

Morphology and Proportion of Testicular and Epididymal Appendices: A Cadaveric Study

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ABSTRACT

Introduction: The testicular and epididymal appendages are small, vestigial remnants of embryonic duct systems which are clinically significant, as the torsion of these appendages represent one of the most common causes of acute scrotum. A precise knowledge of the morphological features of these appendages would be highly beneficial for the diagnosis and treatment of acute scrotum.

Aim: To estimate the proportion and to describe the morphology of testicular and epididymal appendices.

Materials and Methods: A cross-sectional study was conducted in the Department of Anatomy, Government Medical College, Thiruvananthapuram, Kerala, India, from February 2026 to April 2026. A total of 112 testicular specimens available in the Department were used to study the testicular and epididymal appendages. The specimens were analysed for the following situations: (i) Absence of both testicular and epididymal appendages; (ii) Presence of appendix of testis alone; (iii) Presence of appendix of epididymis alone; (iv) Presence of both testicular and epididymal appendages; (v) Presence of more than one testicular or epididymal appendices in one testis. The morphology of these appendages were also evaluated. The data obtained were analysed, qualitative variables were presented in percentages and the quantitative variables in mean and Standard Deviation (SD).

Results: Some type of testicular or epididymal appendices were found in 83 (74.1%) specimens. In 54 (48.2%) appendix was present in testis alone, in 19 (17%) appendix was present in epididymis alone, and in 10 (8.9%) it was present in both testis and epididymis. Out of 83 specimens, there were no specimens with more than one epididymal or testicular appendages. Among the appendix of testis, it was found in both sides in 93.8% and majority of them were sessile (79.7%). Among the appendix of epididymis, in 96.6% they were present on both sides and majority were pedunculated (79.3%). The mean length, width and thickness of testicular appendices were 1.67 ± 0.70 mm, 1.23 ± 0.25 mm and 0.30 ± 0.25 mm respectively. The mean length, width and thickness of epididymal appendices were 2.90 ± 1.39 mm, 1.57 ± 1.00 mm and 0.55 ± 0.18 mm, respectively.

Conclusion: In the present study, appendix of testis was found on both sides in most of the specimens and majority of them were sessile. Epididymal appendix were found on both sides in most of the cases and majority were pedunculated. So, if the acute scrotum is due to torsion of these appendages, the surgeon should carefully examine the opposite side also to prevent its torsion in future. A detailed anatomical knowledge of these appendages would be vital in the diagnosis and treatment of acute scrotum. The study findings would be promising for the clinical practice and research.

Keywords: Epididymis, Hydatid of Morgagni, Testicular torsion, Testis

INTRODUCTION

The appendices of the testis and epididymis are small, vestigial remnants of embryonic duct systems, found in the majority of normal individuals [1]. The appendix of testis (also known as the sessile hydatid of Morgagni), is a remnant of the cephalic end of the paramesonephric (Müllerian) duct [2]. The appendix of epididymis is the remnant of cranial blind end of the mesonephric (Wolffian) duct and is frequently found to be pedunculated [3].

Previous studies have shown that the incidence of testicular appendix is approximately 76% of adults, while the epididymal appendix is about 21.9% [2,4]. As one of the most common causes of acute scrotum, these appendages hold considerable clinical significance [5-7]. Torsion occurs when these appendices rotate around their own axis, particularly those that are long or pedunculated [1]. Accurately differentiating appendiceal torsion from the testicular torsion is essential to avoid unnecessary operative exploration [8]. Some cases have reported testicular ischaemia and necrosis resulted from the torsion of testicular appendix [9]. Studies evaluating bilateral symmetry suggest that the appendages often possess similar anatomical features on the contralateral side [2,8].

There are two hypotheses regarding the function of these appendices, one suggests that they may control the amount of serous fluid within the space of vaginal process [10] and the other suggests the

surface epithelium, subepithelial capillaries and lymphatic vessels of testicular appendices form a functional unit [11]. Recently ectopic epididymal ducts and efferent ductules in the testicular appendices of adult men have been reported [12] and also tumours have been reported from these appendices [13]. Consequently, understanding the incidence and anatomical characteristics of these remnants is of great importance for ensuring proper diagnosis and guiding appropriate therapy [8].

Previous studies have primarily focused on the incidence, morphological types, and dimensions of testicular and epididymal appendages [2,4,8]. The present study aimed to extend the existing knowledge by comparing its findings with those reported in previous research, with particular emphasis on the incidence, type and laterality of these appendages and their clinical significance. The present study aimed to estimate the proportion and to describe the morphology of testicular and epididymal appendices in the specimens obtained.

MATERIALS AND METHODS

A cross-sectional study was conducted in the Department of Anatomy at Government Medical College, Thiruvananthapuram, Kerala, India from February 2026 to April 2026. The study was started after obtaining Institutional Ethical Committee (IEC) approval

(HEC No. 03/22/2026.MC TVM) and has been carried out in accordance to the ethical standards.

Inclusion criteria: A total of 112 formalin fixed testes obtained from 56 adult male cadavers dissected as a part of routine undergraduate training in the Department of Anatomy at Government Medical College, Thiruvananthapuram were included and examined.

Exclusion criteria: Since there were no gross abnormalities in the specimens obtained, no specimens were excluded from the study.

Sample size: Sample size was calculated using the formula, Sample size, $n=4pq/d^2$, where p (proportion)=65.78 [8], $q=1-p$ (34.22), d (absolute precision)=10%

$$n=4 \times 65.78 \times 34.22 / 10^2$$

and the sample size was found to be 90 and in the present study, a higher sample size of 112 was included to improve the power of the study.

Study Procedure

A total of 112 formalin fixed testes obtained from 56 adult male cadavers, available in the Department of Anatomy was taken for study. The laterality of the specimen was identified by hanging the testis by holding the spermatic cord and looking for the sinus of epididymis, which is always posterolateral to testis [14,15]. The tunica vaginalis layer of testis was cut opened by putting a longitudinal incision on its anterior border. At the superior pole of testis, divided the tunica vaginalis which joins it to the head of epididymis. Separated the testis and epididymis by gentle blunt dissection and studied the specimen for the presence of the appendices of testis and epididymis.

In the present study, the following situations were first analysed: (i) Absence of both testicular and epididymal appendages; (ii) Presence of appendix of testis alone; (iii) Presence of appendix of epididymis alone; (iv) Presence of both testicular and epididymal appendages; (v) Presence of more than one epididymal or testicular appendices in one testis. Once the presence of an appendix was confirmed, the morphology was studied (sessile or pedunculated) and the finding were confirmed using a magnifying lens. The dimensions of the appendices was measured to the nearest 0.01 mm by a sliding caliper with vernier attachments. Photographs of specimen were taken using digital camera.

STATISTICAL ANALYSIS

The data obtained were entered in Microsoft Excel Sheet, compiled and analysed statistically using Statistical Package for the Social Sciences (SPSS) statistics version 27.0. Quantitative variables expressed as mean and SD. Qualitative variables expressed as proportion.

RESULTS

In the present study, 83 (74.1%) specimens out of 112 showed some type of testicular or epididymal appendices. The incidence of testicular and epididymal appendices were studied and are demonstrated in [Table/Fig-1]. Out of 83 specimens, there were no specimens with more than one epididymal or testicular appendages.

Out of 64 specimens with testicular appendix, unilateral sessile appendix was found in 3 (4.7%) cases and all of them were on the

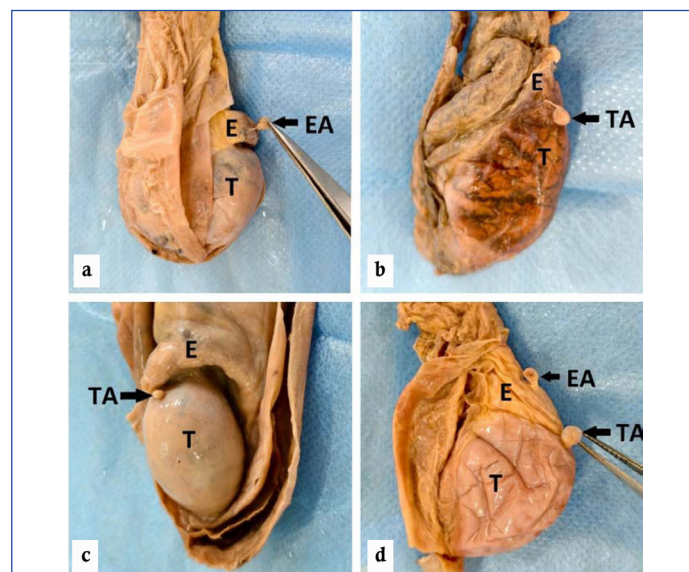
Appendices	n (%)
Absent	29 (25.9)
Present in testis	54 (48.2)
Present in epididymis	19 (17.0)
Present in both testis and epididymis	10 (8.9)
Presence of more than one appendix in testis/epididymis	0

[Table/Fig-1]: Incidence of testicular and epididymal appendages.

right-side. Only one (1.5%) was unilaterally pedunculated testicular appendix, which was on the left-side. Epididymal appendices were found in 29 cases, out of that only one (3.4%) was found unilaterally, which was pedunculated and on the right side [Table/Fig-2]. [Table/Fig-3] illustrates various types of testicular and epididymal appendices identified in the present study.

Type and laterality of appendices	Testicular appendix	Epididymal appendix
	n (%)	n (%)
Unilateral pedunculated appendix	1 (1.5)	1 (3.4)
Bilateral pedunculated appendix	12 (18.8)	22 (75.9)
Unilateral sessile appendix	3 (4.7)	0
Bilateral sessile appendix	48 (75.0)	6 (20.7)

[Table/Fig-2]: Type and laterality of testicular and epididymal appendices.



[Table/Fig-3]: Shows appendix of testis and epididymis: (a) Shows pedunculated appendix of epididymis; (b) Shows pedunculated appendix of testis; (c) Shows sessile appendix of testis; and (d) Shows the specimen with both testicular and epididymal appendices. (T-Testis, E-Epididymis, EA-appendix of epididymis, TA- appendix of testis).

The dimensions of the appendices were measured and the [Table/Fig-4] shows the mean and SD of the measurements of the testicular and epididymal appendices.

Measurements	n	Mean±SD (mm)
Testicular appendage length (mm)	64	1.67±0.70
Testicular appendage width (mm)	64	1.23±0.25
Testicular appendage thickness (mm)	64	0.30±0.25
Epididymal appendage length (mm)	29	2.90±1.39
Epididymal appendage width (mm)	29	1.57±1.00
Epididymal appendage thickness (mm)	29	0.55±0.18

[Table/Fig-4]: Shows the mean and Standard Deviation (SD) of the measurements of the testicular and epididymal appendices.

DISCUSSION

The testicular appendix was initially documented by Morgagni in 1703, though he did not differentiate between testicular and epididymal types [16]. It was later, in 1893, that Griffith identified these appendages as distinct anatomical entities. The occurrence of these structures is notably variable in medical literature, with reported incidences ranging from as low as 24% (Jozsa T et al.) to as high as 92% (Rolnick D et al.) [17,18]. Identifying the presence, shape, and size of these appendages is clinically significant due to the potential for torsion and the risk of tumour development within them [13].

In the present study, some type of testicular or epididymal appendages were identified in 74.1% (83 out of 112) of the specimens examined.

This frequency was consistent with previous researches, such as studies by Sahni D et al., (76%), Sundarasivarao D (80.3%), and Barbosa RG et al., (65.78%) [2,4,8].

Specifically, testicular appendages were found in 57.1% (64/112) of cases, aligning with the results of Barbosa RG et al., (44.72%) [8], but shows a higher percentage in the studies by Sahni D et al., (76%), and Sundarasivarao D (80.2%) [2,4]. Epididymal appendages were observed in 25.9% (29/112) of sample in the present study, which was comparable to findings by Barbosa RG et al., (25%) [8], Sundarasivarao D (23%) [4], Sahni D et al., (21.9%) [2], and Rolnick D et al., (34%) [18]. Although literature suggests multiple appendages can occur, they are considered rare and none were observed in the current study [2,4,18].

The appendages were further categorised based on their attachment as either sessile or pedunculated. The vast majority of testicular appendages were sessile (79.7%), with only 20.3% being pedunculated. This high prevalence of sessile attachments is mirrored in the work of Sahni D et al., who reported only a 6.7% pedunculated rate [2]. In contrast, majority of the epididymal appendages were pedunculated (79.3%) and this finding corresponds with data from Sahni D et al., (78.5%), although it differs from the lower rate of 18.42% reported by Barbosa RG et al., [2,8].

Regarding laterality, testicular appendices were bilateral in the majority of cases (93.8%). Unilateral occurrences were noted only in four instances (three were right-sided sessile and one was left-sided pedunculated). Study done by Sahni D et al., showed bilateral appendix in 77.4% cases, but a lower rate is found by Barbosa RG et al., (45%) [2,8]. In majority of the cases, the epididymal appendix were found bilaterally (96.6%) and a unilateral epididymal appendage was

found in only one case (right-sided and pedunculated). In contrast, majority of the epididymal appendices were found unilateral in the previous studies.

In the present study, the mean length, width, and thickness of the testicular appendix were 1.67 ± 0.70 mm, 1.23 ± 0.25 mm, and 0.30 ± 0.25 mm, respectively. In comparison, Barbosa RG et al., [8] reported higher values. On the right-side, the mean length, width, and thickness were 3.20 ± 2.95 mm, 1.62 ± 1.58 mm, and 0.38 ± 0.31 mm, while on the left-side they were 3.10 ± 3.75 mm, 1.55 ± 1.74 mm, and 0.45 ± 0.51 mm. For the epididymal appendix, we found mean values of 2.90 ± 1.39 mm in length, 1.57 ± 1.00 mm in width, and 0.55 ± 0.18 mm in thickness. Barbosa RG et al., reported similar but slightly variable measurements [8]. On the right-side, the mean length, width, and thickness were 3.70 ± 3.68 mm, 1.90 ± 1.97 mm, and 0.47 ± 0.43 mm, and on the left-side they were 3.00 ± 3.11 mm, 1.80 ± 2.10 mm, and 0.54 ± 0.56 mm.

The clinical relevance of these morphological findings is tied to the risk of torsion. Torsion of the appendix testis was first mentioned by Ombredanne in 1913, with the first case report published by Colt GH in 1922 [19]. According to research by Knight PJ and Vassy LE, torsion of the testicular appendix accounts for 24% of acute scrotal pain cases, following testicular torsion (38%) and epididymitis or orchitis (31%) [20]. Findings in the present study, that testicular appendages are primarily sessile (79.7%) while epididymal appendages are primarily pedunculated (79.3%) is in strong agreement with the established findings of Sahni D et al., [2].

The comparison between the present study and previous studies are summarised in the [Table/Fig-5] [1,2,4,8].

S. No.	Author's name and year of study	Place of study	Sample size	Objective	Parameters assessed	Conclusion
1	Barbosa RG et al., [8] 2024	Brazil	152	To evaluate the number, shape, size and to determine the laterality pattern of the testicular and epididymal hydatids in human cadavers and in patients with prostate cancer who underwent bilateral orchiectomy	Type of appendages, Laterality of appendages, Dimensions of testis, epididymis, testicular appendix, epididymal appendix	Testicular appendices were present in 44.72% and epididymal appendices in 25% of the samples, being pedunculated in almost half of the cases with bilateral similarity. There is a significant chance in cases of twisted appendices that the same anatomical characteristics are present on the opposite side, which is a factor that tends to indicate the need for contralateral surgical exploration in cases of torsion.
2	Sahni D et al., [2] 1996	Chandigarh, India	Paired testes obtained from 425 adults, 50 children and 10 neonates.	To evaluate the number, type, dimensions and the structure of testicular and epididymal appendices	Incidence of testicular and epididymal appendices, its type, dimensions of sessile appendices of testes, structure of appendices	The incidence of testicular appendices was 76% in adults (majority were sessile) and epididymal appendix was present in 21.9% of adults and majority were stalked. The microscopic structure of the appendices and the ultrastructure of their epithelia were described.
3	Favorito LA et al., [1] 2004	Brazil	65 patients with cryptorchidism totalising 83 testes, and 40 patients having prostate adenocarcinoma and hydrocele (control group)	To study the incidence of testicular and epididymal appendages in patients with cryptorchidism	Incidence of testicular and epididymal appendices	The occurrence of testicular and epididymal appendages is quite variable. There was no statistically significant difference in the incidence and distribution of the testicular and epididymal appendages between patients with cryptorchidism and those from the control group.
4	Sundarasivarao D [4] 1953	England	152	To evaluate the incidence, type and structure of testicular and epididymal appendices	Incidence, type, structure of testicular and epididymal appendices	Appendices of the human testis and epididymis are distinct. The appendix testis has a variable but complex structure.
5	Nair SS et al., 2026	Kerala, India	112	To estimate the incidence, type and to describe the morphology of testicular and epididymal appendices	Incidence, type, laterality and dimensions of testicular appendix and epididymal appendix	Testicular and epididymal appendages were found in about 74.1% of the specimens, which were found on both sides in majority of cases. Majority of testicular appendices were sessile and epididymal appendices were pedunculated in most of the cases. Acute scrotum may occur due to the torsion of these appendages, in those cases surgeon should carefully examine the opposite side to prevent the torsion of those appendages in future because of their bilateral similarity.

[Table/Fig-5]: Shows the comparison between the present study and previous studies [1,2,4,8].

Limitation(s)

As the study was conducted on embalmed cadavers, the measurements may differ slightly from those in living individuals due to tissue stiffening or contracture. Comparison between the measurements of left and right testicular appendages were not carried out.

CONCLUSION(S)

The prevalence of testicular and epididymal appendages in a significant portion of the population (identified in 74.1% of specimens in this study) necessitates thorough clinical awareness, as torsion of these structures is a recognised cause of acute scrotal pain requiring precise evaluation and management. Based on the present study findings that epididymal appendages are predominantly pedunculated (79.3%), we assume that these structures may be more susceptible to torsion than their predominantly sessile testicular counterparts.

The study also noticed that these appendages are present on both sides. So, if torsion happens on one side, it is important to check the other side as well to help prevent future problems. Since both sides tend to have symmetrical anatomical characteristics, examining or even surgically exploring the opposite side might be useful in cases of twisted appendages. However, more research with larger groups of people is needed to confirm this.

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