

TRANSVERSE GENICULAR LIGAMENT OF THE KNEE IN HUMAN- A CADAVERIC STUDY

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ABSTRACT

The transverse genicular ligament is an anatomical structure present in knee connecting the anterior horns of the menisci. It is not present in all the individual. Hence this study aimed to observe the occurrence and variations of transverse genicular ligament of human knee. A descriptive observational study was planned and conducted in the Department of Anatomy of Nepal Medical College and Teaching Hospital in 15 male cadavers from June 2021 to December 2021. The ethical approval was taken from Institutional Review committee (IRC) of the Nepal Medical College and Teaching hospital (Ref no: 004-078/079). In present study, 15 male cadavers were observed. The presence of transverse genicular ligament was observed in 28 knee samples and absent in 2 samples. The knee joint with meniscal attachment of this ligament was observed in 12 (80.0%) of left knee and 13 (86.6%) in the right knee. Therefore, the menisco-meniscal pattern of attachment was the primary pattern of attachment of transverse genicular ligament in this study.

KEYWORDS

Knee joint, meniscus, transverse genicular ligament

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INTRODUCTION

The knee joint is the largest, compound and complex joint of the human body formed by the condyles of femur, tibia and posterior articular surface of the patella. The condylar articulations between the respective medial and lateral condyles of femur and tibia are subdivided incompletely by the menisci or semilunar cartilage.¹ Among the ligaments, the transverse ligament (TL) of the knee (transverse geniculate ligament, anterior intermeniscal ligament) connects the anterior horns of the menisci. This ligament is present in some of the individuals only.¹⁻⁴

The transverse ligament of the knee plays an important role in the stability of the menisci during movement and also in the prevention of hyper-rotation of the joint.¹ This ligament is a band of connective tissue from the infrapatellar adipose body, surrounded by fatty tissue and these fibers intermingle with the bundles of fibrocartilage of the menisci. This shock-absorbing function of the menisci is due to the conversion of an axial load into circumferential hoop stresses, which is also related to formation of a complex known as a ligament-capsule-menisci complex.⁵

Any surgical procedure in the TL leads to changes in knee biomechanics, increase in femoro-tibial contact, decrease in contact areas between the bones and finally moving force of center of application, which moves towards the center inside the joint.⁶ The meniscus gets distorted when inflicted upon by sports injury, road traffic accident and degeneration. The diagnosis of tears of the anterior horn of the meniscus by plain radiographs are challenging and even with Magnetic Resonance Imaging may be sometimes different from that obtained by arthroscopic examination.⁷ Hence a precise knowledge of transverse ligament of knee is essential and when applied would help to minimize the iatrogenic injury during surgical procedures.⁸ Studies performed in Western countries have shown the variation in the attachment pattern of this ligament.^{9, 10} However, so far such cadaveric study has not been performed in Nepal. Hence the aim of this study was to observe the occurrence and variations of transverse genicular ligament of human knee.

MATERIALS AND METHODS

A descriptive observational study was conducted in Department of Anatomy, Nepal Medical College and Teaching Hospital. A total

number of 15 male cadavers were included in the study. The previously dissected cadaveric specimens with intact knees were also included. However, cadavers with observable gross congenital anomalies and acquired deformities of lower limb, with damage in the area or amputation of the lower limb, cadavers which had reconstructive operations of the knee joint and with knee replacement were excluded from the study. Therefore, the sample size was thirty knee joints including right and left side of the lower limb. The study was conducted during routine dissection procedure from June 2021 to December 2021. The ethical approval was taken from Institutional Review committee (IRC) of the Nepal Medical College and Teaching hospital (Ref no: 004-078/079).

The transverse genicular ligament of knee joint was exposed by dissection of knee joint as according to the standard procedures of Cunningham's manual of dissection.¹¹ All dissections were carried out on the cadaver placed in supine position on a dissection table with the neck in neutral position, leaving the knee joint intact with its capsular and ligamentous attachments. The ligaments of the knee joint were exposed, then the transverse genicular ligament was identified and the attachment was observed and the photographs were taken with digital camera. The data were then recorded in Microsoft excel and analyzed with SPSS version 16 using descriptive statistics. The collected data was divided by sides for description of their distribution in the left and right sides. The figures and tables were used for presentation of the results.

RESULTS

In present study, 15 male cadavers were observed. Thus, the total number of knees were 30 including both right side and left side. In total study sample, the knee joints in which the presence of TL was in 28 and absence in 2 knee joints (Table 1).

The knee joint with meniscal attachment of TL was observed in 12 (80%) of left knee and 13 (86.6%) in the right knee (Table 2).

Table 1: Status of transverse geniculate ligament of knee joint

Side of Knee	Present n(%)	Absent (%)
Right Knee	14 (93.3)	1 (6.7)
Left Knee	14 (93.3)	1 (6.7)

Table 2: Meniscal attachment of transverse geniculate ligament

	Present	Absent (in other areas)
Left knee	12 (80.0%)	3 (20.0 %)
Right knee	13 (86.6%)	2 (13.3 %)

DISCUSSION

The knee is the largest and complex joint of human body composed of condyles of femur and tibia and posterior articular surface of the patella. Further, the medial and lateral condyles of femur and tibia are containing the menisci of semilunar shape. Among the ligaments of knee joint, the transverse ligament of the knee develops during 7–8 weeks of intra-uterine life.¹

In this study, the TL of knee (Fig. 1) was observed in almost all the cadavers (93.33%) except one on the right knee and another on the left knee



Fig. 1: Transverse genicular ligament of right and left knee

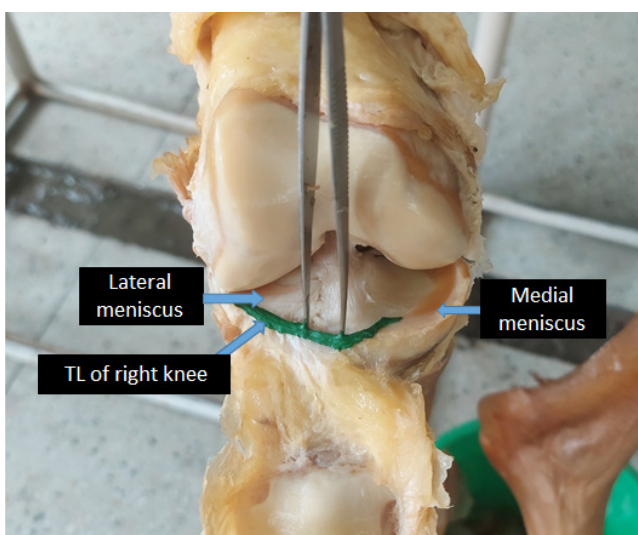


Fig. 2: TL of right knee with menisco-meniscal attachment

of the male cadavers. The meniscal attachment was also observed in 80% of the left knee (Fig. 3) and 86.6% of the right knee (Fig. 2) among the cadavers. The finding of this study was inconsistent to the findings of Tubbs *et al.*¹² in which the TL was reported in only 55% of the knee joint, suggesting the structure may represent a vestigial part of the mesenchyme. In another study it was shown TL in 58% of cadavers.¹

In a MRI based study, Kang *et al.*⁷ showed the presence of TL in 67.3% which includes 67.4% in

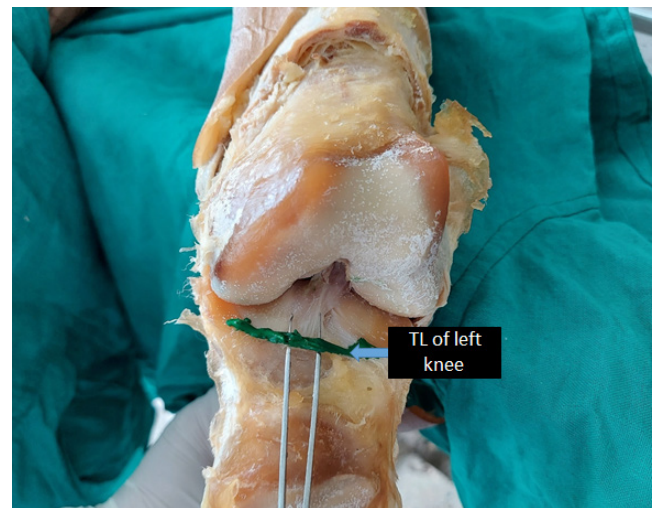


Fig. 3: TL of left knee with menisco-meniscal attachment

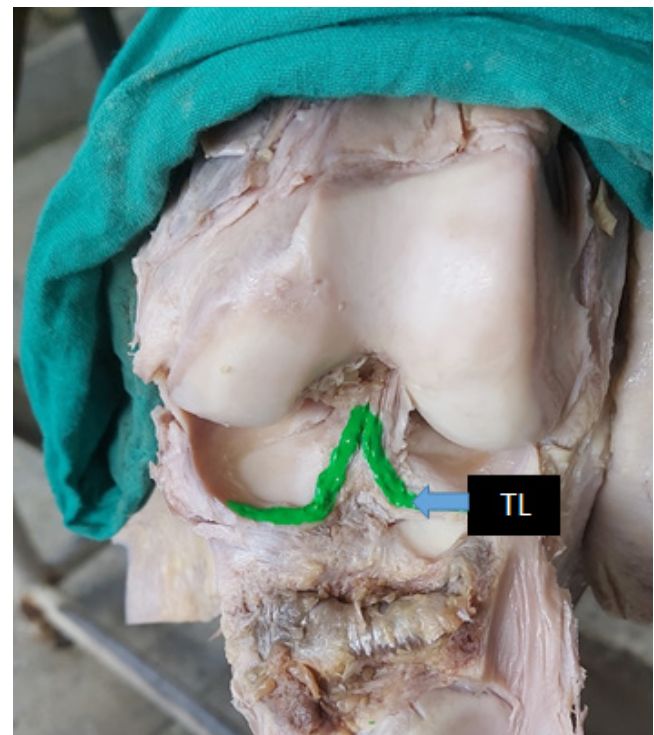


Fig. 4: TL attached in tibial intercondylar area

left side and 67.2% in right side in line with our findings. However, our study was performed on 15 cadavers and the study of Kang *et al*⁷ was MRI based study conducted in China including 101 orthopedic patients. In another study, Gupte *et al*³ also reported the TL to be present in 93% of the cadavers which was consistent to our finding.

Research related to TL has also been done and reported in MRI based retrospective data and then verified on the basis of histological study of cadavers.¹⁰ The researcher, de Abreu *et al*¹⁰ on the basis of their findings suggested that the TL was a frequent anatomical structure connecting the anterior horn of the medial meniscus to anterior horn of the lateral meniscus which was similar to the present study (Fig. 2 & 3).

In a case series reported on the basis of 12 patients, Anderson *et al*,⁹ reported that the anterior horn of medial meniscus was attached to the postero-lateral wall of femoral intercondylar notch signifying the attachment of medial meniscus may vary. In the present cadaveric study, more than 10% the attachment was present in tibial intercondylar area (Fig. 4).

In another study, Ratajczak *et al*⁵ reported that the menisco-meniscal ligament was the band of connective tissue extending from the infrapatellar adipose body surrounded by fatty tissue up to meniscus and was present on only in 58 percent of subjects. Since findings of the present study was more than 80% having menisco-meniscal attachment which was not consistent with the findings of Ratajczak *et al*.⁵

Murlimanju *et al*¹³ conducted their study in 106 knee joints of South Indian formalin fixed fetuses and reported that there was presence of TL in 87.7% of the fetuses, which was nearly similar to the finding of present study. Another study attempted in 50 unpaired cadaveric knee joints found with TL in 94% of sample and also had the inter meniscal attachment was the primary pattern of attachment which was the similar finding of the present study having TL on 93.3% and among them 83.3% having menisco-meniscal pattern of attachment.⁸

The above researches have shown which ever modality is chosen either cadaveric study, or histological, or examination through MRI, the TL has variation among the individuals. The transverse ligament of the knee is vital for stability of the menisci during movement of legs. It aids in the prevention of hyper-rotation of the joint during extension of knee, the transverse ligament restricts the forward movement of anterior horns of the menisci leading to restriction of antero-posterior

excursion of the anterior horn of the medial meniscus for flexion of knee at a lower rate.¹ The meniscus are also effected and get distorted during sports injury, road traffic accident, surgeries and degeneration.¹⁴⁻¹⁶ In a MRI based study, Gadgil *et al* reported that out of 136 patients, 90.44% had medial meniscal tear.¹⁷

The present study also has few limitations as the study was conducted only in the cadavers available in Human Anatomy Department of Nepal Medical College and Teaching Hospital with a small number of sample size. Therefore, the results thus obtained cannot be generalized.

In conclusion, the transverse genicular ligament is an anatomical structure present in knee joint connecting the anterior horns of the menisci. The TL of the knee plays an important role in the stability of the menisci during movement and also in prevention of hyper-rotation of the joint. The ligament was observed in majority of knee joint (93.3%) except one on the right knee and another on the left knee of the male cadavers. The meniscal attachment was also observed in 80% of the left knee and 86.6% of the right knee. Therefore the menisco-meniscal pattern of attachment was the primary pattern of attachment of TL in the present study.

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