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Original Research Article

AN ANATOMICAL STUDY OF GRACILIS MUSCLE & ITS ROLE IN CLINICAL RECONSTRUCTION SURGERIES

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ABSTRACT

Introduction: It is the most superficial of the adductor group of muscles. Gracilis muscle is used oftenly in reconstructive plastic surgery,because ofits reliable vascular and neurological pedicles and the minimal donor-site morbidity.

Materials and Methods: The present study was conducted on 40 cadaveric lower limbs (22 males and 18 females) in the Deptartment of Anatomy of VIMS&RC.Metrical and non-metrical characteristics of gracilis muscle and vascular pedicles were analyzed.

Results: All the parameter were more in males compared to females. distal tendon length was more than proximal tendon length. P value was significant in all the measurements. The ratios between various components of muscle remain fairly constant. Main vascular primary pedicle was arising from profund femoral artery in 60 % & 40% from Medial circumflex femoral artery .Presence of proximal secondary pedicle was only in 30% of the specimens arising from profunda femoral artery or Medial circumflex femoral artery. Distal secondary pedicles arising from 5% of femoral artery.

Conclusion: These parameters will help the reconstructive surgeon in assessing the length of muscle belly or tendon available for reparative procedures before undertaking surgery like Anterior Cruciate Ligament graft, Restoration of sphincteric function in anogenital area, Repair of ano-vaginal or recto-vaginal fistulas, Facial rehabilitation, Upper limb and lower limb defects, Groin wounds and autologous breast reconstruction.

KEY WORDS: Length of muscle belly, Gracilis Muscle, Grafting, fistulas, Facial rehabilitation.

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INTRODUCTION

"Gracilis" the muscle derives its name from the latin word meaning slender. It is the most superficial of the adductor group of muscles. It arises by a thin aponeuroses from the medial margins of the lower half of the body of the pubis, the whole of the inferior ramus of pubis and the adjoining part of ischial ramus. The fibres descend and curve around the medial condyle of the tibia, where it fans out and attaches to the upper part of the medial surface of the tibia just below the condyle. It is innervated by the anterior division of obturator nerve and derives its blood supply from the obturator artery, medial circumflex femoral artery, descending genicular artery, or from the superior and inferior medial genicular arteries or from femoral artery [1]. Usually two or three vascular pedicles accompanied by venae comitans, enter the muscle from its deep surface and nourish it. Of these the proximal pedicle is generally the dominant blood supply to the muscle and supplies 70% of the bulk of the muscle. The number of minor pedicles range from one to five which distally supply 15%-30% of the bulk of the muscle [2].

The reason why this muscle has been favored by reconstructive surgeons is that it has reliable vascular and neurological pedicles and the minimal donor-site morbidity. This muscle can also be easily harvested and its multi-fascicular innervation allows safe muscular debulking preserving contractility [3]. It is used loco-regionally a pedicled flap for reconstruction after oncological surgeries, for repair of ano-vaginal or recto-vaginal fistulas which are resistant to repeated repair procedures [4-6]. Gracilis tendon grafts are used in repair of anterior cruciate ligament of knee joint. It has also been used for a wide variety of procedures including breast reconstruction, lip augmentation, facial palsy management, anorectal and urethral fistula. A technique called dynamic Graciloplasty where in the gracilis muscle along with its nerve supply has been used for restoration of anal function in patients with faecal incontinence [7]. Bringing rich blood supply, free muscle flaps are advocated as helpers in the treatment of chronic osteomyelitis. In this series the gracilis could always adequately fill the defect created by the debridement. It provided stable wound coverage [8].

Aim: To measure various parameters of gracilis and evaluate the mean values and also calculate statistical inter-relationship between various parameters in an individual muscle. This will help the surgeon to be aware of the availability of the muscle belly or tendon (approximately) while undertaking a reconstructive surgery.

MATERIALS AND METHODS

The present study was conducted on 40 cadaveric lower limbs (22 males and 18 females) in the Dept. of Anatomy of VIMS&RC. The legs with previous surgeries had been undertaken or those associated with obvious pathology that could disturb the local anatomy were excluded. Metrical and non-metrical characteristics of gracilis muscle and vascular pedicles were analyzed. Measurements taken were: Total muscle length from its origin to insertion, Length of muscle belly, maximum Width of muscle belly, length of Proximal &Distal tendon, Distance of primary vascular pedicle from the origin of the muscle, Length of the primary pedicle from its origin to the muscle. & No. of proximal & distal secondary pedicles grossly visible were recorded. statestical analysis were calculated using SPSS version 16 were : mean, standard deviation, student t test.

Fig. 1: Showing length of gracilis muscle from its origin to insertion.

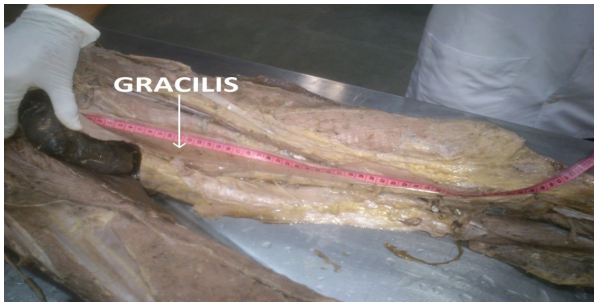

Fig. 2: Showing proximal tendon of gracilis muscle.

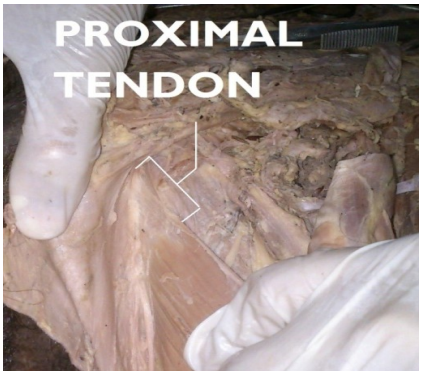

Fig. 3: Showing distal tendon of gracilus muscle.

Fig. 4: Showing primary pedicle of arteryarising from femoral artery supplying muscle.

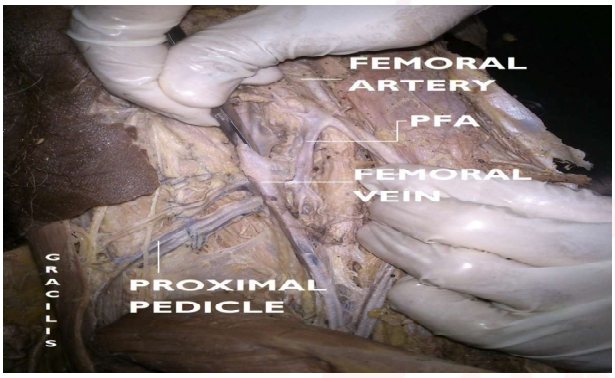

Fig. 5: Showing distal secondary pedicle artery from femoral artery.

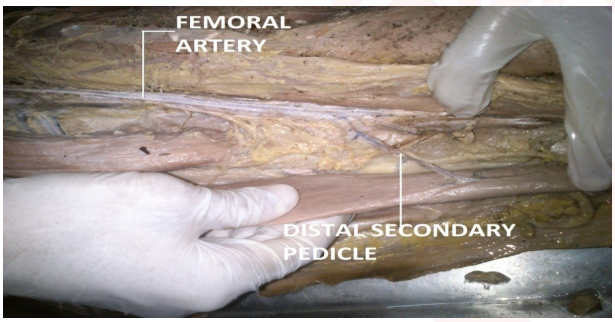

Table 1: Showing various parameters of gracilus muscle (M: Male, F: Female)

Sl no	Parameter	Gender	Mean±SD	P valve
1	Total length of muscle	M	47.2±1.76	P < .00001.
		F	39.87±2.87	
2	Length of muscle belly	M	31.6±1.77	P < .00001.
		F	26.55±1.9	
3	Width of muscle belly	M	2.71±0.61	P <.000147.
		F	2.06±0.33	
4	Proximal tendon length	M	2.00±0.23	P < .00001
		F	1.59±0.23	
5	Distal tendon length	M	13.35±1.56	P <.000158.
		F	11.32±1.66	
6	Total tendon length	M	15.35±1.61	P < .00002.
		F	12.91±1.68	
7	Distance of primary pedicle	M	9.76±1.78	P <.000824.
		F	8.25±0.71	
8	Length of primary pedicle	M	6.36±0.56	P < .00001.
		F	5±0.6	

All the parameter were more in males compared to females. distal tendon length was more than proximal tendon length. P value was significant in all the measurements.

Table 2: Showing Statistical analysis of ratio of various components of gracilius musle (M: Male, F: Female).

Sl no	Ratio of various components of muscle	Gender	average	Range
1	Muscle belly:total length	M	67:100	65:100-70:100
		F	67:100	67:100-68:100
2	Distance of center of hilum:total length	M	0.902778	14:100-25:100
		F	28:100	19:100-20:100
3	Distal tendon:total length	M	28:100	25:100-31:100
		F	28:100	27:100-28:100

Ratio between the different components were fairly constant.though significant differences exist in total length of muscle in different individuals and sexes but the ratios of muscle belly, distal tendon and distance of hilum from ramus to total length of muscle remain reasonably constant in all cases.

Vascular finding: Primary pedicle in most of the specimen took origin from the Profunda femoral artery.Two distal secondary pedicles were found. Hilum is present only in anterior half of the lateral side of the muscle. Primary pedicle was in the upper 1/3rd of the muscle.

DISCUSSION

Length of muscle in both male &femal was more compared to others studies, muscle belly in male is more when compared to theirs studies &less in females compared tohurbanetal [9], total tendon length in both male & femal is more compared to others study, distal tendon length in both male & femal is more compared to others study, pedicle length from origin was less compared to vigatoetal [5], morrisetal [10], machii vetal [13], rajeshwarietal [14], lainetal [2] studies and more compared to Hurban etal[9], Hussy et al [11], Dorothee etal [15].

Gracilis muscle derives its vascular supply from a wide range of arteries. The number of pedicles to the muscle ranges from one to five, out of which the proximal pedicle is considered as the principal or the main pedicle and provides nutrition to the upper two thirds of the muscle. The accessory pedicle, if present they are seen mainly in the lower two thirds of the muscle. Occasionally a small minor accessory pedicle

Table 3: Comparision of various parameters of gracilus muscle with different authors (M: Male, F: Female)

Sl no	Authors	Gender	Total length of muscle (cms)	Muscle belly(cms)	Total tendon (cms)	Distal tendon (cms)	Distance of centre of vascular pedicle (cms)
1	Hurban et al [9]	M	43.2±2.08	29.1±1.3	1.42±2.5	11.5±2.08	9.4±0.72
		F	37.1±0.76	24.6±0.76	12.6±0.49	10.9±0.30	7.9±0.26
2	Vigato et al [5]		41±2.1	-	11±21	-	10±1
3	Morris et al [10]		44±2	-	-	-	10±1
4	Hussy et al [11]		38.4	-	-	-	9.4
5	Giordan et al [12]		-	27.9±0.2	-	-	-
6	Machii V et al [13]		41+2.1	-	-	-	10+1.3
7	Rajeshwari et al [14]		42.2+2	-	-	-	10.5+2
8	Lain et al [2]		-	-	-	-	10+2
9	Dorothee et al [15]		-	-	-	-	9.28
10	Present study	M	47.2±1.76	31.6±1.77	15.35±1.61	13.35±1.56	9.76±1.78
		F	39.87±2.87	26.55±1.9	12.91±1.68	11.32±1.66	8.25±0.71

that is proximal to the main or principal pedicle may be present which is known as proximal accessory pedicle [2]. Earliest studies and anatomical textbooks report the main pedicle as a branch of the circumflex medial artery [3,12,10],

Hurbanetal [9] study revealed presence of main or primary vascular pedicle arising from PFA (70%) or MCFA (30%). In hurban's study main artery originated in common with artery to adductors in all cases whereas Vigato et al [5] reported origin of main artery equally divided between artery to adductors(46%) and PFA(45%), in 9% cases they found origin from MCFA.

The persistent proximal secondary pedicle of varying size was observed arising from MCFA(61%), artery to adductors (23%) and PFA(16%) in Hurban et al [9]. Shatari et al [7] found proximal secondary pedicle in 34.6% cases only.

In the present study primary pedicle was arising from profund femoral artery in 60 % & 40% from MCFA goes with Huber lain etal study. Presence of proximal secondary pediclewas only in 30% of the specimens arising from PFA or MCFA goes with shatarietal study. Distal secondary pedicles arising from 5% of femoral artery.

CONCLUSION

Morphometric study of gracilis showed there are variations in muscle length, belly, distal tendon etc. measurements; in a single individual as well as in both genders. Ratios however of muscle belly or tendon to total length of muscle remained fairly constant in both genders. Ratios are useful to surgeon in pre-assessing available length of muscle belly or tendon from the total length of the muscle in an individual patient for whom reparative surgery using this muscle as a free or pedicled graft is being planned. In all cases primary vascular pedicle entered muscle through anterior half of lateral surface of the muscle.Hence posterior half of muscle can be removed if debulking has to be carried out to appropriately match the recipient site.

Conflicts of Interests: **None**

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