International Journal of Anatomy and Research,
Int J Anat Res 2015, Vol 3(4):1551-54. ISSN 2321- 4287
DOI: http://dx.doi.org/10.16965/ijar.2015.278

Original Research Article

VARIATIONS OF MIDDLE SEGMENTAL ARTERY OF HUMAN KIDNEY AND CLINICAL SIGNIFICANCE

Gyan Prakash Mishra *[1], Mirza R.U. Beg [2], Shobha Bhatnagar [3], Brijendra Singh [4].

[1] Associate Professor, Department of Anatomy, Career Institute of Medical Sciences and Hospital, Ghaila, Lucknow, U.P, India.

[2] Associate Professor, Department of Anatomy, Major SD Singh Medical College, Farrukhabad, U.P. India.

[3] Professor, Department of Anatomy, Career Institute of Medical Sciences and Hospital, Ghaila, Lucknow, U.P, India.

[4] Additional Professor, Department of Anatomy, AIIMS, Jodhpur, India.

ABSTRACT

Aim: To assess the arterial pattern of middle segmental artery and its relation with collecting system in the human kidneys.

Materials and Methods: We studied 50 fresh human Kidneys by corrosion cast techniques. We used different colour coded moulding granules of butyl butyrate, red for artery, blue for vein and black for collecting system of the human kidneys. 20% solution of butyl butyrate in acetone was injected into renal vessels and ureter of each kidney. Injected kidneys were kept immersed in concentrated Potassium Hydroxide solution for corrosion to obtain the endocasts. These endocasts were cleaned under the running tap water and observed macroscopically.

Results: We observed three types of variations in arterial pattern of middle segmental artery namely Middle Segmental Artery Type-1 (MSAT1), Middle Segmental Artery Type-2 (MSAT2), Middle Segmental Artery Type-3 (MSAT3) and they were seen in 29(58%), 14(28%), 6(12%) kidneys respectively. We also observed three different variations in relation between middle segmental artery and collecting system namely Middle Segmental Artery Group-1 (MSAG1), Middle Segmental Artery Group-2 (MSAG2), Middle Segmental Artery Group-3 (MSAG3) and they were seen in 32%, 24%, 42% kidneys respectively.

Conclusion: Anatomical knowledge of these variations is of valuable contribution for uro-surgeon in performing more and more conservative renal surgeries which lead to preservation of healthy and functional renal parenchyma and prevent intraoperative and post-operative complications.

KEY WORDS: Kidney, Middle Segmental Artery, Collecting System, Variations, Corrosion Cast, Conservative Renal Surgeries.

Address for Correspondence: Dr. Gyan Prakash Mishra, 317, Shiv Vihar Colony, Near Divyata Palace, Sector-I, Jankipuram, Lucknow, U.P, 226021, India.
E-Mail: gyanprakash.mishra88@gmail.com

Access this Article online

Quick Response code

DOI: 10.16965/ijar.2015.278

Web site: International Journal of Anatomy and Research
ISSN 2321-4287
www.ijmhr.org/ijar.htm

Received: 20 Sep 2015 Accepted: 13 Oct 2015
Peer Review: 20 Sep 2015 Published (O): 30 Nov 2015
Revised: None Published (P): 31 Dec 2015

INTRODUCTION

Kidneys are chief excretory organs in the human body and eliminate nitrogenous waste products produced during metabolic activities via urine. In the kidney urine passes through minute ducts called as collecting system of nephrons. This

collecting duct system is very closely related with the segmental renal arteries. Objective of the present study is to investigate the variations in arterial pattern of middle segmental artery and its anatomical relations with collecting system of human kidneys. Graves [1] laid the foundation of segmental pattern of intrarenal arterial distribution and its variation. He divided the renal parenchyma into five segments that were apical, upper, middle, lower and posterior. Kher [2] observed that anterior division gives origin to apical segmental artery first and then to upper, middle and lower segmental arteries. Ajmani [3] and Longia [4] studied the intrarenal arterial pattern of Kidney by corrosion cast method and found variations in arterial pattern of segmental arteries. Anatomical knowledge about branching and relations of intra-renal arteries is important for performing intra-renal surgeries with minimal blood loss and minimal injury to adjacent parenchyma [5].

MATERIALS AND METHODS

Corrosion cast techniques were used to study the detailed anatomy of middle segmental artery of human kidneys. We obtained 50 human kidneys for our study from the mortuary, within 24 hours of death. A solution containing 20 gram moulding granules of butyl butyrate dissolved in 100 ml acetone was injected into the renal vessels and ureter of each kidney. Injected kidneys were kept immersed in 10% formal saline for polymerization for a day. Next day these kidneys were transferred into concentrated Potassium Hydroxide solution for corrosion, so that endocasts can be obtained. Endocasts were cleaned under the running tap water and small branches of renal arteries were pruned out to observe the arterial pattern of middle segmental artery and its relation with collecting system.

RESULTS

Anatomical variations of middle segmental artery were studied in 50 human kidneys by corrosion cast techniques. Middle segmental artery was present and observed in 49(98%) kidneys and it was absent in 1(2%) Kidneys. We investigated the arterial pattern of middle segmental artery and observed three types of variations namely Middle Segmental Artery Type-1 (MSAT1), Middle Segmental Artery Type-2 (MSAT2) and Middle Segmental Artery Type-3 (MSAT3). MSAT1 arose from anterior division of renal artery and seen in 29 (58%) kidneys (figure 1). Out of these in 6(12%) kidneys the origin of the artery was extra renal, in 18(36%) kidneys intra renal and in 5(10%) kidneys within the hilum of the kidney. MSAT2 arose with upper segmental artery and seen in 14(28%) Kidneys (Figure 2). Out of these in 10(20%) Kidneys the origin was intrarenal and in 4(8%) kidneys at hilum. MSAT3 arose with lower segmental artery and seen in 6(12%) kidneys (Figure 3). Out of these in 5(10%) kidneys the origin was intrarenal and in 1(2%) kidney at the hilum. We also observed variations in the relation between middle segmental artery and collecting system of the kidney. These variations have been divided into three groups namely Middle Segmental Artery Group-1 (MSAG1), Middle Segmental Artery Group-2 (MSAG2) and Middle Segmental Artery Group-3 (MSAG3). MSAG1 ran infront and lower half of pelvis. It was seen in 16(32%) kidneys (Figure 2). MSAG2 ran infront and middle of pelvis. It was seen in 12(24%) kidneys (Figure 1). MSAG3 ran infront and upper half of pelvis. It was seen in 21(42%) Kidneys (Figure 4).

Fig. 1: Anterior view showing Middle Segmental Artery Type-1 (MSAT1) and Middle Segmental Artery Group-2 (MSAG2). A-Renal Artery, B-Anterior Division, C-Middle Segmental Artery, D-Upper Segmental Artery, E-Ureter, F- Pelvis, G- Upper Major Calyx, J-Lower Segmental Artery.

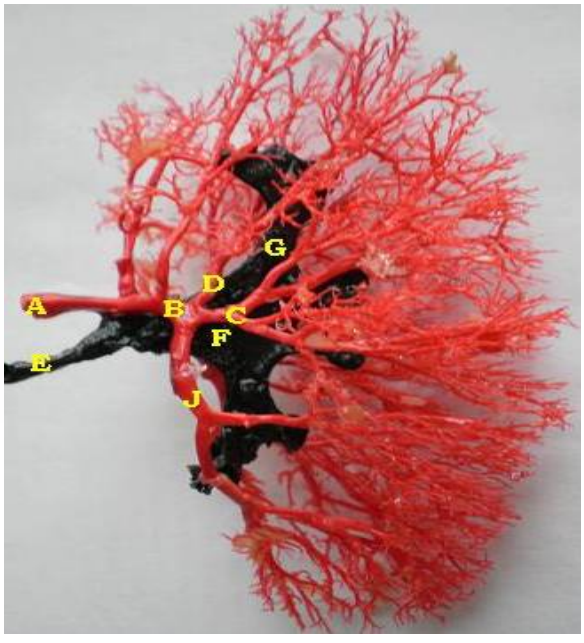


Fig. 2: Anterior view showing Middle Segmental Artery Type-2 (MSAT2) and Middle Segmental Artery Group-1 (MSAG1). A-Renal Artery, C-Middle Segmental Artery, D-Upper Segmental Artery, E-Ureter, F- Pelvis, I- Renal Vein.

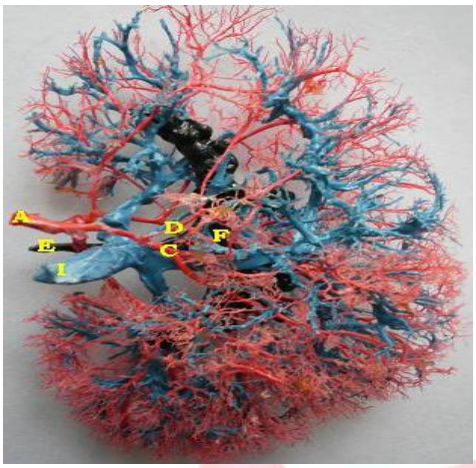


Fig. 3: Anterior view showing Middle Segmental Artery Type-3 (MSAT3). A-Renal Artery, B-Anterior Division, C-Middle Segmental Artery, E-Ureter, J-Lower Segmental Artery.

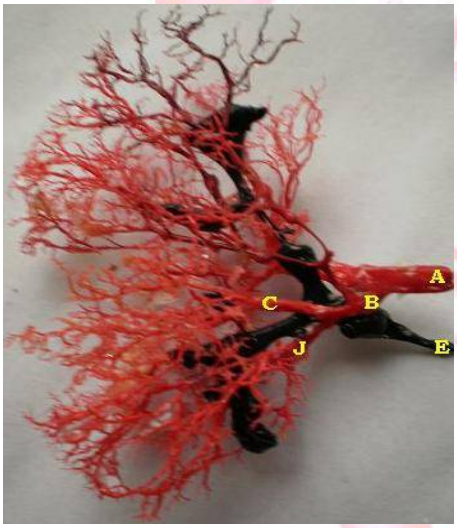
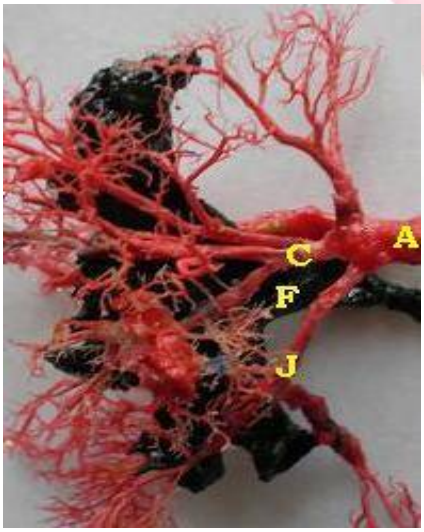


Fig. 4: Anterior view showing Middle Segmental Artery Group-3 (MSAG3). A-Renal Artery, C-Middle Segmental Artery, F- Pelvis, J-Lower Segmental Artery.



DISCUSSION

Variations in arterial pattern of middle segmental artery have been reported by other authors. In our study we also found variations in its arterial pattern. We compared our finding with past studies by other authors [6-9] shown in Table 1. We also found three different variations in relation between middle segmental artery and collecting system namely MSAG1, MSAG2, MSAG3 and they were found in 32%, 24%, 42% kidneys respectively. It is to be noted that the arterial pattern of middle segmental artery and its variations has already been reported previously by other authors (tabulated in table 1) but the relation of middle segmental artery with collecting system has not yet been reported and our present study is the foremost to do so. A very serious and troublesome complication of endoscopic intra-renal operations is bleeding from an injured vessel and damage to collecting ducts of kidneys. To diminish the risk of such injury, the surgeon must know and recall the spatial positions of the intra-renal vascular structures and their anatomical relations with the collecting system [10]. The knowledge of these anatomical relations and variations are very useful for uro-surgeon for performing nephrectomies, removal of calculi or other various intrarenal surgeries with minimal complications.

Table 1: Comparative study on arterial pattern of middle segmental artery. Middle Segmental Artery Type -1(MSAT1), Middle Segmental Artery Type -2 (MSAT2), Middle Segmental Artery Type -3 (MSAT3).

Types	Verma et al 1961 [6]	V.P. Raghavendra et al 2007 [8]	Rani Neerja et al 2014 [9]	Present study 2015
MSAT 1	72%	55%	50%	58%
MSAT 2	8%	13.33%		28%
MSAT 3	4%	28.33%	50%	12%

CONCLUSION

The precise knowledge of arterial pattern of middle segmental artery and its relation with collecting system is of valuable contribution for surgeon in performing more and more conservative renal surgeries like partial and segmental resection of renal tissue instead of going for radical nephrectomy which may cause extensive damage and can also lead to intraoperative and post-operative complications like

bleeding. These conservative methods can thus lead to preservation of healthy and functional renal parenchyma. Moreover it is of valuable contribution of development of new and different techniques for removal of renal calculi, surgery for renal masses and renal trauma management.

Conflicts of Interests: None

REFERENCES

[1]. Graves F.T. The anatomy of intrarenal arteries and its application to segmental resection of the Kidneys. Br J Surg. 1952;42:132-140.

[2]. Kher G.A, Indra Bhargava and Makhni F.S. Intrarenal branching of the renal artery. Ind. J. of Surg. 1960;22:563-579.

[3]. Ajmani M.L. and Ajmani K. To study the intrarenal vascular segments of human Kidney by corrosion cast technique. Anat Anz, 1983;154(4):293-303.

[4]. Longia G.S, Kumar V and Gupta C.D. Intrarenal arterial pattern of human Kidneys-corrosion cast study. Anat Anz, 1984;155:183-194.

[5]. Novick, A.C. Partial nephrectomy for renal cell carcinoma. Urol Clin North Am 1987;14:419.

[6]. Verma Mahesh, Chaturvedi RP, Pathak RK. Anatomy of renal vascular segments J of Anat Soc of Ind. 1961;10:12-9.

[7]. Verma Mahesh, Chaturvedi RP. Buteryate acetate and alkathene for renal casting. J of Anat Soc of Ind 1961;10:34-7.

[8]. V.P. Raghavendra. A study on intrarenal arterial segmental patterns of human Kidney and its variations. Thesis, Department of Anatomy, Rajiv Gandhi University of Health Sciences, Karnataka 2007. Available from: https://sites.google.com/site/anatomyrguhsthesis.

[9]. Rani Neerja, Singh Seema, Dhar Pushpa, Kumar Rani. Surgical importance of arterial segments of human Kidneys: An Angiography and corrosion cast study. Journal of Clinical and Diagnostic Research. 2014;8(3):1-3.

[10]. Francisco J.B. Sampaio. Anatomic background for intra renal endourologic surgery. Journal of Endourology 1992;6(5):3-4.

How to cite this article:

Gyan Prakash Mishra, Mirza R.U. Beg, Shobha Bhatnagar, Brijendra Singh. VARIATIONS OF MIDDLE SEGMENTAL ARTERY OF HUMAN KIDNEY AND CLINICAL SIGNIFICANCE. Int J Anat Res 2015;3(4):1551-1554. **DOI:** 10.16965/ijar.2015.278