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## **A STUDY OF MIDDLE SUPRARENAL ARTERY IN 30 ADULT HUMAN CADAVERS – CLINICAL IMPLICATIONS**

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### **ABSTRACT**

Variations in arterial anatomy of suprarenal gland are significant for radiological and surgical interventions. Knowledge of anomalous suprarenal artery is required to avoid complications in surgical procedures. The present study was undertaken on 30 human cadavers to study the mode of origin, vertebral level, variations and the clinical implications thereof. Present study findings suggest, thorough knowledge of anomalous arterial supply of suprarenal gland is required for surgical and radiological interventions of retroperitoneal organs of upper abdomen to avoid complications.

**Key Words:** *Suprarenal Gland, Middle Suprarenal Artery, Anomalous, Haemorrhage*

### **INTRODUCTION**

The knowledge of commonest pattern of arterial supply of abdomen and the deviants thereof is mandatory in various diagnostic, interventional and surgical procedures. A faulty interpretation may be made in angiographic procedures in the presence of variants or there may be a possibility of a troublesome and dangerous haemorrhage that otherwise could be averted in the light of knowledge of larger arterial trunks with their exact anatomy. Anomalous blood vessels are always interesting from a purely scientific point of view, especially since they so often shed light on obscure problems of phylogeny and ontogeny. They may also be of considerable significance from a clinical or a surgical standpoint (Dawson and Reis, 1922). In view of the clinical application of the variations, the present study was conducted on 30 adults human cadavers. Suprarenal arteries may arise from the renal arteries close to the kidney where they may be traumatised or clamped in nephrectomy or nephrotomy or even during mobilization, decapsulation or denervation (Pick and Anson, 1941). The functional and clinical implication to the findings are discussed. They (suprarenalis media) arise, usually one, two or three on each side, from the aorta. Most frequently, they arise above the renal level, but they may also arise below the renal arteries. Other sources may be the coeliac trunk or the inferior phrenic arteries. When arising from the aorta, they may occur ventrally, laterally, or from the dorsal side of the aorta. The middle suprarenal arteries course obliquely upward from their source, across the crura of the diaphragm to reach the suprarenal gland (Anson, 1966). The variations of the arteries that develop from the mesonephric arteries – including renal, gonadal and suprarenal arteries – are common. Understanding the anatomy of the vascular variations of this region is essential for the clinicians to perform procedures such as renal transplantation, interventional radiologic procedures and renal vascular operations more safely and efficiently.

### **MATERIALS AND METHODS**

The material for this study comprised of 30 well embalmed adult human cadavers of known sex obtained from the Department of Anatomy, Govt. Medical College, Amritsar. They were serialized from 1-30 with suffix 'M' for male and 'F' for female.

The abdominal cavity was opened by a cruciform incision passing through the whole thickness of the anterior abdominal wall. Flaps were reflected. The abdominal viscera i.e. stomach, intestines liver, pancreas and spleen were systematically removed according to Cunningham's Manual of Practical Anatomy (Romanes, 2000).

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The abdominal aorta was cleaned along its whole length and the origin of various branches was traced. Then fat and fascia from the anterior surface of the kidney and suprarenal gland was removed thus exposing the renal arteries. The crus of the diaphragm with the inferior phrenic artery was traced and cleaned. The middle suprarenal artery were subsequently traced and studied with respect to the following parameters.

1. Number of arteries
2. Mode of origin of each suprarenal artery.
3. Vertebral level of each middle suprarenal artery.
4. Any variation.

**RESULTS**

Suprarenal arteries are developmentally part of a richly plexiform network of channels, so adult variation in their arrangement is to be expected (Anson et al 1947).

Out of 28 cases (93.4%) in which middle suprarenal arteries were present, it was bilateral in 18 cases (59.4%); in the rest of the 10 cases (30.0%) the artery was unilateral i.e., present on the right side only in 4 cases (13.2%) and on the left side only in 6 cases (19.8%)

**Table 1: Comparison (side wise) of the incidence of middle suprarenal artery**

Author	Total No. of cases	Middle suprarenal artery			Bilateral		Unilateral			
		Absent	Present		No. of cases	%age	Right		Left	
			No. of cases	%age			No. of cases	% age	No. of cases	% age
Cauldwell and Anson (1936)	184	32	152	82.2	102	55.4	32	17.4	18	9.2
Present study (2011)	30	2	28	93.4	18	60.0	4	13.4	6	20.0

**Number**

It is usually a single vessel on each side (85%) and predominantly is distributed to the anteromedial surface of the gland which it reaches by passing through or behind the coeliac ganglion. The number of suprarenal arteries varied between 0 to 3. Out of the 26 cases the artery was single in 23 cases (88.4%) and multiple i.e. 3 in number in 3 cases (12.6%) – in 2 cases (8.2%) on the right side and in 1 case (4.4%) on the left side.

**Origin:**

**Source:**

The incidence of source of origin of middle suprarenal artery in 30 cases compared with Merklin and Michels (1958) were somewhat different.

**Table 2 Comparison (side-wise) of the source of origin of middle suprarenal artery**

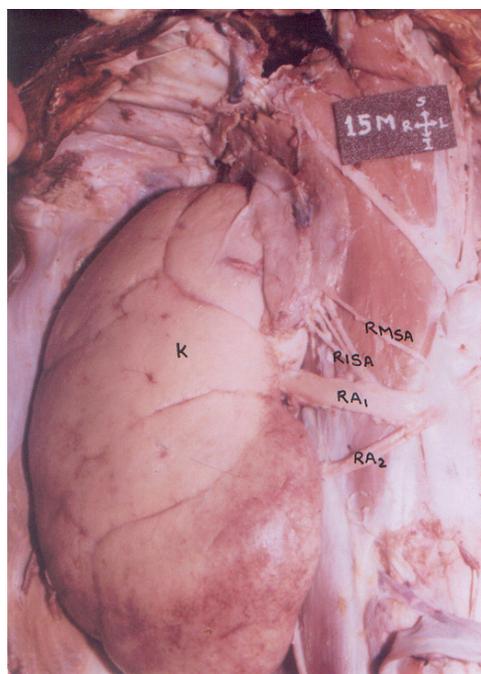
Author (year)	No. of dissections	Presence of artery	Inferior phrenic artery			Aorta			Renal artery			Coeliac trunk		
			R	L	%	R	L	%	R	L	%	R	L	%
Merklin and Michels (1958)	50 (25 cases)	40 (80.0%)	4	6	20.0	12	12	48.0	2	2	8.0	1	1	4.0
Present study (2011)	60 (30 cases)	46 (76.6%)	2	4	10.0	14	17	51.6	6	3	15.0	-	-	-

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The disparity in the percentages of origin of the artery is explainable on the developmental basis as given by Bremer (1915) who emphasized that the arteries are formed from a periaortic network having many connections with the aorta. This plexus unites the dorsal segmental, mesonephric and ventral arteries, the axial branch forms the inferior phrenic, the inferior branch forms the renal artery, while middle persists as middle suprarenal artery. He further stressed that blockage in the usual course of the artery results in the variations.

### **VERTEBRAL LEVEL**

The level of origin of the suprarenal arteries is highly variable (Cauldwell and Anson, 1936). The vertebral level of origin of the artery in the present study ranged from the body of L<sub>1</sub> to the upper 1/3<sup>rd</sup> of L<sub>2</sub> vertebra. In a maximum number of cases (26 i.e. 86.6%) it was opposite the lower 1/3<sup>rd</sup> of L<sub>1</sub> vertebra just above the renal arteries.



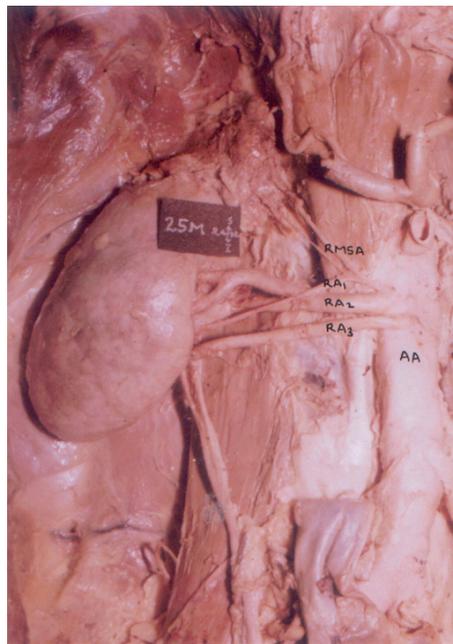
**Figure 1: Normal origin of right middle suprarenal artery from abdominal aorta.**

### **DISCUSSION**

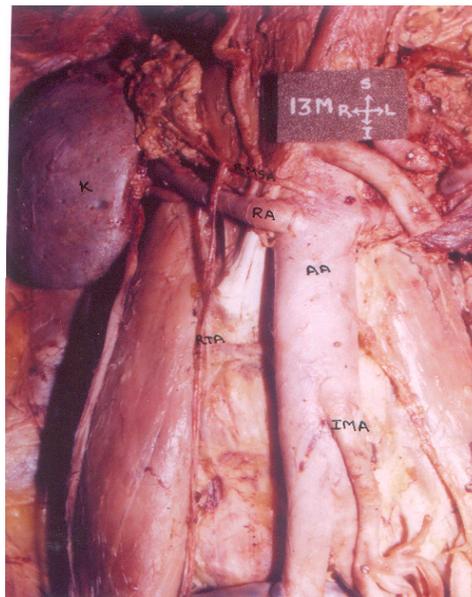
In anatomy, normality embraces a range of morphologies. It includes those that are most common and others called variations which are less frequent but not considered abnormal. Variations ranging from subtle to remarkable affect every part of the human body. They may have important influences on predisposition to illness, symptomatology, clinical examination, investigation and patient management including operative surgery. Recognition of variations enables clinicians to distinguish features which merit further investigations or treatment from those which do not (Willan and Humpherson, 1999).

Merklin and Michels (1958) in their extensive study on middle suprarenal artery concluded that it arises more frequently from the aorta, but may take origin from the proximal part of inferior phrenic artery, from the first part of renal artery, from an aortic superior polar artery or from the coeliac trunk.

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**Figure 2: Superior renal artery (RA<sub>1</sub>) taking origin in common with right middle suprarenal artery (RMSA)**



**Figure 3: Right middle suprarenal artery giving origin to right testicular artery.**

Manso and DiDio (2000) performed an exhaustive study on the suprarenal arteries and concluded that middle suprarenal arteries appeared in only 93.3% cases with varying origin from aorta or inferior phrenic artery.

The origin of the middle suprarenal arteries from the trunk of the inferior phrenic artery on both sides ( $26.7\% \pm 8.1$  on the right and  $36.7\% \pm 8.8$  on the left) should be considered relevant. The anatomical findings warrant a further investigation for the identification, illustration and nomenclature of arterial anatomicosurgical segments.

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