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Original Article

The testicular position and descent in developing human

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ABSTRACT

Aim: The present study aimed at reevaluating and providing a more comprehensive knowledge of position and descent of the testis.

Materials and methods: The position and descent of testis was studied on 104 male formalin fixed human fetuses in the Department of Anatomy, RIMS, Imphal. The fetuses were dissected and the location of the testes and the extent of the gubernaculum were noted. Special staining was done using Weigert's iron hematoxylin and Van Gieson's stain.

Results: The testes were located, in the earliest specimen of the present series, retroperitoneally in the lower abdomen at L3–4 level. Left testis was usually at a lower level than the right. Testicular descent was observed earliest at 24 weeks of intra-uterine life (IUL) and 100% successful complete bilateral descent by 36 weeks IUL. Descent through the inguinal canal was rapid and no case of undescended testis was encountered. The testicular descent was symmetrical in majority of the cases except in 7 where the descent was asymmetrical with the left descending earlier. Structural changes in gubernaculum but not its contraction played a role in testicular descent.

Conclusion: Thus, a comprehensive and thorough knowledge of the testicular descent will assist in management of cases related with testis, especially the undescended and ectopic testis.

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1. Introduction

During the course of development, the testis comes to occupy different positions gradually till it reaches its definitive position in the scrotum and this gradual change in the position is termed as the descent of the testis.

The testis develops high in the abdomen, in the position that would correspond with that of the kidney in the adult and that it descends to the groin.¹ In human embryos of 10–15 weeks of gestation, the testis remains close to the future inguinal region during the development of the abdominal cavity.² The testis descends from the loin to the iliac fossa at 3rd month and lies at the deep inguinal region from 4th to 7th month.³

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The final descent of the testis is rapid, occurring between the 23 and 24 cm stage i.e., early in the 7th month.¹ The descent of the testis through the inguinal canal is a rapid process, with 75% of the testes descending between 24 and 28 weeks of gestation and in only 2.6% between 23 and 31 weeks of gestation, the testis is found in the inguinal canal itself. Asymmetrical descent occurs in 17% of these fetuses, the left descends prior to the right in 70% and also non-descent occurs more commonly on the right (65%).⁴ The earliest observation of a descended testis is found at 23 weeks (6.6%) and beyond 32 weeks over 98% of the fetuses has both testes in the scrotum.⁵ The testis descends to the scrotum before birth, left ahead of right.⁶

The actual cause of the testicular descent is uncertain but some of the mechanisms attributed to it are the traction by gubernaculum, intra-abdominal pressure, maturation of the epididymis, effect of the genitofemoral nerve, differential growth of the body and hormonal influence etc.⁷

2. Materials and methods

One hundred and four normal fresh male fetuses of different gestational ages ranging from 9 weeks (35 mm) to 40 weeks (440 mm), products of terminated pregnancy under MTP Act of India, 1971 and stillbirths collected from the Department of Obstetrics and Gynecology, RIMS, Imphal in the period between April 2004 to June 2006 were utilized for the present study with permission from the local ethical committee. Only those fetuses which were free from any gross anatomical abnormality were selected for the present study. The age of the fetuses was calculated from the obstetrical history, crown



Fig. 1 – Photograph of a 22 weeks old fetus before testicular descent where both the testes (orange arrows) are still inside the abdomen. Gubernacula testis (yellow arrows) is soft and jelly-like at this stage.

rump length (CRL) and gross features. The fetuses were fixed for 10 days with 10% formalin by whole body immersion and perfusion of the abdominal cavity and then were dissected. The location of the testes and the extent of the gubernaculum were noted and relevant specimens were photographed for record.

To study the microstructure of the gubernaculum, some of the specimens were fixed by immersion in neutral buffered formalin. Special staining was done using Weigert's iron hematoxylin for nuclear staining and Van Gieson's stain for differentiation between the collagen fibers, fibrin and muscle fibers. Slides were examined under different magnification. Slides showing maximum clarity were chosen and photographed.

3. Results and observations

In the specimens of 9 weeks of IUL, the testes were located retroperitoneally medial to the developing mesonephros in the lower abdomen at L3–4 level. During the course of development, the position of the testis changed from this initial position to reach the groin at 13 weeks of IUL and the

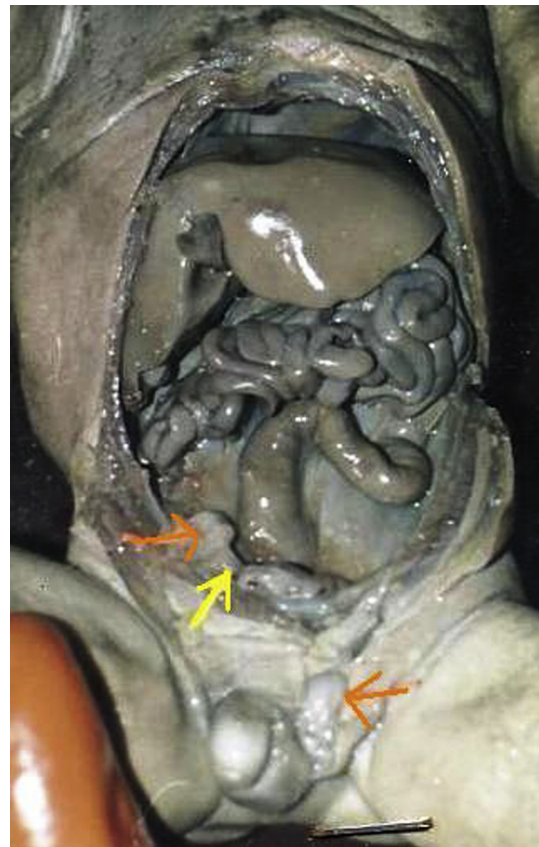


Fig. 2 – Photograph of a 32 weeks old fetus showing asymmetrical testicular descent where the left testis (orange arrow) is descending earlier than the right. The left testis is entering the scrotum and the right testis is still inside the abdomen. Gubernaculum testis (yellow arrow) is thick and cord-like at this stage.



Fig. 3 – Photograph of 36 weeks old fetus showing complete descent of both the testes (orange arrows). Gubernacula testes become ligamentous bands at this stage.

testes remained in this position in groin just above the deep inguinal in the earlier stages (Fig. 1). At 24 weeks of IUL, a single testis of the left side was found in the inguinal canal and around this time onwards, the testes rapidly passed through the inguinal canal to enter the scrotum (Fig. 2) and by 36 weeks of IUL, all had reached the definitive position inside the scrotal sac (Fig. 3). Left testis was usually at a lower level than the right. With development, the long axis of the testis also changed from vertical in the abdomen to oblique in the inguinal canal to vertical again in the scrotum.

In the study, the testis was regarded undescended when it was situated above the deep inguinal ring and descended when it was below the ring. And complete descent when it was completely inside the scrotum.

The earliest case of a descended testis was observed at 24 weeks of IUL though in a low percentage of cases (7.1%). As shown in Table 1, this percentage almost progressively increases with increasing gestational age through 30% at 26 weeks of IUL to 50% at 28 weeks of IUL finally to 100% of complete bilateral descent at 36 weeks of IUL. The descent through the inguinal canal was rapid and only 3 testes out of 40 (7.5%) were found in the inguinal canal (Table 2). Seven cases of asymmetrical descent were seen where the left testis always descended before the right (100%) (Table 2) (Fig. 2). No undescended testes were encountered in the present study as 100% complete bilateral descent was observed in term fetuses above 37th completed weeks of gestation (Table 1).

Gubernaculum testis was seen to be attached to the lower pole of the testis throughout and to the adjoining part of epididymis from 16th week of IUL onwards. It changed from initial soft jelly-like tissue (Fig. 1) to enormously thick cord-like structure (Fig. 2) and finally to ligamentous band (Fig. 3) during the course of development. Its thickening and shortening is undoubtedly a factor for testicular descent. It extended down through the inguinal canal to the scrotum preceding the descending testis (Fig. 1). The gubernaculum consisted of undifferentiated spindle shaped cells without any striated or un-striated muscle fibers (Fig. 4).

4. Discussion

Slightly variable period of time had been mentioned for the position of the testis near the inguinal region: 10–15 weeks,² 4th to 7th month,³ 3rd to 7th month⁸ and 6th and 7th month.⁶ In the present study, the testes were initially identified at 9th week of IUL at the level of L3–4 and then found descended inferiorly above the deep inguinal ring at 13 weeks; along with this the longitudinal axis also changed from an initial longitudinal to an oblique axis.

Table 1 – Percentage of testicular descent at different gestational ages.

Sl. No.	Gestational age (Wk)	Number of fetuses	Descended testis (left + right)	Percentage of descended testis (%)
1	9–23	66	0	0
2	24	7	1	7.1
3	25	3	1	16.7
4	26	5	3	30
5	27	3	2	33.3
6	28	4	4	50
7	29	2	3	75
8	30	4	7	87.3
9	32	2	3	75
10	34	2	4	100
11	36	2	4	100 (C)
12	38	2	4	100 (C)
13	40	2	4	100 (C)
Total		104	40	

C: Complete descent.

Table 2 – Site of descended testis at different gestational ages.

Sl. No.	Fetal age (Wk)	No. of fetuses		Descended testis (left + right)	Site of testis in case of D		Asymmetrical descent (no.)	Side with lower position of testis
		Total	D		Left	Right		
1	24	7	1	1	IC	IA	1	Left
2	25	3	1	1	ES	IA	1	Left
3	26	5	2	3	ES	IA	2	Both left
4	27	3	1	2	ES	IC	0	–
5	28	4	2	4	ES	ES	0	–
6	29	2	2	3	ES	ES	1	Left
7	30	4	4	7	ES	IA	1	Left
8	32	2	2	3	ES	ES	1	Left
9	34	2	2	4	ES	IA	0	–
10	36	2	2	4	ES	ES	0	–
11	38	2	2	4	S	S	0	–
12	40	2	2	4	S	S	0	–
Total		38		40	S	S	7 fetuses	

D: With descent; IA: Intra-abdominal; IC: Inguinal canal; ES: Enters scrotum; S: Completely inside the scrotum.

The result of the present study compares favorably with previous studies which showed no descent prior to 24th weeks' of gestation.^{5,9,10} Previous workers have reported the time of final extra-abdominal descent variously at the beginning of 7th month¹ and about the 8th month.¹¹ A study found 62% testes descended between 28 and 30 weeks⁹ while another study found 75% descended between 24 and 28 weeks of gestation.⁴ The earliest observation of a descended testis was found at 23 weeks (6.6%) and beyond 32 weeks over 98% of

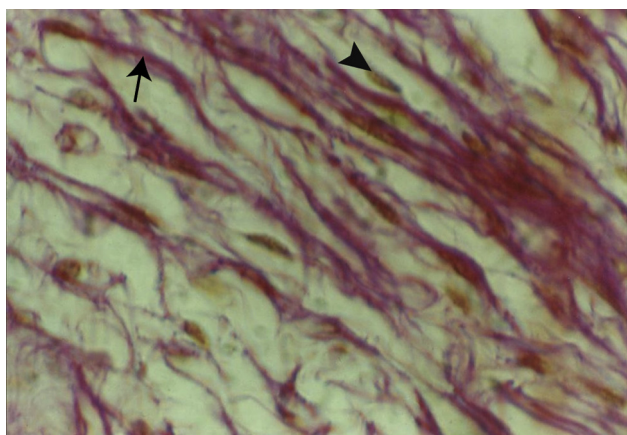


Fig. 4 – Photomicrograph of cytoarchitecture of 16 weeks old fetal testis (Weigert's iron hematoxylin and Van Gieson's stain ×100) showing mesenchymal cells (arrow head) and collagen fibers (arrow) of the gubernaculum testis and absence of muscle fiber in it.

the fetuses had both the testes in the scrotum.⁵ In the present study, earliest observation of descended testis was found at 24 weeks of IUL (7.1%) and 100% of complete bilateral descent was seen by 36 weeks of IUL.

The present authors agree with the previous authors^{1,4} that the final descent of the testis through the inguinal canal is rapid as the testis was found in the inguinal canal in only 3 cases (7.5%).

The descent of the testis to the scrotum occurs before birth, with left ahead of right.⁶ Asymmetrical descent was found in 17% of the fetuses, the left descended prior to the right in 70% and also non-descent occurred more commonly on the right (65%).⁴ Whereas in another study, the descent was found taking place a little earlier on the right than on the left.¹² In the present study, asymmetrical descent was found in 7 cases and in all these cases, the left descended before the right (100%).

The gubernaculum develops in the substance of the plica inguinalis at 20 mm stage.¹ One author stated that it first appeared in human fetus during the 6th week of gestation¹³ whereas another mentioned that it condensed during the 7th week.⁸ In the earliest fetus of the present series i.e., 9 weeks of IUL, the gubernaculum was identifiable as a thin soft jelly-like structure attached to the lower pole of the testis and from 16 weeks of IUL to both the lower pole of the testis and the tail of the epididymis which is comparable with the findings of one study⁴ but is in contrast to another study¹ that reported the cranial attachment of the gubernaculum to the Wolffian duct and not to the testis.

Previous workers mentioned contrasting changes in the gubernaculum in the course of testicular descent: atrophy,⁴ reduction in size due to its condensation,¹⁴ increase in the

bulk,¹⁵ retaining the same length¹² or rhythmic contraction.¹⁶ The gubernaculum with an intact distal attachment is a necessary prerequisite for testicular descent¹⁷ and its transection would prevent testicular descent.¹⁸ In the present study, it was seen that the gubernaculum increased in size and changed from thin jelly-like to enormously thick cord-like structure and finally to ligamentous band as it shortened. The present study agrees with the findings of previous authors^{4,19} that histologically the gubernaculum consisted of undifferentiated spindle shaped cells without any striated or unstriated muscle fibers.

5. Conclusion

The detailed study of position and descent of the testis in the developing human was conducted and the observations were noted, critically analyzed and discussed with the findings of previous workers and the following conclusions were arrived at:

Testes were abdominal in position in the earlier stage of development; at 24 weeks of IUL the earliest case of testicular descent was observed and 100% successful complete bilateral descent was seen by 36 weeks of IUL. Left testis was usually at a lower position than the right and descent also occurred earlier on the left in cases of asymmetrical descent. No undescended testis was encountered. Change in the structure of gubernaculum was observed as a factor for descent as the initial thin jelly-like structure became enormously thick cord-like structure and finally ligamentous band with development but its contraction is ruled out as it was found to be devoid of muscle fibers. The detailed knowledge of the position and descent of the testis will help the clinicians to deal better with the cases of undescended and ectopic testis and their complications.

Conflicts of interest

All authors have none to declare.

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