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Original Research Paper

Anatomy

DETERMINATION OF THE TIME SINCE DEATH BY HISTOLOGICAL CHANGES IN HUMAN PELVIS OF URETER

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ABSTRACT

Introduction: The pelvis of ureter is a funnel like structure from where ureter arises located within the hilum of kidney. Like the urinary bladder and ureter the pelvis of ureter is lined by transitional epithelium. Till now postmortem histological changes have been studied on muscle, kidney, liver, RBC, WBC etc. of various animals. A few studies also performed for same purpose on various organs of human being. The histological changes in kidney and pelvis of ureter after death have been studied in various animals but yet studies with same view which may provide keen and fruitful results for human pelvis of ureter has not been done. **Material and Method:** In this study 10 cases were studied histologically. Human pelvis of ureter was obtained as and when available from cadavers at the time of autopsy. It was removed from cadaver with a known time of death, where death had resulted from accident. **Result:** The rate of autolysis was found to be increased with raise in temperature and duration. Retraction and disruption of epithelium with individualization of cells, nuclear pyknosis, karyolysis and loss of epithelial architecture were observed. Muscle layer presented broken fibres and clear spaces. **Conclusion:** This present study is being carried out with this hope that it will be helpful for estimation of time since death.

KEYWORDS : Retraction, Pyknosis, Karyolysis, Smooth muscle fibres, Ureter.

INTRODUCTION

The pelvis of ureter located within the hilum of kidney behind the renal vessels. It is lined by transitional epithelium. Transitional epithelium is made up of three types of cell layers: basal intermediate and superficial.[1]The basal layer foster the epithelial stem cells in order to provide constant renewal of epithelium.[2] These cell cytoplasm is rich in tonofilaments and mitochondria, however they contain few rough endoplasmic reticulum. The tonofilament play a role in the attachment of the basal layer to the basement membrane via desmosome.[3] The basal layer of the epithelium is much less differentiated, however it does act as a replacement source for more superficial layer.[4] The intermediate cell layer is highly proliferative and, therefore, provides for rapid cell regeneration in response to injury or infection of the organ or tube in which it reside.[2] The cells in the superficial layer of the transitional epithelium are highly differentiated, allowing for maintenance of this barrier membrane.[4] Autolysis is an intrinsic activity brought about by the breakdown of cells and tissue of the human body because of the constituent of the said cells.[5] Just after death, the cell membranes breakdown and release enzymes that star self-digestion. The first external sign of autolysis is the whitish appearance of the cornea. On autopsy, the doughy appearance of the parenchyma of the pancreas and lung within hours of death.[6] Gradual decrease of body temperature is one of the earliest sign of death.[7] Despite many decades of investigation on the topic, accuracy in determination of the time of death has not significantly improved and no single method can be reliably used to accurately estimate the PMI.[8,9] In Urinary Bladder the transitional epithelium showed early sign of fragility at 24 hr. Detachment of the epithelium progressed during the following 2 days, leaving a single layer of triangular and spike-shaped cells by day three. Only small areas of epithelium were found at day seven all the epithelium had been lost by three weeks.[10]

METHEDOLOGY

This research was done in Department of Anatomy in close association with the Department of Forensic Medicine & Toxicology Pt .J .N .M. Medical College and Dr. B. R. Ambedkar Memorial Hospital Raipur (C.G.) Present study was done on human cadaver. Material for the present study was pelvis of ureter, taken directly from the dead bodies at the time of autopsy. Human pelvis of ureter was obtained as and when available from cadaver at the time of autopsy with a known time of death, where death had resulted from accident.10 Human pelvis of ureter sample were of different age sex obtained. Cases excluded dead individual with unknown time of death, suffering from renal disease, cases complicated by other metabolic disorders i.e. Diabetes mellitus. The environmental temperature in 0c (minimum/maximum) and humidity in % (minimum/maximum) was recorded from "India Meteorological Department, Meteorological Center Raipur." After collection of biopsy of pelvis of ureter from mortuary it was transported in 10% formalin solution for 48hr for fixation. Small pieces or block of pelvis of ureter tissue.

OBSERVATIONS & RESULTS

STUDY NO:-1 Post mortem interval (PMI)- 14hrs Temperature-22.7/31.20C, humidity-76/92% H& E staining- Pelvis of ureter Transitional epithelium is retracted at places with peripheral dark stained nuclei.

Muscle layer architecture is somewhat maintained. Clear spaces are seen between smooth muscle fibres, broken muscle fibres are seen at places & pyknotic nuclei are also seen. Fibrous layer is retracted from muscle layer. Pyknotic nuclei are seen, fibres are broken at most of places & separated by clear spaces.

STUDY NO:-2 Post mortem interval (PMI)- 15hrs Temperature-20.2/31.70C, humidity-55/86% H& E staining-Pelvis of ureter Transitional epithelium architecture is disturbed. Retraction and disruption of epithelium at places, pyknotic nuclei are seen mostly & cell outline is not clear.

Muscle layer architecture is disturbed, clear spaces are seen between smooth muscle fibres at places & broken muscle fibres are seen at places with peripheral dark stained nuclei. Fibrous layer is widely retracted from muscle layer, nuclei are not clearly seen. Fibres are broken at most of places & separated by clear spaces.

STUDY NO:-3 Post mortem interval (PMI)- 15hrs 40mins Temperature17.5/31.0C, humidity-49/59% H&E staining-Pelvis of ureter. Transitional epithelium architecture is severely disturbed .Retraction of epithelium is seen at places with pyknotic nuclei. Cell outline is not clear & epithelial cells are rarely identified. Muscle layer architecture is maintained. Clear spaces are seen between smooth muscle fibres at places & broken muscle fibres with pyknotic nuclei are seen at places. Fibrous layer is slightly retracted, nuclei are not clearly seen, fibres are broken at most of places.

STUDY NO:-4 Post mortem interval (PMI)- 17hrs10mins Temperature-30.5/39.9 0C , humidity-49/59% H& E staining- Pelvis of ureter Transitional epithelium architecture is disturbed with retraction and disruption of epithelium at places. Pyknotic nuclei are seen mostly. Cell outline is not clear. Muscle layer architecture is disturbed. Clear spaces are seen between smooth muscle fibres at most of places. Broken muscle fibres are seen at most of places with pyknotic nuclei. Fibrous layer is widely retracted from muscle layer, nuclei are not clearly seen, fibres are separated by clear spaces.

STUDY NO:-5 Post mortem interval (PMI)- 18hrsTemperature-24.7/35.30C, humidity-65/87% H& E staining- Pelvis of ureter Transitional epithelium architecture is disturbed. Retraction and disruption of epithelium at most of places. Peripheral dark stained nuclei are seen. Some karyorrectic nuclei are also seen. Individualization of epithelial cells are seen.

Muscle layer-broken muscle fibres are seen at most of places with pyknotic nuclei.

Fibrous layer is widely retracted from muscle layer. Nuclei are not clearly seen. Fibres are separated by large clear spaces, fibres are broken at most of places.

STUDY NO:-6 Post mortem interval (PMI)-18hrs 25 mins Temperature-17.5/31.0C , humidity-49/59% H& E staining- Pelvis of ureter Transitional epithelium architecture is disturbed. Retraction and disruption of epithelium at most of places with peripheral dark stained nuclei. Some pyknotic nuclei & individualization of epithelial cells are seen. Muscle layer architecture is disturbed. Clear spaces are seen between smooth muscle fibres & broken muscle fibres are seen at most of places, nuclei are not visible. Fibrous layer is slightly retracted and disrupted, pyknotic nuclei are seen. Fibres are separated by clear spaces & broken at most of places.

STUDY NO:-7 Post mortem interval (PMI)- 19hrs Temperature-27.6/42.20C, humidity-31/55% H& E staining- Pelvis of ureter Transitional epithelium architecture is severely disturbed. Retraction and disruption of epithelium at most of places, dark stained nuclei are seen. Cell outline is not clear. Muscle layer architecture is disturbed. Clear spaces are seen between smooth muscle fibres & broken muscle fibres are seen at places, dark stained nuclei are seen. Fibrous layer is retracted from muscle layer, some pyknotic nuclei are seen. Fibres are separated by clear spaces & broken at places.

STUDY NO:-8 Post mortem interval (PMI)- 20hrs50mins Temperature-14.8/25.10Chumidity-30/59% H& E staining- Pelvis of ureter Shredding of epithelium is seen, only 1 to 2 layers of epithelial cells with, pyknotic nuclei are seen. Muscle layer architecture is disturbed. Clear spaces between smooth muscle fibres & broken muscle fibres are seen at most of places. Pyknotic nuclei are seen. Fibrous layer is retracted and disrupted at most of places, nuclei are not clearly seen. Fibres are separated by clear spaces & broken at most of places.

STUDY NO:-9 Post mortem interval (PMI)-21hrs10min Temperature-17.5/310C humidity-49/59% H& E staining- Pelvis of ureter Transitional epithelium architecture is disturbed, retraction and disruption of epithelium with peripheral dark stained nuclei, pyknotic nuclei are also seen. Cell outline is not clear, individualization of cells are seen. Muscle layer architecture is disturbed. Clear spaces are seen between smooth muscle fibres at most of places. Fibrous layer is retracted from muscle layer, nuclei are not clearly seen, fibres are broken at most of places.

STUDY NO:-10Post mortem interval (PMI)- 22hrs 25mins Temperature-21.2/28.60C, humidity-47/77%

H& E staining- Pelvis of ureter Transitional epithelium architecture is severely disturbed, retraction and disruption of epithelium with peripheral dark stained nuclei. Cell outline is not clear.

Clear spaces are seen between epithelial cells. Muscle layer architecture is severely disturbed. Clear spaces are seen between smooth muscle fibres at most of places. Broken muscle fibres are seen at most of places with pyknotic nuclei are seen.

Fibrous layer is widely separated from muscle layer, nuclei are not clearly seen. Fibres are separated by clear spaces & broken at most of places.

PAS Staining- basement membrane transitional epithelium is partially PAS positive.

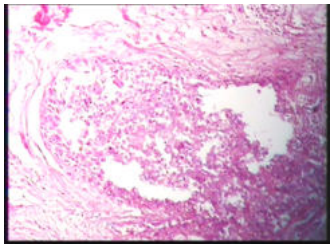


Fig1.14hrsTem-22.7/31.2^{0}C H&E stain 10X.

Transitional epithelium(TE) is retracted at places with peripheral dark stained nuclei. Muscle layer architecture is somewhat maintained.

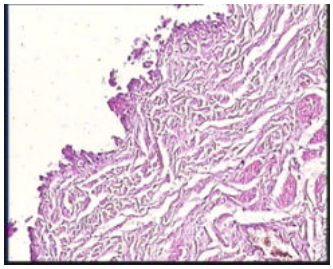


Fig2.15hrs40minTem17.5/31.0^{0}CH&Estain10X

Transitional epithelium(TE) architecture is severely disturbed .Retraction of epithelium is seen at places with pyknotic nuclei. Muscle layer architecture is maintained. Clear spaces are seen between smooth muscle fibres at places & broken muscle fibres with pyknotic nuclei are seen at places.

Fig3.17hrs10minsTem-30.5/39.9 0CH & E Stain10X epithelium (TE) architecture is disturbed Muscle layer(Ms) architecture is disturbed. Clear spaces are seen between smooth muscle fibres at most of places. Broken muscle fibres are seen at most of places with pyknotic nuclei. Fibrous layer is widely retracted.

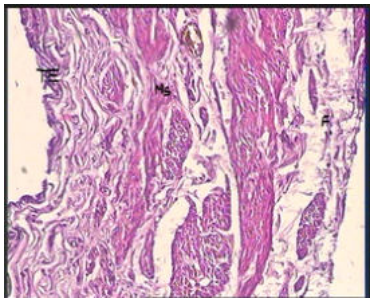


Fig4.19hrsTem-27.6/42.20C,H&EStain40X Transitional epithelium architecture is severely disturbed. Retraction and disruption of epithelium at most of places, dark stained nuclei are seen. Cell outline is not clear.

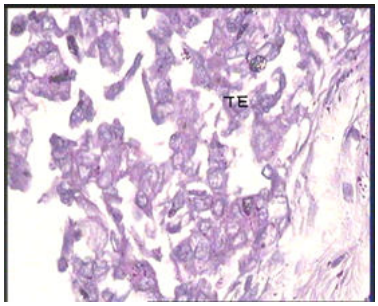
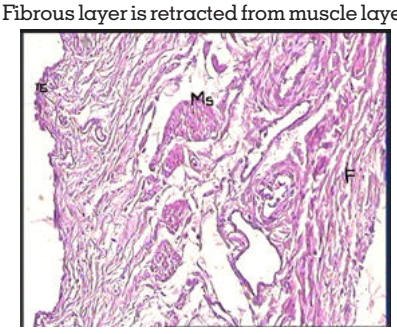


Fig5.21hrs10minTem17.5/310CH&Estain Shredding of epithelium is seen. Muscle layer architecture is disturbed. Clear spaces are seen between smooth muscle fibres at most of places. Fibrous layer is retracted from muscle layer.



DISCUSSION

Autolysis is normally associated with autopsies and recognition of the phenomenon is very important,[11,12] to elucidate forensic cases. Thus autolytic changes have been investigated by forensic pathologists, because they may assist in determining the time of death, especially in the first few hours.[13] Although postmortem autolysis depends on various factors, the most important factor is the postmortem period.[14,15] The transitional epithelium showed early signs of fragility at 24 h. Detachment of the epithelium progressed during the following two days leaving a single layer of triangular and spike-shaped cells by day three. Only small areas of epithelium were found at day seven and all the epithelium had been lost by three weeks.**[M. Erlandsson et.al.[16](2007)]**

Vinita Kushwaha et al[17] found in their study after 13- 18 hrs PMI with increasing temperature of up to 31 to 35^{0}C, moderate& severe changes. Architecture maintained, more cloudy swelling and disruption of epithelium, glomeruli swollen. Only 2 out of 13 cases showed severe changes , architecture disturbed, cloudy swelling and disruption of epithelium was prominent. **Rajni Thakur**[18] found after 13 hrs (23.9/38.7^{0}C) PCT were expanded with debris in the lumen. Retraction and disruption of the epithelium was observed. Epithelial cells were mostly anucleate. At places dark stained nuclei were seen but vesicular nuclei were hardly visible and in DCT debris in the lumen, disruption of epithelium with dark stained nuclei at few places were seen while epithelial cells were mostly anucleate. In CT retraction and disruption of epithelium with dark stained as well as vesicular nuclei and individualization of cells at places were observed.

In present study at (PMI)- 14hrs (T22.7/31.2^{0}C) In pelvis of ureter, transitional epithelium retracted at places with peripheral dark stained nuclei were seen mostly. In muscle layer clear spaces were seen between smooth muscle fibres at places with broken muscle fibres at places and pyknotic changes in nuclei. Fibrous layer was retracted from muscle layer with broken fibre at most of places and separated by clear spaces with pyknotic changes in nuclei. .At (PMI) 18hrs (T24.7/35.3^{0}C) in pelvis of ureter the transitional epithelium was retracted and disrupted at most of places with peripheral dark stained nuclei. Some karyorrectic nuclei were also seen . Individualization of epithelial cells were seen and architecture was disturbed. At (PMI)18hrs25mins (17.5/31.0^{0}C) some pyknotic nuclei were seen but karyorrhectic changes were not seen. At (PMI) 18hrs (T24.7/35.3^{0}C) in muscle layer Clear spaces were seen between smooth muscle fibres at most of places. Fibres were broken at most of places with pyknotic nuclei. Similar changes were seen at (PMI)18hrs25mins (17.5/31.0^{0}C) along with that architecture was disturbed. At (PMI) 18hrs (T24.7/35.3^{0}C) fibrous layer was widely retracted from muscle layer and nuclei were not clearly seen. At (PMI)18hrs25mins (17.5/31.0^{0}C) was slightly retracted and pyknotic changes were seen.

Vinita Kushwaha et.al.[17] found in their study after 19- 24 hrs PMI, with increasing temperature of up to 31to 35^{0}C,severity increases(G-3changes) i.e. architecture disturbed, cloudy swelling and disruption of epithelium was prominent, collapse of glomeruli. **Rajni Thakur**[18] found after19hrs PMI (27.3/ 41.4^{0}C) glomeruli were expanded with dark stained nuclei .PCT showed retraction and disruption of epithelium with dark stained nuclei. In CT retraction were seen. After19hrsPMI (19.5/35^{0}C) glomeruli were expanded and disrupted with vesicular as well as dark stained nuclei. In CT retraction and disruption of epithelium with vesicular nuclei were seen in all tubules.

In present study at (PMI) 19hrs (T 24.7/35.3^{0}C) in pelvis of ureter the transitional epithelium was retracted and disrupted at most of the places with peripheral dark stained nuclei. Some karyorrhectic nuclei were also seen. Individualization of cells were seen. In muscle layer clear spaces were seen between smooth muscle fibres at places. Fibres were broken at places with pyknotic nuclei but architecture was somewhat maintained.

Rajni thakur[18] found at 21hrs PMI (25.5/31^{0}C) glomeruli were expanded and splitted with dark stained nuclei. Red blood cells were seen in glomeruli. In PCT retraction and disruption of epithelium with dark stained nuclei and debris in the lumen were seen. At few places anucleate epithelial cells and individualization of epithelial cells were present. DCT showed complete disruption of epithelium with individualization of epithelial cells in most of the places having dark stained nuclei. In CT retraction, disruption of epithelium with dark stained nuclei and individualization of epithelial cells were present. After 21 hrs PMI(25.5/31^0 C, T)glomeruli were expanded with dark stained nuclei having pyknotic changes at places. Retraction and disruption of epithelium with debris in the lumen of PCT, DCT&CT was observed. In present study at (PMI)- 21hrs10mins (T17.5/31.0^{0}C) In pelvis of ureter transitional epithelium was retracted and disrupted with peripheral dark stained pyknotic nuclei. Individualization of cells was seen with unclear cell outline and disturbed architecture. In muscle layer clear spaces between smooth muscle fibres, broken fibres were seen at most of places with disturbed architecture. Dark stained nuclei and some pyknotic nuclei were seen. Fibrous layer was retracted from muscle layer. Fibres were separated by clear spaces and broken at most of places. Nuclei were not clearly seen.

In present study at (PMI)- 22hrs25mins (T 21.2/28.6 ^{0}C) In pelvis of ureter, transitional epithelium was retracted and disrupted with peripheral dark stained nuclei. Pyknotic changes with severely disturbed architecture were seen. Clear spaces were seen between epithelial cells with unclear cell outline. In muscle layer clear spaces were seen between smooth muscle fibres with broken muscle fibres at most of the places. Architecture was severely disturbed and nuclei were pyknotic. Fibrous layer was widely separated from muscle layer. Fibres were broken at most of places and fibres were separated by clear spaces with hardly seen nuclei.

CONCLUSION

A study of postmortem histological pelvis of ureter was done in 10 random samples of human pelvis of ureter at different time intervals and in different temperature conditions after death. Pelvis of ureters were studied under the light microscope after staining with Harris haematoxylin and eosin. Retraction and disruption of epithelium with individualization of cells, nuclear pyknosis, karyolysis and loss of epithelial architecture were observed in transitional epithelium of pelvis of ureter.

Post-mortem histological changes are directly dependent not only on the length of post-mortem time but also to a bigger extent on the temperature of environment. The rate of autolysis varies with environmental temperature, body size, nutritional status, pelage.(**Deborah Barber**) 19 This current study is being carried out with this hope that it will be helpful for estimation of time after death.

Compliance With Ethical Standards.
Conflict Of Interest – None.
Funding – None.
Consent - Obtained.

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