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Original Article

MEAN TUBULAR DIAMETER (MTD) IN CADAVERIC VERSUS CRYPTORCHID TESTES

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ABSTRACT

Cryptorchidism refers to hidden testicle. It is a clinical condition where one or both testicles have been retained from entering the scrotum during the later part of the foetal period. Along with irreversible damage at both gross and cellular levels there is impairment of endocrine and reproductive functions of the testicles. As the incidence of cryptorchidism is very low and previously reported research and data on comparative findings between cadaveric and cryptorchid testes in the state of Bihar was not available this study was undertaken.

KEYWORDS: Cryptorchidism, testicle, scrotum, comparative.

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INTRODUCTION

The testis is a white, ovoid organ that is normally 15 to 25 ml in volume[1], has a length of 4.5 to 5.1 cm[2], a diameter of 2.5cm[3] and weighs 10-15 grams[3]. The testicles are the only organs in humans that are located outside the body and have two main functions: to produce hormones, in particular testosterone and to produce male gametes, the spermatozoa[4]. Leydig cells are the prime source of testosterone[5,6,7] and contribute to about 5-12% of testicular volume[8,9,10]. Parenchyma of the testicle is divided into compartments separated by connective tissue septa [3,11]. Each septum divides seminiferous tubules into lobes [11]. Each seminiferous tubule contains developing germ cells and interstitial tissue[11]. In humans, interstitial tissue comprises 20-30% of total testicular volume[12].

Seminiferous tubules are long, highly coiled, looped structures, both ends of which usually terminate in the rete testis [11]. Each seminiferous tubule is about 200µ in diameter [3]. They are surrounded by several layers of peritubular tissue[13]. Cryptorchid testicles of adults are much smaller than normal and there is no doubt that undescended testicles not operated upon early in life are seriously damaged[14].

MATERIALS AND METHODS

Both apparently normal testes were carefully dissected and removed from an adult cadaver. These were the control testes and labeled as “C”. Four museum specimens of orchidectomized cryptorchid testes were examined both morphologically and histologically.

These were labeled as T_1, T_2, T_3 & T_4 respectively. Their findings were contrasted with morphological and histological findings of apparently normal testes obtained from cadaver. The focus of the present study is to find out justifiable deviations present in a cryptorchid testis from a normal testis. Both "C" as well as "T_1, T_2, T_3 & T_4" were measured in three dimensions using ruler and thread, they were weighed on an electronic weighing scale. After that both control and specimens were subjected to tissue processing using Bouin's fluid as a fixative. This fluid rapidly coagulates the tissue and yet well preserves the tubular cytoarchitecture. It also imparts a bright yellow colour to the tissue which makes it clearly visible during embedding and section cutting. Routine processing was performed and the tissues were stained according to Ehrlich's H & E method. Lastly the stained sections of each specimen were studied under the Carl Zeiss Observer Z1 microscope at various magnifications and the following information was recorded.

- Mean Tubular Diameter (MTD) in microns (µ)
- Presence or absence of spermatogonia
- Presence or absence of Leydig cells
- Condition of the basement membrane
- Presence or absence of peritubular fibrosis
- Presence or absence of Sertoli cells

OBSERVATIONS

In the present study the observations were as follows.

Mean Tubular diameter (MTD) was calculated by measuring the average of vertical and horizontal diameters of 20 randomly selected seminiferous tubules (ST) in each of "C, T_1, T_2, T_3 & T_4".

Fig. 1: Histological observation of Control Testis in 10X.

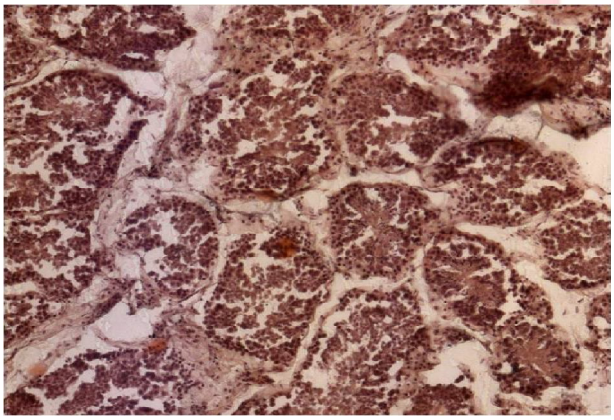


Fig. 2: Histological observation of T1 in 10X.

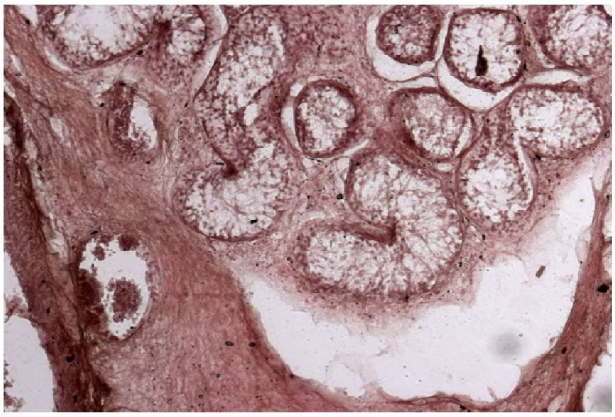


Fig. 3: Histological observation of T2 in 10X.

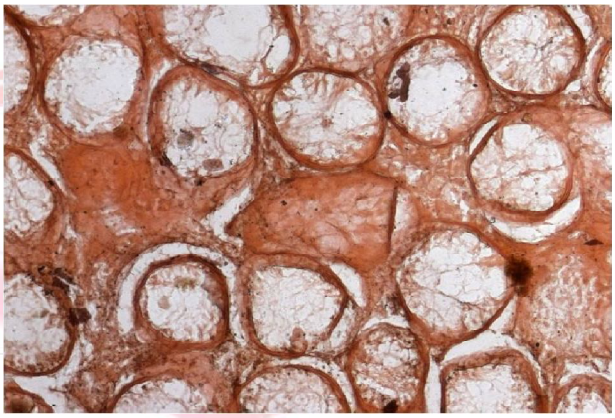


Fig. 4: Histological observation of T3 in 10X.

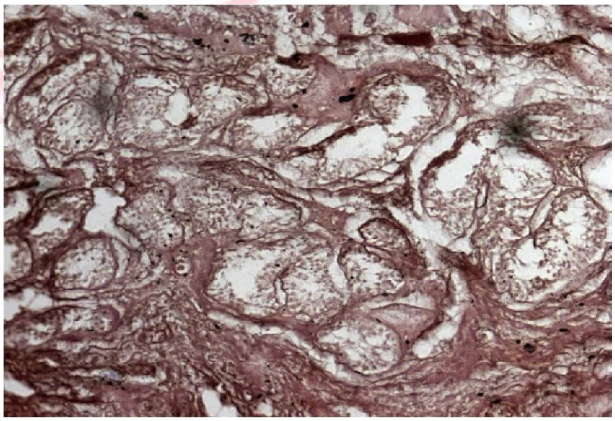


Fig. 5: Histological observation of T4 in 10X.

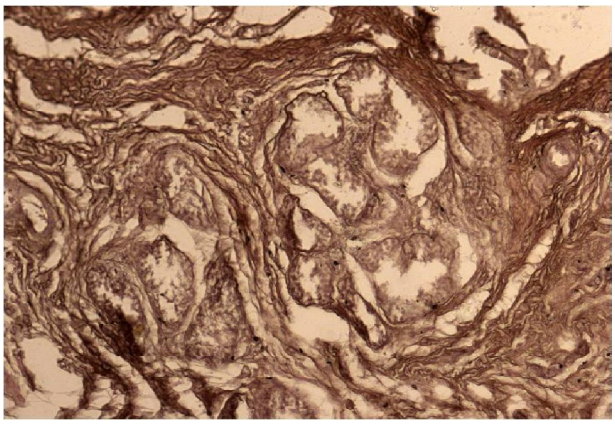
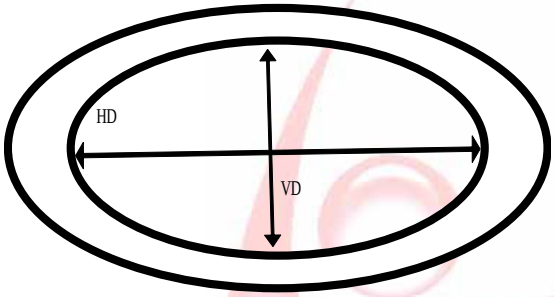


Table 1: Showing morphological findings of "C, T_1, T_2, T_3 & T_4".

Specimen	C	T_1	T_2	T_3	T_4
Length (cm)	4.4	1.2	2.6	2.8	3.2
Breadth (cm)	2.8	0.9	1.6	1.8	2.2
Thickness (cm)	2.2	0.6	1.2	1.5	1.8
Weight (gram)	15	1	3	5.5	8.5



VD = Vertical Diamete **HD** = Horizontal Diameter

Table 2: Showing the Vertical diameters (VD) and Horizontal diameters (HD) of seminiferous tubules (ST) of "C, T_1, T_2, T_3 & T_4" in microns (µ).

Seminiferous Tubules	C		T_1		T_2		T_3		T_4	
ST	VD	HD	VD	HD	VD	HD	VD	HD	VD	HD
ST-01	225	314	68	87	101	89	111	77	56	59
ST-02	192	227	41	63	87	73	73	91	49	53
ST-03	211	246	95	108	95	64	77	62	57	73
ST-04	166	180	57	33	91	87	69	53	59	71
ST-05	168	192	53	56	75	78	91	74	61	66
ST-06	163	198	49	43	73	79	83	87	63	67
ST-07	211	201	51	62	87	62	67	82	73	55
ST-08	221	187	43	36	83	61	51	61	77	49
ST-09	191	191	54	37	117	67	85	75	61	63
ST-10	231	211	52	39	94	61	41	47	68	74
ST-11	204	254	85	93	84	91	52	53	62	56
ST-12	261	176	71	57	83	97	57	49	59	69
ST-13	223	322	40	39	86	64	61	61	53	64
ST-14	201	179	77	91	81	69	76	83	61	73
ST-15	174	206	49	43	96	93	63	65	57	59
ST-16	193	187	58	65	91	83	79	81	63	57
ST-17	243	183	39	43	79	81	72	118	54	58
ST-18	196	181	46	38	81	77	77	91	55	66
ST-19	178	213	56	45	85	95	58	44	65	57
ST-20	227	207	57	49	79	93	63	57	59	64

Table 3: Showing Mean Tubular Diameter (MTD) of "C, T_1, T_2, T_3, T_4" in microns (µ).

Testes	Avg VD (µ)	Avg HD (µ)	MTD (µ)
C	203.95	212.75	208.35
T_1	57.05	56.35	56.7
T_2	87.4	78.2	82.8
T_3	70.3	70.55	70.42
T_4	60.6	62.65	61.62

I - Morphological Observations: Cryptorchid testes were atrophic and small compared to the cadaveric testes.

II - Histological Observations

1. Reduction in number of seminiferous tubules in cryptorchid testes.
2. Remaining seminiferous tubules are atrophic in nature and distorted in shape.
3. Most seminiferous tubules are either elliptical or oval.
4. Smaller seminiferous tubules appear to be hyalinized.
5. Larger seminiferous tubules contain only Sertoli cells.
6. Basement membrane is apparently thickened.
7. Interstitial cells of Leydig are vacuolated.
8. Absence of any identifiable spermatogonia.
9. No evidence of spermatogenesis.
10. Extensive peritubular fibrosis.

III - Histometric observations – (HO):

Table 4: Showing Histometric observations (HO).

HO	C	T_1	T_2	T_3	T_4
MTD (µ)	208.4	56.7	82.8	70.42	61.62
Max VD (µ)	231	95	117	111	77
Min VD (µ)	163	39	73	41	49
Max HD (µ)	314	108	97	118	73
Min HD (µ)	176	36	61	44	49

DISCUSSION

The early genital systems in both sexes is similar hence the initial period of development has been termed as indifferent state of sexual development[15]. The gonads are derived from three sources: mesodermal epithelium lining the posterior abdominal wall, underlying mesenchyme, primordial germs cells [15]. Testicles usually develop in embryos with a normal Y chromosome but only the short arm of this chromosome is critical for sex determination[15]. The SRY gene for the testis-determining factor (TFD) on the short arm of the Y chromosome acts as a switch that directs the development of a gonad into a testis[15]. By 26 weeks the testes have descended retroperitoneally from posterior abdominal wall to the deep inguinal rings[16]. The process is controlled by androgens and takes 2 or 3 days[16]. More than 97% of full term new

born males have both testes in the scrotum and during the first three months most undescended testes descend into the scrotum[16].

Cryptorchidism refers to interruption of the normal descent of the testicle into the scrotum. The testicle may reside either in the retroperitoneum, inguinal canals or any of the rings. A distinction should be made between undescended and retractile testicle. A congenitally absent testicle results from failure of normal development or an intrauterine accident leading to loss of blood supply to the developing testicle. It is now established that cryptorchid testicle shows increased predisposition to malignant degeneration. In addition fertility is decreased when the testicle is not in the scrotum. Orchidopexy will never improve the fertility potential. The testicle will remain at risk to malignant change although its scrotal location will facilitate earlier detection of malignancy. Males with bilateral empty scrotum are often infertile. When a testicle is not in the scrotum it results in decreased spermatogenesis due to exposure to higher temperature. Mengel and coworkers demonstrated by histologic analysis that after two years of age there is reduction of spermatogonia. Incidence of infertility is twice as high in men who have undergone orchidopexy that in those men with normal testicular descent. In this study significant differences between apparently normal cadaveric and cryptorchid testes have been reported. The MTD is an excellent indicator of the development of the seminiferous epithelium[17]. In the prepubertal testes the tubular diameter depends principally on Sertoli cells and thus indicates whether they are adequately stimulated by FSH. Tubular diameter varies throughout, being smallest in the end of third year of life, slowly enlarging upto nine years of age and rapidly enlarging thereafter up to fifteen years by which the tubules reach their definitive diameter ranging from 160µ to 170µ.The most frequently abnormality in cryptorchid testes is a low MTD. These findings are supported by the fact that the MTD of a randomly selected seminiferous tubule of a healthy adult testis is approximately 200µ.This is in accordance with our findings where we have shown that the MTD of the normal testis obtained from cadaver is 208.35µ.

None of the cryptorchid testes had an MTD remotely near the 100µ mark. Due to morphological distortions all the cryptorchid testes were smaller as well as lighter than the cadaveric testis. In the past, authors have emphasized the relationship between testicular deformity and malignant disease. The absence of spermatogenesis and identifiable spermatogonia, thickening of the basement membrane, vacuolated Leydig cells, extensive peritubular fibrosis and reduction in both, number as well as MTD of seminiferous tubules strongly supports this fact.

CONCLUSION

Cryptorchidism either unilateral or bilateral has deleterious effects on the testicles. Our study has demonstrated the same. Early orchidopexy in unilateral maldescent is strongly suggested to safeguard both ipsilateral and contralateral testicles.

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Conflicts of Interests: **None**

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