MORPHOMETRIC STUDY OF MEDIAL COLLATERAL LIGAMENTS OF ANKLE

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ABSTRACT

BACKGROUND

The ankle joint is one of the most frequently injured joint. A sprained ankle results due to tear of anterior talofibular and calcaneofibular ligaments when the foot is twisted in lateral direction. In forcible eversion of the foot, the deltoid ligament may be torn. At times, the deltoid ligament pulls the medial malleolus thereby causing avulsion fracture of the malleolus. The strong eversion pull on the deltoid ligament causes transverse fracture of medial malleolus. If the tibia is carried anteriorly, the posterior margin of the distal end of the tibia is also broken by the talus producing a trimalleolar fracture.

The talocrural joint is a major weight bearing joint of the body. The weight of the body is transmitted from the tibia and fibula to the talus which distributes the weight anteriorly and posteriorly within the foot. One sixth of the static load of the leg is carried by the fibula at the tibiofibular joint. These require a high degree of stability which is determined by the passive and dynamic factors. A sprained ankle results due to tear of anterior talofibular and calcaneofibular ligaments when the foot is twisted in lateral direction. In forcible eversion of the foot, the deltoid ligament may be torn. At times, the deltoid ligament pulls the medial malleolus thereby causing avulsion fracture of the malleolus. The strong eversion pull on the deltoid ligament causes transverse fracture of medial malleolus. If the tibia is carried anteriorly, the posterior margin of the distal end of the tibia is also broken by the talus producing a trimalleolar fracture.

Conventionally, X-ray techniques have been used to diagnose ligament injuries.

Magnetic resonance (MR) imaging has opened new horizons in the diagnosis and treatment of many musculoskeletal diseases of the ankle and foot. It demonstrates abnormalities in the bones and soft tissues before they become evident at other imaging modalities.

The anatomy of the deltoid ligament is very poorly understood. The ligament in case of tear or injury has to be repaired which is impossible to do so if a proper morphometric knowledge is not known. So a sincere effort has been put in the study to find the morphometry of the deltoid ligament.

METHODS

- One hundred specimens were dissected. In this, fifty belonged to the right and fifty belonged to the left side.
- The study was done in the Department of Anatomy, Nalanda Medical College, Patna.
- The study was done from June 2015 to April 2016.
- The morphometry was seen and the comparisons were done.
- The dissection was done to expose the deltoid ligament. The anterior, middle and posterior length was taken. Then, the superior, middle and inferior width was taken. Then, the thickness was measured.
- Then, the presence or absence of the deep part was noted.

RESULTS

Irrespective of the side and sex to which the ligaments belong, the mean value of the length of the deltoid ligaments in the anterior, middle and posterior parts are 24.40 mm, 21.53 mm and 17.20 mm. The widths in the superior, middle and inferior parts are 19.94 mm, 22.59 mm and 27.45 mm. The thickness mean measurement is 6.94 mm.
Deep Part was found in 100% of cases.

The superficial part trapezoid in shape wide anteriorly and narrow posteriorly, also is narrow superiorly where it arises and broad inferiorly where it gets inserted.

CONCLUSION

The ligaments of the talocrural joint are one of the most difficult ligaments to study. A sincere effort has been put in this study to find the morphometry of ligaments of ankle joint. The same has been studied and reported successfully to help the surgeons to understand and help the needful in a better way.

KEYWORDS

Morphometry, Deltoid, Ligament, Talocrural joint, Dissection.

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INTRODUCTION: The medial collateral ligament also called as the deltoid ligament is a strong, triangular band, attached to the apex and to the anterior and posterior borders of the medial malleolus. Of its superficial fibres, the anterior also called the tibionavicular, passes forward to the navicular tuberosity, behind they blend with the medial margin of the plantar calcaneonavicular ligament.

Intermediate also called the tibiocalcaneal fibres descend almost vertically to the entire length of the sustentaculum tali. Posterior fibres also called the posterior tibiotalar, passes posterolaterally to the medial side of the talus and its medial tubercle. The deep fibres (Anterior tibiotalar) pass from the tip of the medial malleolus to the non-articular part of the medial talar surface.

The passive stability of the talocrural joint depends on the contour of the articular surfaces, the integrity of the collateral ligaments, the integrity of the distal tibiofibular ligaments, the reticular system around the ankle and the crossing and attached tendon tunnels. The medial malleolus has a smooth lateral surface with a crescent shaped facet that articulates with the medial talar surface. The distal border is pointed anteriorly, posteriorly depressed and gives attachment to the deltoid ligament. The medial malleolus ends slightly higher than the lateral malleolus, and also more anteriorly than the latter. The capsule of the ankle joint is attached to its anterior surface.

The ankle joint is one of the most frequently injured joint.[1]

The talocrural joint is a major weight bearing joint of the body. The weight of the body is transmitted from the tibia and fibula to the talus which distributes the weight anteriorly and posteriorly within the foot. One sixth of the static load of the leg is carried by the fibula at the tibiofibular joint.[2] These require a high degree of stability which is determined by the passive and dynamic factors[3]. A sprained ankle results due to tear of anterior talofibular and calcaneofibular ligaments when the foot is twisted in lateral direction. In forcible eversion of the foot, the deltoid ligament may be torn. At times, the deltoid ligament pulls the medial malleolus thereby causing avulsion fracture of the malleolus. The strong eversion pull on the deltoid ligament causes transverse fracture of medial malleolus. If the tibia is carried anteriorly, the posterior margin of the distal end of the tibia is also broken by the talus producing a trimalleolar fracture.

Conventionally, X-ray techniques have been used to diagnose ligament injuries.

Magnetic resonance (MR) imaging has opened new horizons in the diagnosis and treatment of many musculoskeletal diseases of the ankle and foot. It demonstrates abnormalities in the bones and soft tissues before they become evident at other imaging modalities.

A tibia attributed to Australopithecus anamensis is around 4 million years old and indicates that this species was bipedal.[4] An efficient bipedal adaptation has been obtained by altering the foot to act as a stable support instead of a grasping limb. These tell us the originality of the development of deltoid ligament.

The anatomy of the Deltoid ligament is very poorly understood. The ligament in case of tear or injury has to be repaired which is impossible to do so if a proper morphometric knowledge is not known. So a sincere effort has been put in the study to find the morphometry of the deltoid ligament.

AIMS AND OBJECTIVE:

1. To find the morphometry of Deltoid Ligament.
2. To compare the right and left side morphometry of the ligament.
3. To compare the male and female morphometry.

MATERIALS AND METHODS: One hundred specimens were dissected. In this, fifty belonged to the right and fifty belonged to the left side.

The study was done in the Department of Anatomy, Nalanda Medical College, Patna.

The study was done from June 2015 to April 2016.

The morphometry was seen and the comparisons were done.

The dissection was done to expose the deltoid ligament. The anterior, middle and posterior length was taken. Then, the superior, middle and inferior width was taken. Then, the thickness was measured. Then, the presence or absence of the deep part was noted.

Deltoid	Side	Mean	Std. Deviation	Sig.
Mid length	R	20.76	2.39	0.435
	L	20.14	1.81	
Ant length	R	24.09	3.88	0.176
	L	23.67	3.47	
Post length	R	16.51	2.92	0.299
	L	15.14	1.27	
Sup width	R	17.71	1.22	0.029
	L	20.19	1.60	
Mid width	R	20.75	1.99	0.043
	L	24.43	3.98	
Inf width	R	24.79	2.21	0.27
	L	26.11	1.76	
Thickness	R	5.01	1.71	0.631
	L	5.82	0.41	

Table 1: Morphometry in Each Side and Gender in the Deltoid Ligament

DISCUSSION: Irrespective of the side and sex to which the ligaments belongs, the mean value of the length of the deltoid ligaments in the anterior, middle and posterior parts are 24.40 mm, 21.53 mm and 17.20 mm. The widths in the superior, middle and inferior parts are 19.94 mm, 22.59 mm and 27.45 mm. The thickness mean measurement is 6.94 mm.

Deep Part was found in 100% of cases.

The deep fibres (anterior tibiotalar) pass from the tip of the medial malleolus to the non-articular part of the medial talar surface. The superficial part trapezoid in shape wide anteriorly and narrow posteriorly, also is narrow superiorly where it arises and broad inferiorly where it gets inserted. The medial collateral ligament also called as the deltoid ligament is a strong, triangular band, attached to the apex and to the anterior and posterior borders of the medial malleolus. Of its superficial fibres, the anterior also called the tibionavicular, passes forward to the navicular tuberosity,

behind they blend with the medial margin of the plantar calcaneonavicular ligament. Intermediate also called the tibiocalcaneal fibres descend almost vertically to the entire length of the sustentaculum tali. Posterior fibres also called the posterior tibiotalar, passes posterolaterally to the medial side of the talus and its medial tubercle.

The mean length values on the right side are 25.09 mm, 21.98 mm and 17.61 mm with a standard deviation of 2.88 mm, 3.39 mm and 1.92 mm. The mean width values are 18.71 mm, 21.75 mm and 26.79 mm with a standard deviation of 3.22 mm, 2.99 mm and 3.59 mm. The mean thickness measurement is 7.01 mm with a standard deviation of 0.71 mm.

The mean length values on the left side are 23.72 mm, 21.08 mm and 16.79 mm with a standard deviation of 2.47 mm, 2.81 mm and 2.27 mm. The mean width values are 21.17 mm, 23.43 mm and 28.11 mm with a standard deviation of 2.60 mm, 1.98 mm and 2.76 mm. The mean thickness measurement is 6.87 mm with a standard deviation of 0.91 mm.

The measurements are similar on both sides except the superior width of deltoid ligament. The measurement is more in right side and is statistically significant (P=0.02).

This may be due to the natural dominance.

According to Rodrigo Sepulveda et al's.[5] study (2012) on morphometric study and anatomical relations of the medial ligament of the talocrural joint, it was found that three forms of the superficial deltoid ligament were present, namely the trapezoid, rectangular and triangular forms. In trapezoid form, the mean anterior and posterior length was 30.6 mm with a standard deviation of 10.3 mm and 28.5 mm with a standard deviation of 8.5 mm. The mean superior width was 22.5 mm with a standard deviation of 3.4 mm and inferior width was 48.4 mm with a standard deviation of 8.9 mm.

In rectangular form, the mean anterior and posterior length was 21 mm with a standard deviation of 7.2 mm and 24.8 mm with a standard deviation of 7.34 mm. The mean superior width was 22.7 mm with a standard deviation of 6.9 mm and inferior width was 28.2 mm with a standard deviation of 7.6 mm.

In triangular form, the mean anterior and posterior length was 37 mm with a standard deviation of 10.6 mm and 37.8 mm with a standard deviation of 3.9 mm. The mean superior width was 00 mm with a standard deviation of 00 mm and inferior width was 48.3 mm with a standard deviation of 6.4 mm.

The deep layer is present in 100 percent of cases.

Boss et al.[6] (2002) measured sub-divisions of deltoid complex and the mean anterior length measured 29.5 mm with a standard deviation of 10.5 mm, the middle mean length was 16.1 mm with a standard deviation of 6.8 mm and the mean posterior length was measured to be 26.9 mm with a standard deviation of 8.6 mm.

The mean width was 20 mm with a standard deviation of 4.3 mm.

In a study of medial collateral ligament complex of the ankle by Bernanrd Mengiardi et al.,[7] the mean thickness of deltoid ligament in females was found to be 9.2 mm with a range of 7 to 12 mm. In men, it was 10.8 mm with a range of 7 to 15 mm. In the total population, it was measured to be 10.2 mm with a range of 7 to 15 mm.

In our study, the male and female varieties could not be studied because of lack of enough of female specimens.

In the study, it closely resembles the trapezoid variety in majority of the cases, but the measurements were very less when compared to the study of Rodrigo Sepulveda et al.[5]

This may be due to population difference.

This may also be due to the fact that our study was in formalin embalmed cadavers and the study by Rodrigo Sepulveda et al.[5] were on embalmed bodies.

The study is in agreement with that of other studies.

CONCLUSION: The ligaments of the talocrural joint are one of the most difficult ligaments to study. A sincere effort has been put in this study to find the morphometry of ligaments of ankle joint. The same has been studied and reported successfully to help the surgeons to understand and help the needful in a better way. The study has a lot of future scope because very little or negligible study has been done in this field. The geographic variation is to be found out if any as Indian population consists of a vast diversity of people belonging to a plethora of ethnic background.

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