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A Study on Microscopic Vascular Anatomy by Luminal Cast Plastination of Renal Blood Vessels Using Epoxy Resin In Bulls Kidney.

Dr. S. Angelie Jessica, BDS, MSc, **Dr. R. Mukilan,** BDS, MSc, PhD,

Assistant Professors, Department of Physiology, CSI College of Dental Sciences and Research, Madurai.

Abstract:

In teaching anatomy for medical students plastination is a newer technique which paves the way for the preservation of biological specimens. The luminal corrosion cast of renal blood vessels using epoxy resin provides a clear understanding of the ultra vascular architect pattern of the kidney. The epoxy resin was injected into the renal artery of the bovine kidney. Once the resin was set, the soft tissues of the organ were macerated using a potassium hydroxide solution. Scanning electron microscopic study was done from the cast. The glomerular capillary, the morphology of afferent and efferent arteriole, the peritubular branching pattern and vasa recta were studied from the plastinated specimen. The vascular pattern of the human kidney is well known. It was observed that several similarities were present between the bovine cast plastinate pattern and human vascular arrangement. Therefore these type of cast plastinates gives a clear three-dimensional view of the microvascular arrangement of human organs and serves as an excellent teaching model for the students which may aid in better understanding.

Keywords: Luminal Plastination, Renal vasculature, Scanning Electron Microscope, Glomerulus.

INTRODUCTION:

The circulatory anatomy of renal blood vessels and its architecture are sequentially as artery, arteriole, glomerulus, peritubular capillaries ,vasa recta and continues as venules. Such complex arrangement can be studied both macroscopically and microscopically through luminal cast plastination. It is a process of injecting epoxy resin into the blood vessels of a whole animal or of an organ, once it is hardened the overlying tissues are macerated by immersing into the potassium hydroxide solution, finally a three dimensional cast of luminal structure of vessels are produced. The flow of resin into small capillaries provides anatomy model that exposes the microscopy level of the internal structures.

The luminal cast plastination is an in expensive method, which provides anatomical model at microscopic level. The luminal plastinates from the whole species or specific organ of bull or sheep or small animals will enlighten the knowledge of comparative anatomy, such model provide the student in learning anatomy in dissection/ microscopic studies and it also enlightens the researchers with its importance in therapeutic drug testing in animal model. Scanning electron microscopy (SEM) aid in microscopic examination of the plastinates of vascular corrosion cast (1,2,3,4).

MATERIALS AND METHOD:

For pre casting the cannula was inserted into the renal artery of fresh kidney and sutured the cannula with the vessel will restrict the slippage during perfusion. The blood is removed from the renal vessels with a saline solution before injection of resin, so that every fine detail of the vessel wall and valve structures can be casted. (5,6).

The resin was prepared by adding the catalyst to the monomer to initiate the polymerization. The mixture is taken in a separate syringe and connected to the canula. The resin is perfused with constant injection pressure to avoid blockage or rupture of small capillaries. The specimen is left in room temperature for 1 hour for polymerization and to harden the resin (7). After complete polymerization the surrounding tissues are macerated by potassium hydroxide solution. Several changes of mascerating solution may be required depending upon the size of the overlying tissue. After masceration the cast plastinates are washed with distilled water and air dried.

Using traditional light microscopy, basic examination of the cast structures such as lobar, lobular, arcuate arteries are examined. The ultra microscopic structures like renal capillaries are examined through scanning electron microscope. The specific study area was identified, taken and fitted in aluminium SEM conductive bridges are made to attach the cast to the foil sheets. Spater coating is done with gold over the cast surface for interaction with electron beam to achieve adequate imaging (8) , and gave an idea about the use of scanning electron microscope in in microscopic examination of cast.

In 1935 schummer et al made extensive research on corrosion cast on circulatory system for studying both macro and microscopically using low viscosity plastic type material (9).

These luminal cast plastinates will provide the medical and vertinary student in learning the anatomy in detail, through the virtually realistic specimens. In specific these model can alivate various ethical concerns in teaching (10)

RESULT:

SEM examination of renal capillaries

The vascular pattern of kidney is highly specialized where the plasma is filtered in the glomerular portion of nephron, in various portion of renal tubules reabsorption and secretion takes place.

Each afferent arteriole takes blood to a single nephron ,the afferent arteriole forms an interaction with the cup shaped portion of nephron (Bowman's capsule).When the

arteriole breaks extensively into tuft of capillaries called glomerular capillaries. The diameter of an efferent arteriole is smaller than the afferent as the efferent arteriole takes away the blood from the glomerulus. Because of its smaller size , some resistance is created to the blood flow, this back flow of blood to the glomerulus increases pressure in the cavity (11).

The efferent arteriole of cortical nephron forms a network of capillaries around the tubular portions of the nephrons called as peritubular capillaries (12). Whereas in the juxta medullary nephron the efferent arteriole descends as straight arteriole into the medulla forming capillary network , These capillaries bend like hair pin shaped arrangement called vasarecta.

DISCUSSION:

In human tough the size of the kidney is smaller than the brain, it receives 25% of cardiac output. Thus the kidney plays a major role in removal of waste products in maintaining the water and electrolyte balance (13). The students should have a clear understanding while learning the functional anatomy of kidney.

The luminal cast plastinates will provide clear understanding on micro structures of kidney. Examination of such specimen under the scanning electron microscope reveals the three dimensional picture of ultra structure of renal blood vessels. Through this corrosion cast circulatory anatomy of specific organ or whole specimen can be easily under stood.

CONCLUSION:

Low viscosity resin can easily flow into the micro configuration of hollow organs such as lungs, heart, kidney, liver etc. From both cadaveric and fresh specimens. Future studies can be done renal veins and in renal tubules of fresh mammalian specimens and from the unembalmed cadaver. Plastinated specimens are excellent model for museum display, teaching aid which enables the students to observe and understand the three dimensional architect of hollow organs.

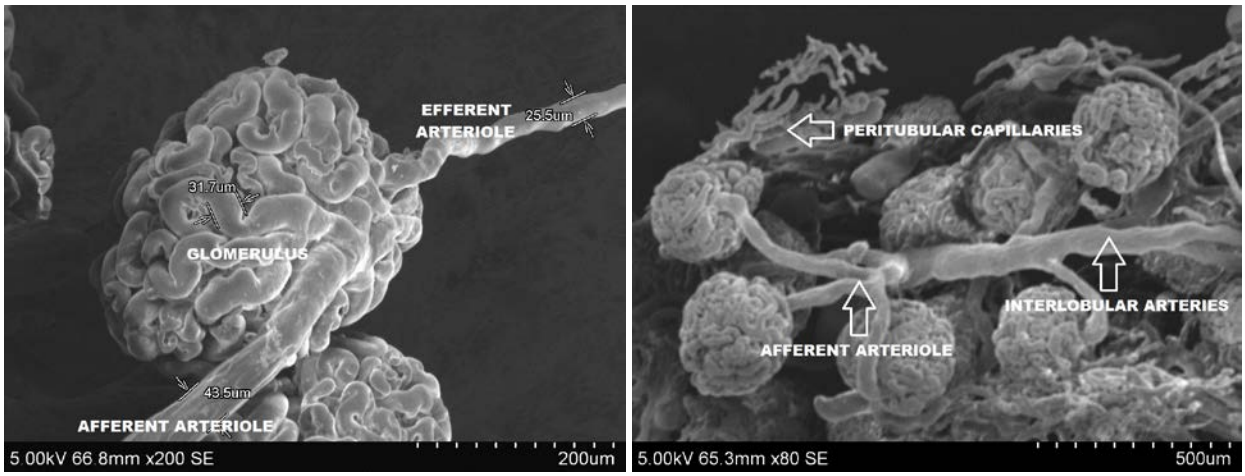

Fig no: 1 & 2 shows the afferent arteriole branching from the interlobar artery to form glomeruli. The diameter of the afferent arteriole is larger than the efferent arteriole.

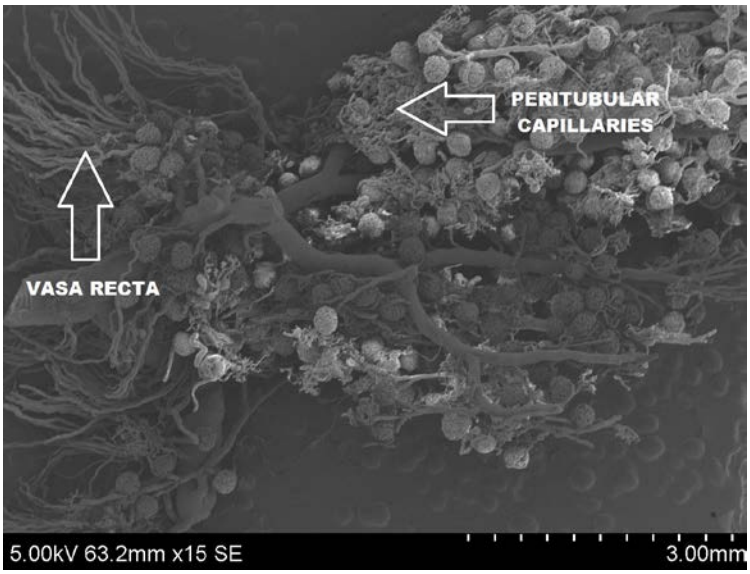

Fig .no 3 shows the efferent arteriole of cortical nephron forming mesh of capillaries (peritubular) from the juxtamedullary nephron efferent arteriole form the straight arteriole called as vasarecta (SA).

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REFERENCES:

1. Giuvarasteanu I. Scanning electron microscopy of vascular corrosion casts-standard method for studying microvessels. Romanian Journal of Morphology and Embryology. 2007;48:257-261.
2. Meyer EP, Beer GM, Lang A, Manestar M, Krucker T, Meier S, Mihic-Probst D, Groscurth P. Polyurethane elastomer: A new material for the visualization of cadaveric blood vessels. Clinical Anatomy. 2007;20:448-454.
3. Gassner J, Lametschwandtner A,Weiger T, Bauer HC. Diluted and undiluted Mercox severely destroy unfixed endothelial cells. A light and electron microscopic study using cultured endothelial cells and tadpole tail fin vessels. Scanning Microscopy. 1994;8:721-732.
4. Jedrzejewski KS, Cendrowska I, Okraszewska E. Evaluation of several methods used in anatomical investigations of the blood and lymphatic vessels. Folia Morphologica (Warsz.) 2002;61:63-69.
5. Aharinejad SH, Lametschwandtner A. Producing optimal microvascular corrosion casts a practical guide. Microvascular Corrosion Casting in Scanning Electron Microscopy. Springer Vienna**.** 1992;52-102.
6. Verli FD, Rossi-Schneider TS, Schneider FL, Yurgel LS, Lopes DE Souza MA. Vascular corrosion casting technique steps. Scanning. 2007;29:128-132.
7. Krucker T, Lang A, Meyers EP. New polyurethane-based material for vascular corrosion casting with improved physical and imaging characteristics. Microscopy Research and Technique 2006:69:138-147.
8. Lametschwantner A, Miodonski A, Simonsberger P. On the prevention of specimen charging in scanning electron microscopy of vascular corrosion casts by attaching conductive bridges. Mikroskopie. 1980;36:270-273.
9. Schummer A. Ein neues Mittel ("Plastoid") und Verfahren zur Herstellung corrosions-anatomischer Praparate. Anatomischer Anzeiger Jena. 1935;81:177-201.
10. Menaka R, Kelawala, NH and Vyas KN (2015). Plastination technique represents a life in biological specimens–An overview. Veterinary Research International, 3(2): 20- 23.
11. Kriz, W., Bankir, L., *1988*. A standard nomenclature for structures of the kidney. Am. J.phisiol. 254,F1–*F8*.
12. Koushanpour, kriz w: Renal physiology: Principles, structure and Function, 2nd edition, New York, Springer – Verlag, 1986.
13. Eaton, Douglas C., Pooler, John P. (2004). Vander's Renal Physiology (8th ed.). Lange Medical Books/McGraw-Hill. ISBN 0-07-135728-9.