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DETERMINATION OF THE TIME SINCE DEATH BY HISTOLOGICAL CHANGES IN HUMAN RENAL VESSELS

Anatomy

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ABSTRACT

Introduction: The renal vessels supply kidney. Each kidney is supplied by a single renal artery and a single renal vein, which accounts for about 20% of the cardiac output. The medium-sized renal artery has all layers i.e tunica intima, media, adventitia. The basic structure of veins is similar to that of arteries. After death due to deprivation of blood supply, every organ undergoes series of gross as well as histological changes. Most of the organ in human body undergoes coagulative necrosis, cell swelling, and cell membrane disruption, staining changes in cytoplasm, enzymatic digestion of cellular organelles, nuclear changes like pyknosis, karyorrhexis and karyolysis. **Aims and Objectives:** 1.To determine the time since death by histological changes in human renal vessel. 2. To determine the effect of temperature on histological changes in renal vessel. **Material and Method:** In this study 10 cases were studied histologically. Human renal vessel 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 and Conclusion:** Retraction of epithelium from basement membrane and its disruption with darkening of nuclei of endothelial cell and loss of endothelial cells were observed in tunica intima of renal vessels. Appearance of clear spaces between smooth muscle fibres, broken smooth muscle fibres, nuclear pyknosis, karyorrhexis and loss of architecture were observed in tunica media of renal vessels. Various degree of loss of adventitial tissue and disruption of collagen fibres with loss of architecture were observed in tunica adventitia of renal vessels.

KEYWORDS

Pyknosis, karyorrhexis and Karyolysis.

INTRODUCTION

After death due to deprivation of blood supply, every organ under goes series of gross as well as histological changes. Most of the organ in human body undergoes coagulative necrosis, cell swelling, cell membrane disruption, staining changes in cytoplasm, enzymatic digestion of cellular organelles, nuclear changes like pyknosis, karyorrhexis and karyolysis etc. Autolysis matches with the activity of certain enzyme called autolytic enzyme, proved in lysosomes of living cells, which after death lead to the destruction of their own cell components.

Those enzymes disintegrate intracellular material, including organelles very quickly, so the cytoplasm becomes of homogenic looks and intensively eosinophilic , which culminates with a loss of cell details and tissue architecture.[1,2,3,4] The rate of autolysis varies with environmental temperature, body size, nutritional status, existing disease conditions .Autolytic changes proceed rapidly at $37^{0}C$, corresponding to the temperature optimum for mammalian enzymes.[5] Therefore the rate of cellular degradation is increased by warm weather. Conversely cooling of a carcass slows the autolytic process. The histological studies on various tissues after death have been mostly confined to single organ or tissue by individual workers at different atmospheric conditions. Since only a single organ was studied by most workers, any comparative evaluation of the varying rate of decomposition of the different organs and tissues can not be made out. In this study control cannot be taken because the histological changes of tissue after death is influenced a great deal by atmospheric temperature and humidity besides other external and internal factors . So in this study random sampling is done.

Aim & Objectives

1. To study the sequence of postmortem histological changes in human renal blood vessels.
2. To determine the effect of temperature on histological changes in renal blood vessels.

METHODOLOGY

This study was performed 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 renal vessels directly from the dead bodies during postmortem examination. Human renal vessels were obtained as and when available from cadavers at the time of autopsy. It was removed from cadavers with a known time of death where death had resulted from an accident. The stages for which it was available were temperature between14.8/25.1-27.6/42.20C,humidity between 17/53 to 75/95% and duration range was between 4hr30min to 22hr25min. In the present study 10 cases were studied. In each case renal vessels were studied histologically. Total 10 cases of different age and sex were selected . After collection of renal vessels from mortuary it was transported in 10% formalin solution for 48 hrs. for fixation. Small pieces or block of renal vessels were taken and processed by the routine methods for histological examination.

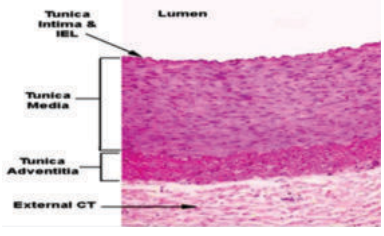
Inclusion Criteria

The selection of cases were based on following criteria-

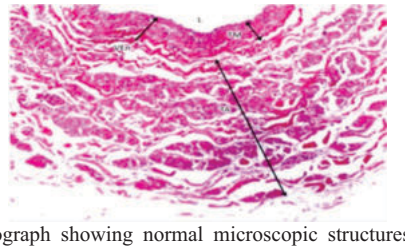
1. Deceased registered in Department of Forensic Medicine & Toxicology.
2. Deceased without any history or evidence of any vascular & renal disorder.
3. The exact time of death of individual must be known.
4. Consent from Department of Forensic Medicine & Toxicology as well as from the attendant of dead individual taken before renal vessels biopsy.
5. All road traffic accident cases were taken into account.

Exclution Criteria

1. Deceased of unknown time of death and diseased renal vessels & kidney.
2. Deceased individual suffering from vascular diseases, hypertension, diabetes mellitus etc.
3. Burn and poisoning cases.



Photomicrograph showing normal microscopic structures of renal artery.



Photomicrograph showing normal microscopic structures of renal vein.

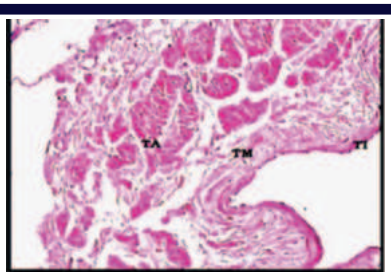


Fig 1 PMI 4hrs 30 mins Temp-23.9/33.4 oC H&E stain 10X photomicrograph of renal vein showing tunica intima (TI) is adhered to basement membrane, few clear spaces between smooth muscle fibres are seen in tunica media(TM), mild loss of adventitial tissue are seen in tunica adventitia(TA).

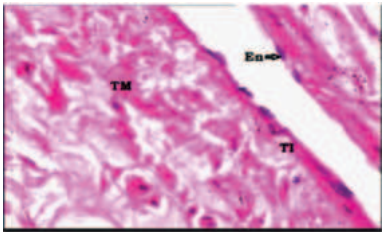


Fig 2 PMI 4hrs 30 mins Temp-23.9/33.4 oC H&E stain 40X photomicrograph of renal vein showing tunica intima (TI) is adhered to basement membrane and few endothelial cells(En), few clear spaces between smooth muscle fibres are seen in tunica media(TM).

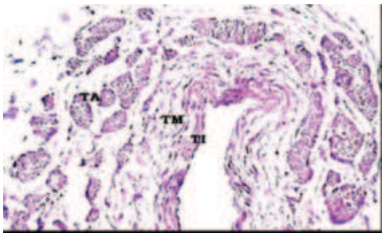


Fig 3 PMI 12hrs 10 mins Temp-25.4/38.8 oC H&E stain 10X photomicrograph of renal vein showing tunica intima (TI) is adhered to basement membrane, clear spaces between smooth muscle fibres are seen at most of places in tunica media(TM) .Moderate loss of adventitial tissue are seen in tunica adventitia(TA).

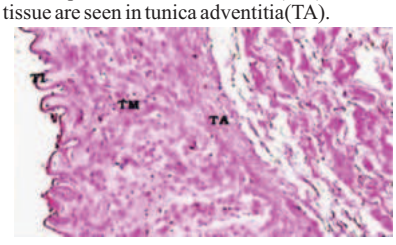


Fig 4 PMI 13hrs 30 mins Temp-27.3/38.3 oC H&E stain 10X photomicrograph of renal artery showing tunica intima (TI) is retracted from basement membrane, clear spaces between smooth muscle fibres are seen in tunica media(TM), tunica adventitia(TA)is adhered to tunica media(TM).

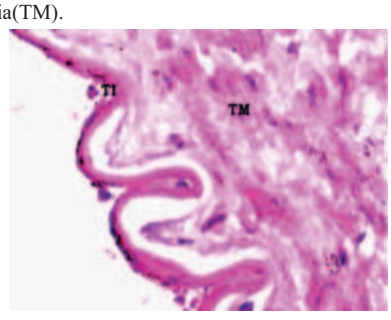


Fig 5 PMI 13hrs 30 mins Temp-27.3/38.3 oC H&E stain 40X photomicrograph of renal artery showing tunica intima (TI) is retracted from basement membrane and oedematous endothelial cells with dark stained nuclei are seen. Clear spaces between smooth muscle fibres are seen at places in tunica media .Dark stained and some pyknotic nuclei are seen in tunica media(TM).

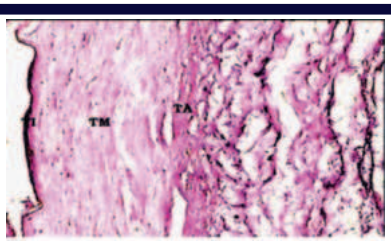


Fig 6 PMI 18hrs Temp-24.7/35.3 oC H&E stain 10X photomicrograph of renal artery showing tunica intima (TI) is slightly retracted from basement membrane at places, clear spaces between smooth muscle fibres are seen at most of places in tunica media(TM), tunica adventitia(TA)is slightly retraced from tunica media(TM).

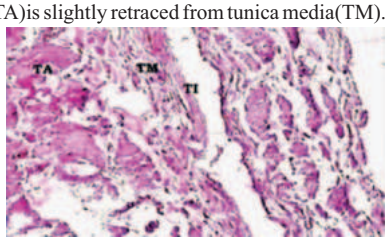


Fig 7 PMI 18hrs 45 mins Temp-27.3/38.3 oC H&E stain 10X photomicrograph of renal vein showing tunica intima (TI) is retracted and disrupted at places, clear spaces are seen between smooth muscle fibres at most of places in tunica media(TM), severe loss of adventitial tissue and disturbed architecture are seen in tunica adventitia(TA).

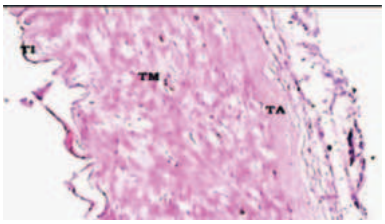


Fig 8 PMI 22hrs25min Temp-21.2/28.6 oC H&E stain 10X photomicrograph of renal artery showing tunica intima (TI) is widely retracted from basement membrane and disrupted at places, clear spaces between smooth muscle fibres are seen at most of places in tunica media(TM), tunica adventitia(TA)is slightly retraced from tunica media(TM)at places.

DISCUSSION

Moriyama et al.[6](2001) examined functional, metabolic, and histological changes in the aortic tissue of rats after the period of warm ischemia ranging from 0 to 24 hours to determine the window of time in which grafts can be optimally viable for harvest.

Typical histological aortic structure was retained in the control tissues.

Histological examination of all vessels after warm ischemia showed a greater loss of smooth muscle and endothelial cells than vessels examined immediately after death. After 6 hours of warm ischemia, slight separation of the elastic fibers and focal vacuolation were seen sporadically in some specimens, but these changes were not widespread.

After 9 hours of warm ischemia pyknotic nuclei and shrunken smooth muscle cells were seen, but these also were not widespread.

Most vessels at 12 and 24 hours postmortem showed frequent and striking separation of structural elements, suggestive of widespread interstitial edema and increasing smooth muscle cell alterations.

In these specimens , virtually all smooth muscle cells appeared dead. Takahashi N, Higuchi T, Hirose Y, Yamanouchi H, Takatsuka H, Funayama K [7]found in aorta after death, the aorta shrunk at all levels, and became oval in shape in descending thoracic and abdominal aorta. The contraction was greater in younger cases than older cases.

Hyodoh H, Sato T, Onodera M, Washio H, Hasegawa T, Hatakenaka M[8] found in postmortem images, the aortic diameter decreased and changes in the size and shape of the superior vena cava (SVC) were noted.

In the present study after 4 hrs 30 mins postmortem interval (PMI) at

temperature (T23.9/33.40C) tunica intima of renal artery showed slight separation from basement membrane and endothelial cells were seen at few places . In tunica media clear spaces were seen between smooth muscle fibres with peripheral dark stained nuclei ,smooth muscle fibres were broken at places. Tunica adventitia was adhered to tunica media and lamellar structure of collagen fibres were seen .

In renal vein tunica intima was adhered to basement membrane and few endothelial cells were seen. In tunica media clear spaces were seen at few places, peripheral dark stained nuclei were seen mostly and some dark stained nuclei were seen also(.In tunica adventitia there was mild loss of adventitial tissue and clear spaces were seen between smooth muscle fibres at places with pyknotic nuclei.

In present study at (PMI)- 22hrs25mins (T 21.2/28.6 0C) in renal artery, tunica intima was widely retracted from basement membrane and endothelial cells were hardly seen . In tunica media clear spaces between smooth muscle fibres and broken fibres were seen at most of the places with pyknotic nuclei. Tunica adventitia was retracted from tunica media at places, disruption of collagen fibres and pyknotic nuclei were seen .

In renal vein, tunica intima was disrupted at places and endothelial cells hardly visible. In tunica media architecture was disturbed with clear spaces were seen between smooth muscle fibres which were also broken at most of places having pyknotic nuclei . In tunica adventitia severe loss of adventitial tissue was seen with unclear cell outline. Clear spaces between smooth muscle fibres at most of places with some pyknotic nuclei were seen.

SUMMARY AND CONCLUSION

In this study increase in the rate of postmortem histological sequential changes were found to be increased with rise in the temperature and duration.

In the present study earliest remarkable sequential postmortem histological changes were seen after PMI 4hrs 30 mins (T 23.9/33.4 0C) in tunica adventitia of renal vein. In the present study following sequential postmortem histological changes of renal vessels were seen.

Retraction of epithelium from basement membrane and its disruption with darkening of nuclei of endothelial cell and loss of endothelial cells were observed in tunica intima of renal vessels.

Appearance of clear spaces between smooth muscle fibers, broken smooth muscle fibers, nuclear pyknosis, karyorrhexis and loss of architecture were observed in tunica media of renal vessels

Various degree of loss of adventitial tissue (i.e. mild, moderate ,moderate to severe , severe) and disruption of collagen fibers with loss of architecture were observed in tunica adventitia of renal vessels.

Appearance of clear spaces between smooth muscle fibres, broken smooth muscle fibres, nuclear pyknosis, karyorrhexis and loss of architecture were observed in tunica media of renal vessels

Various degree of loss of adventitial tissue (i.e. mild, moderate ,moderate to severe , severe) and disruption of collagen fibres with loss of architecture were observed in tunica adventitia of renal vessels. 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 changes were found to be irregular in some cases. In the present study it was observed that sequential postmortem histological changes were different in some cases of same duration.

The main reason lies in the fact that there are an extreme number of factors, which influence the post-mortem degradation of tissue in each case.

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