

**HISTOLOGICAL STUDY OF URINARY SYSTEM
IN DEVELOPING HUMAN FETUS**

Thesis submitted to Swami Rama Himalayan University

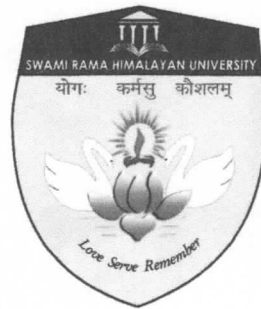
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- (i) Informed Consent Form (English and Hindi)
- (ii) Abbreviations
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SUMMARY

This study was conducted in the Department of Anatomy, Himalayan Institute of Medical Sciences, Swami Rama Himalayan University. Prenatal development is a crucial period for human development of the urinary system. It is a complex process and proceeds precisely in an orchestrated manner with a series of morphological and histological events.

In the present study 30 fetuses ranging from 8th to 38th weeks were studied in a serial manner of increasing gestational age and the changing histological developmental features of the urinary tract were observed. The kidney, ureter, urinary bladder and urethra were studied in all the fetuses. The organs were subjected to standard histological processing and the sections were stained with Haematoxylin and Eosin. Few sections of the ureter were stained with Masson's Trichrome to observe the appearance of the various layers of the muscle coat.

The following observations were made on the developing kidney:

- ❖ Both the kidneys had ascended to its adult lumbar position in the posterior abdominal wall by the 8th week of gestational age.

- ❖ They appeared lobulated and bean-shaped. These lobulations were restricted only on the surface of the organ which finally disappeared by the 38th week.
- ❖ The wide nephrogenic zone consisting of the condensed metanephric blastema which continuously gave rise to renal vesicles that gradually matured to “C” and “S” shaped bodies. These bodies matured consistently into the lobulated glomeruli consisting of podocytes, Bowman’s space and the parietal layer. The distal end of the S-shaped bodies gave rise to the various parts of the renal tubules.
- ❖ The PCT and DCT were observed as early as 16 weeks.
- ❖ The thick limb of the loop of Henle appeared at the 15th week while its thin limb was first observed at the 16th week.
- ❖ The corticomedullary differentiation and the justaglomerular apparatus were observed at the 17th week of gestational age.
- ❖ The collecting tubules were observed in undifferentiated mesenchymal tissue at the 12th week. Their proliferation continued in the subsequent weeks with the mesenchymal tissue decreasing simultaneously.
- ❖ At 21 weeks the Ducts of Bellini (papillary ducts) were observed to open into the renal papilla.

- ❖ The nephrogenic zone was completely replaced by glomeruli at 38 weeks.

The following observations were compiled from the sections studied of the developing ureter:

- ❖ Canalization of the Ureter was first observed to be initiated at the age of 10 weeks.
- ❖ The lining transitional epithelium was 5-6 layered thick with vacuolated and polygonal cells. The mucosa was lined outside by mesenchymal tissue.
- ❖ Single tapered muscle cells replaced the surrounding mesenchymal tissue with increase in the number of mucosal folds at 12 weeks.
- ❖ The lumbar part of the ureter showed the earliest developmental changes which proceeded in a craniocaudal direction.
- ❖ At 23 weeks the inner longitudinal muscle coat was observed in the middle 1/3.
- ❖ The intravesical part of the ureter depicted smooth muscles arranged longitudinally.

Sections of the developing urinary bladder demonstrated the following findings:

- ❖ At about the 11th week the undifferentiated mesenchyme formed the lamina propria and small muscle fibres whose orientation and bundle formation was still not evident.
- ❖ At this gestational age the lining epithelium consisted of only 1-2 layers.
- ❖ The detrusor muscle became thicker at 12 weeks and differentiated into an outer circular and an inner longitudinal coat.
- ❖ Formation of the periureteric sheath was observed at the 13th week.
- ❖ The epithelium got thickened to 5-6 layers by the 15th-17th week.
- ❖ The circular muscle coat of the detrusor became thickened at the neck of the bladder to form the internal urethral sphincter.
- ❖ The trigonal area showed an epithelium consisting of a 1-2 layered flattened cells. Mucosal folds were very short.
- ❖ The deep trigonal muscle was observed to be a continuation of the detrusor at its posteroinferior aspect.
- ❖ The superficial trigonal muscle was observed at the 20th week separated from the former by the Waldeyer's fascia.

The developing urethra gave rise to the following observations:

- ❖ Muscle primordium was first observed around the immature urethral epithelium at 9 weeks of gestational age.
- ❖ At 12 weeks it consisted of a narrow smooth muscle layer on its anterior aspect. This was overlaid by a thick layer of striated muscle fibres which covered it in a U-shaped manner on its anterolateral aspect at the level of the developing verumontanum.
- ❖ The striated muscle fibres were thinner in comparison to the other striated fibres of the levator ani and other surrounding muscles.
- ❖ Just below the prostatic apex the striated muscle layer formed a completely circular coat to form the external urethral sphincter.
- ❖ At 20 weeks the primordia of the bulbourethral glands were observed to develop at this level.
- ❖ The epithelium above the level of the openings of the ejaculatory ducts was transitional in nature while in the rest of the posterior and anterior urethra it was lined by pseudostratified columnar epithelium.
- ❖ Between 19-23 weeks the terminal part of the urethra was observed to be lined by stratified squamous nonkeratinized epithelium arising as a cord of cells from the surface of the glans.

- ❖ Glands of Littre which started developing at 23 weeks continuously kept maturing to open into the walls of the penile urethra.

References