Menisci; Morphometry; Thickness; Width; Peripheral Length.

Introduction

Semilunar cartilages called menisci lie in knee joint attached firmly to the intercondylar area of tibia. The menisci provide structural integrity to the knee when it undergoes tension and torsion, also known to transmit tibio-femoral load, prevent synovial impingement, acts as shock absorbers, lubricators of joint and also in assisting in smooth gliding of surfaces over one another [1].

Lateral meniscus is circular and covers 70% of the lateral tibial plateau. The anterior horns of medial and lateral menisci are attached to each other by transverse ligament. The posterior horn of the lateral meniscus is attached to the posterior cruciate ligament and medial femoral condyle through meniscofemoral ligaments of Wrisberg and Humphrey [2,3].

Incidence of lateral meniscal tears are low, as it translates 9 to 11 mm on the tibia during knee flexion [4,5,6]. Due to close relationship of lateral meniscal horn insertion sites with tibial attachment of anterior cruciate ligament it is important with regard to meniscal reconstruction using meniscal allograft with attached bone plugs [7]. The mean annual incidence of meniscal tears is about 60-70 per lakh with a male to female ratio ranging from 2.5:1 to 4:1 [8]. This study gives morphometric data for preparing meniscal allograft for people of this region so that accurate matching can be done in meniscal transplantation.

Objectives

To analyze peripheral and inner border lengths, thickness, width, distance between anterior and posterior horns of adult lateral menisci of right and

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left knee joints and to compare with that of meniscal parameters available in the literature.

Material and Methods

To carry out this study, embalmed human adult limbs of the cadavers available in the Anatomy Department were used. For this study, 60 lateral menisci from 60 human knees, 31 left and 29 right which were dissected previously and preserved with 10% formalin solution were used. Present Cross sectional study included all the cadaveric limbs available in the Department of Anatomy during study period. Cadavers whose lower limbs had abnormal knee joints like exostosis, any deformity, fractures, traumatic injury or menisci with degenerative changes were excluded.

Approach to menisci was started with dissection of skin & muscles at knee joint. To open the joint cavity first longitudinal incision was made anteriorly on both sides of joint capsule, transverse cut was put on patellar ligament and collateral ligament. To appreciate the menisci clearly joint capsule and intraarticular ligaments were cut, condyles were separated from soft tissue attachments around the edges exposing the tibial plateau. After the systematic dissection data were entered on a standardized data collection sheet.

The peripheral length of menisci was determined first to measure the thickness of outer circumference of menisci. A cotton nonelastic thread was placed along the periphery of the meniscus and with small pins the tibial insertion ligaments of meniscus were held in place. Peripheral length is measured as the length of thread from the most anterior part of the anterior insertion area to the most posterior part of the posterior insertion area. In the same manner, by keeping the thread at the inner free edge thinner free border length was measured [9] (Figure 1 & 2). Then the thread with peripheral circumference length is divided into 3 equal parts by using scale & color marker pens. The thread is placed again over the meniscus and the meniscus were divided into 3 equal parts anterior 1/3 (ant. 1/3), middle 1/3 (mid. 1/3) and posterior 1/3 (post. 1/3) respectively (Figure 3). Then the width and the thickness of the meniscus were measured at the above mentioned parts at their midpoint. The distance between (b/w) the anterior horn (AH) & posterior horn (PH) was also measured [9]. A Vernier caliper of 0.10 mm accuracy was used for taking measurements.

Statistical Analysis included mean and standard variations of each variable calculated and their difference between right and left knee menisci was compared by using Student's unpaired t-test, where significance value was $p < 0.05$.

Results

Table 1 shows the lateral menisci parameters of right and left side, it was observed that all the parameters like peripheral length, inner border length, width and thickness at anterior 1/3 (ant.), middle 1/3 (mid), and posterior 1/3 (post.), distance between anterior and posterior horns were higher in left sided lateral menisci, but the difference was not statistically significant ($p>0.05$).

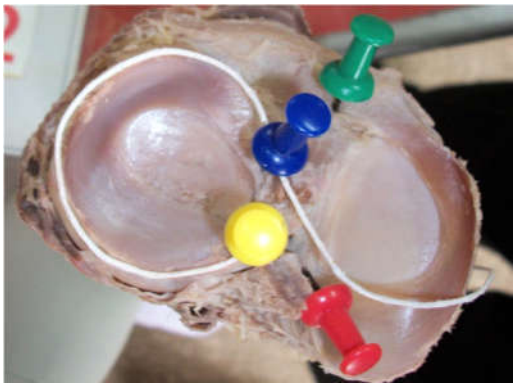

Fig. 1: Showing measurement of peripheral length of lateral meniscus

Table 1: Lateral meniscal parameters in adults (n =60)

Parameters	Right Side (mm)	Left side (mm)	t value	p value
Peripheral Length	87.8 ± 8.39	88.5 ± 7.36	0.371	0.712
Inner Border Length	49.5 ± 8.88	51.8 ± 5.87	1.202	0.234
Width				
Ant 1/3	8.4 ± 2.21	8.8 ± 1.97	0.571	0.570
Mid 1/3	9.2 ± 2.31	9.3 ± 2.61	0.128	0.899
Post 1/3	9.6 ± 1.93	9.5 ± 2.16	0.088	0.930
Thickness				
Ant 1/3	3.8 ± 1.26	3.9 ± 0.87	0.235	0.815
Mid 1/3	4.4 ± 1.58	4.3 ± 1.05	0.425	0.672
Post 1/3	4.7 ± 1.43	4.9 ± 2.25	0.546	0.587
Distance b/w AH & PH	11.4 ± 2.89	12.5 ± 2.62	1.502	0.139

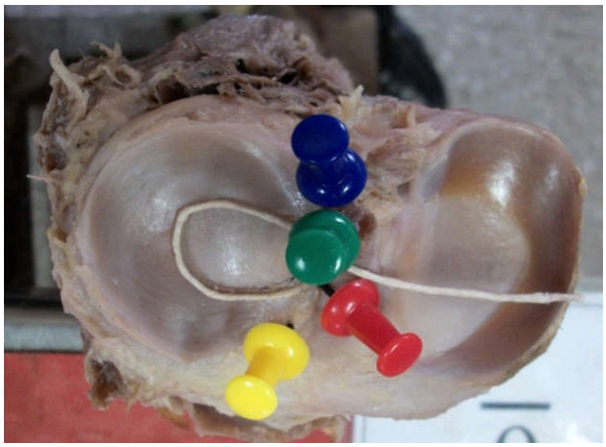

Fig. 2: Showing measurement of inner border length of lateral meniscus

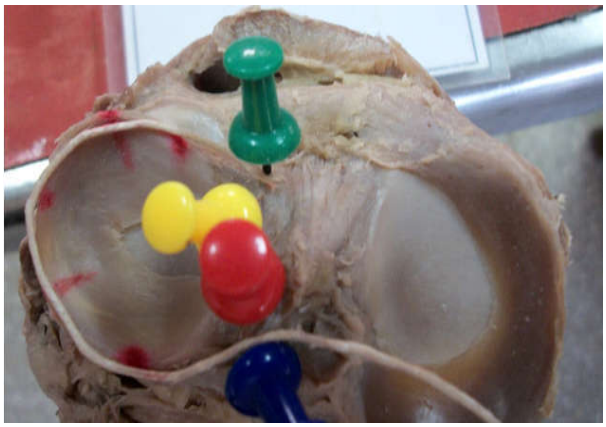

Fig. 3: Showing division of lateral meniscus into anterior 1/3, middle 1/3 & posterior 1/3

Mean values in mm of lateral menisci for peripheral length and inner length were 88.2±7.82 and 50.7± 7.50. Width at ant 1/3 was 8.6±2.08, mid 1/3 9.2± 2.45 and post 1/3 was 9.5±2.04. Thickness of menisci at ant 1/3 was 3.9±1.07, mid 1/3 4.3±1.32 and post 1/3 was 4.8±1.89, 11.9±2.78 is the mean distance between anterior and posterior horns of lateral menisci.

Discussion

In our present study we found the lateral menisci were wider and thicker at post 1/3 followed by mid 1/3 and ant 1/3.

In consistent with our study Ashwini et al found that the posterior third (2.06±9.3 mm) of the lateral meniscus was the thickest part ($p<0.05$) followed by middle third (1.76±0.81 mm) & anterior third (1.41± 0.51 mm) was the least. Width of lateral menisci at ant 1/3, middle 1/3rd & posterior 1/3 are 8.08±1.14mm, 8.52±2.12 mm & 9.36±1.19mm respectively. 83.28±7.464 mm was the peripheral length of lateral menisci & 49±54.92mm was the inner length measured. 6.8±1.99 was the distance between horns of lateral menisci [10]. In contrast to our study, Rohila et al on lateral menisci showed wide mid 1/3 (11.21+2.91) than post1/3(11.03±1.40) and ant 1/3 (9.93±1.71). Thickness wise also mid 1/3 (6.93±1.15) thicker than post 1/3 (6.72±1.12) and ant1/3 (6.40±1.37) [11].

Cadaveric study done on 22 pairs of human menisci found that the peripheral length of lateral menisci was 91.7 ± 9.6 mm, width of the body of lateral menisci was 10.9±1.3 mm [12].

Erbagci et al (2004) performed 174 MRI examinations of the knee with an IT imager. The thickness and width of the anterior horn of lateral meniscus were 4.33±0.98 mm and 8.88±2.3 mm, the thickness and width of the midbody were 4.94±0.99 mm and 8.37±0.83 mm, and the thickness and width of the posterior horn were 5.36±1.03 mm and 9.70±1.69 mm respectively [13].

Kale et al (2006) studied on 22 knee joints of 11 foetal cadavers and measured the mean width of the midpoint of the anterior horn, posterior horn and lateral side of the menisci. They were 0.29, 0.34 and 0.37 cms respectively for the lateral meniscus [14].

Almeida et al (2004) analyzed the morphometric aspects of the lateral menisci of the knee joint. Thickness and width at ant 1/3 were 3.71±1.15mm and 11.86±1.81mm, middle 1/3 were 6.10±1.04mm & 11.97±2.56mm and post 1/3 were 5.29±0.78mm & 11.44±1.07mm respectively. The distance between the anterior & posterior horn of medial lateral meniscus was 12.71±1.84 mm [15]. Dieter Kohn & B. Moreno (1995) measured the peripheral length of the menisci, on 92 knee joints and the value was 111±10 mm for the lateral meniscus [16].

Braz and Silva (2010) in their study on 40 menisci reported the peripheral length of LM was 92.80± 9.36mm. Distance between the anterior and posterior horn of the lateral meniscus (12.55±1.98 mm). With regard to the width of the lateral meniscus, there was no significant difference between the anterior (11.32±1.46 mm), medium (11.16±1.64 mm), and posterior thirds (11.67±1.54 mm). The average thickness of LM was 5.46mm [17].

Kapandji (2000) reports that the distance between the horns of the lateral meniscus are closer together than those of the medial meniscus. Thus LM looks like a ring and MM represents half moon shape. This high proximity between the insertions of the horns of LM would be one of the reasons for the lateral meniscus to be less prone for lacerations [18].

Conclusion

Morphometric parameters of the lateral menisci between right and left knees did not show any significant difference ($p>0.05$). The current study provides added information to database of morphological values of lateral menisci for North Karnataka population for meniscal transplantation. With the above findings, present study proposes that future studies should be undertaken involving assessment of any gender differences in the morphometry of menisci.

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