

The Mystery Around Suprarenal Gland - Dispelled!

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Abstract: The anatomy of the adrenal glands was described almost 450 years ago by Bartholomeo Eustacius¹ and the zonation of the gland elucidated shortly thereafter. Many interesting features of suprarenal gland have generated keen interest in its structure and blood supply. Suprarenal glands are among the most vascular organs in the body. Thorough knowledge of variations in vessels of suprarenal gland is essential for correct approach and proper homeostasis during any surgery on or around the glands.

The present study was undertaken to investigate the source of origin and number of arteries supplying the suprarenal gland and also mode of termination of suprarenal veins – its length and relation to inferior venacava, renal vein and gonadal veins. Along with the normal pattern, a few variations in the origin of the superior, middle and inferior suprarenal arteries were also found. Multiplicity in the origin of superior, middle and inferior suprarenal arteries had attracted our special attention^{2,3}. This study also revealed quite a few cases where, the number of veins on the right and left are double and in some even multiple, though all of them drain into inferior venacava. Mode of termination of left suprarenal vein into the renal vein as well as into the inferior venacava is also noted.

Keywords: Suprarenal gland, Arterial supply, Venous drainage, Variations.

I. Introduction

Any research on anatomical variations is of great significance to an Anatomist and more so to a Surgeon. These variations would add to the existing knowledge of an anatomist, but for a surgeon it comes in handy on table to avoid intra-op and also post-op complications. Any surgical procedure in or around Suprarenal gland is very precarious due to its size. The commonest complication which leaves a surgeon in shambles is intra-op or post-op bleeding. Many think a proper knowledge of the anatomy is enough, but not with Suprarenal gland, where its anatomy is constantly changing.

II. Aim And Objective

Aim of the study was to assess the frequency of variations in arterial supply and venous drainage of suprarenal gland of adult and fetal cadavers. Thorough knowledge of variations in vessels of suprarenal gland is essential for correct approach and proper homeostasis during any surgery on or around the glands.

III. Materials And Methods

The Cadavers for this study were those used in undergraduate dissection in the Department of Anatomy, SVS Medical College, Mahbubnagar, Telangana State. All the Cadavers that were put up for the students to dissect were used, but whenever the abdominal dissection was about to start, care was taken to do a direct dissection on the structures being studied by the same researcher. A total of 30 adult and 50 fetal cadavers were dissected and meticulously studied to observe the arterial supply and venous drainage of the Suprarenal gland in the following method.

In adult cadavers: Anterior abdominal wall was studied after taking the transverse incision at T9 and L3 level. Peritoneum was opened and reflected and specimens were collected after removal of stomach, duodenum, small and large intestine up to sigmoid colon, liver, pancreas and spleen.

For an en block separation two transverse incisions were given. The first was given above the upper pole of kidney posterior to xiphoid process – separating the diaphragm from it. The second incision was below the lower pole. Both incisions passed transversely through the superior and inferior vena cavae respectively and also the aorta. Fibres of the diaphragm separated from ribs and bodies of vertebra. Diaphragm, suprarenal gland and kidney along with inferior venacava and aorta are removed en block –and preserved in 5% formalin.

In fetal cadavers: A mid line incision was given, starting from symphysis menti upto the pubic symphysis. Followed by two horizontal incisions, one at the level of xiphoid process and another at the level of iliac crest to expose the viscera of thorax, abdomen and pelvis. The specimen was, soaked in glycerine to give a glossy sheen and an instant adhesive solution was applied to maintain firmness in the blood vessels to

the suprarenal arteries and allowed to dry. Then the arteries and veins of the suprarenal gland were explored, photographs were taken using a Canon SLR camera.

IV. Observation & Results

Arteries

For the present study 75 specimens were used viz, 50 foetuses and 25 adult cadavers. detailed study of vasculature of suprarenal glands along with the origin, course, branching pattern and point of entry into the gland were tabulated accordingly.

Abbreviations used:

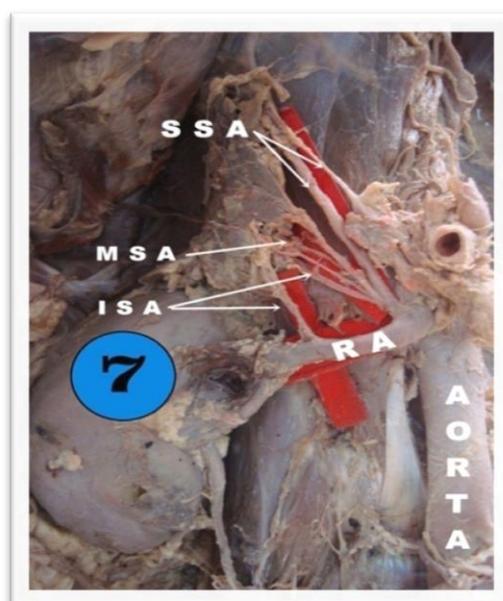
S.S.A - Superior suprarenal artery, M.S.A - Middle suprarenal artery, I.S.A - Inferior suprarenal artery

I.P.A - Inferior phrenic artery, I.V.C - Inferior venacava, R.A - Renal artery, S.P.A - Superior polar (renal) artery

I P V – Inferior phrenic vein, L R V – Left renal vein.

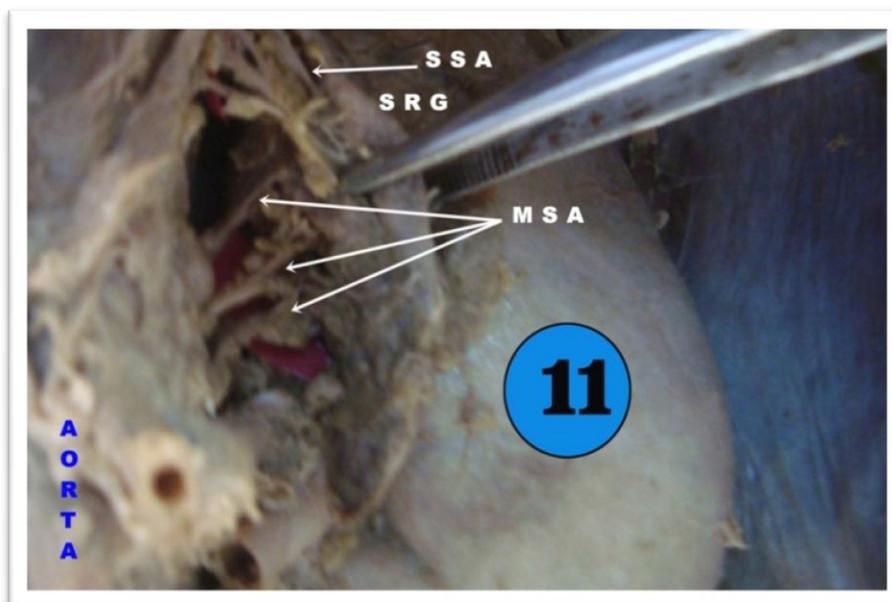
Findings In Specimen 7

Specimen	Site of origin	Course of artery	No: of branches	Remarks
RIGHT SIDE				
S.S.A	From the junction between renal artery and aorta, And from I.P.A.	Upwards and laterally	2	Two superior suprarenal arteries
M.S.A	From the junction between the renal artery and aorta along with the S.S.A	Upwards and laterally	3	Four middle suprarenal arteries
I.S.A	From the renal artery	Upwards and laterally	3	
LEFT SIDE				
S.S.A	From I.P.A	Upwards	11	Numerous branches of superior suprarenal artery
M.S.A	From aorta	Straight laterally		
I.S.A	From the renal artery	Upwards		



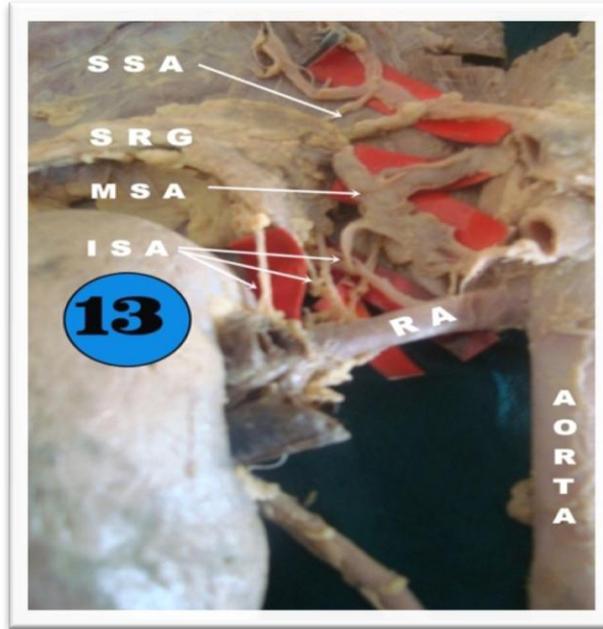
Findings In Specimen 11

Specimen	Site of origin	Course of artery	No: of branches	Remarks
RIGHT SIDE				
S.S.A	From I.P.A and from aorta along with M.S.A	Upwards and laterally	5	Two superior suprarenal
M.S.A	From aorta along with the S.S.A	Straight laterally		
I.S.A	From the junction between the renal artery and the aorta	Upwards and laterally	3	Artery with numerous branches
LEFT SIDE				
S.S.A	From the aorta	Upwards and medially	5	Numerous superior suprarenal branches
M.S.A	From aorta	Upwards and laterally	6	Three middle suprarenal arteries
I.S.A	Absent			Absent inferior suprarenal artery



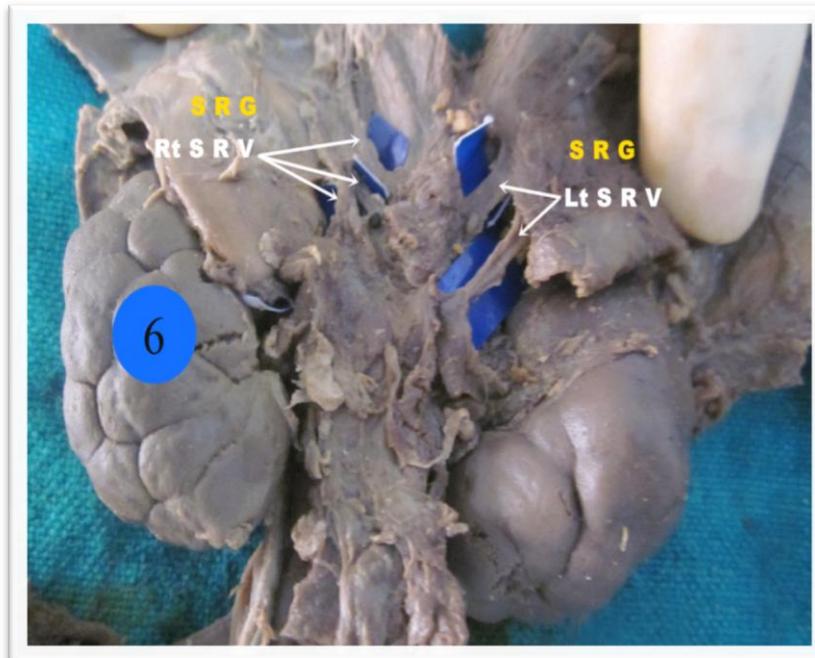
Findings In Specimen 13

Specimen	Site of origin	Course of artery	No. of branches	Remarks
RIGHT SIDE				
S.S.A	From I.P.A	Upwards and laterally	3 one anastomoses with M.S.A	Two middle suprarenal arteries and Anastomosis between the three arteries Four inferior suprarenal artery
M.S.A	From aorta and from renal artery	Upwards and laterally	3 communicate with the S.S.A and I.S.A	
I.S.A	From the renal artery	Upwards and laterally	5	
LEFT SIDE				
S.S.A	From I.P.A	Upwards and laterally	5	Numerous branches from superior suprarenal artery
M.S.A	From aorta	Straight laterally		
I.S.A	From renal artery	Upwards and laterally		



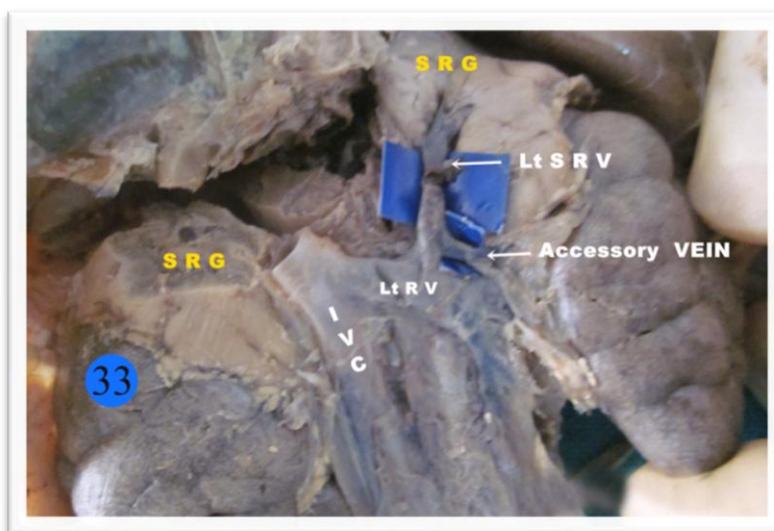
**Veins
Findings In Specimen 6**

Sp.No: F6	Point of exit from the gland	Course	Tributaries	Termination	Length from its exit to termination	Distance of L.S.V entering into the L.R.V from I.V.C	Remarks
RIGHT SIDE							
	Rt side From hilus	Straight medially	-----	Rt. Lateral border of the I.V.C	0.3, 0.3, 0.2 cms		Three S.R.V
LEFT SIDE							
	Lt side From hilus	Obliquely downwards	-----	I.V.C,L.R.V	0.7, 0.8 cms	0.3 cms	Double S.R.V



Findings In Specimen 33

Sp.No:	Point of exit from the gland	Course	Tributaries	Termination	Length from its exit to termination	Distance of L.S.V entering into the L.R.V from I.V.C	Remarks
F33	Rt side	-----	-----	-----	-----	-----	-----
	Lt side From hilus and base	Downwards Medially	Accessory suprarenal vein, I.P.V	L.R.V	1.6 cms , 0.7 cms	0.6 cms	Single vein with accessory branch



V. Discussion

In the present study observations were made on 50 fetuses and 30 adult specimens during routine dissection. From the total of 80 specimens, 47 cases (58.75%) have the normal arterial supply. Arteries were absent in 09 cases (11.25%). Incidence of variations of arterial supply is seen in 19 cases (23.75%) and incidence of venous variation is seen in 2 cases (2.5%) in adult and foetal specimens. Higher incidence was noted in adults as against fetuses. It should be noted that the above figures are varying from the previous literature.

Supernumerary arteries are about twice as common as supernumerary veins – which usually arise at the level of kidney.

Frequently the gland receives one or more twigs from ureteric or gonadal arteries. Inferior suprarenal artery may arise from accessory renal artery [Holinshed, 1971]. No such variation was found in the present study.

Superior Suprarenal Artery

Usually arise from the posterior division of inferior phrenic artery.^{3,4,5} Usually arise from the posterior division of inferior phrenic artery

Present work reveals that out of in 67 out of 80 cases (i.e. 83.75%), the origin of superior suprarenal artery is from the inferior phrenic artery, which is arising either above the celiac trunk, at the level of celiac trunk or just below the celiac trunk.,

In the present study the variation in superior suprarenal artery was found in 9 cases (11.25%). Out of these 9 cases the variation on the right side was found in 6 cases (7.5%) and on left side it was seen in 3 cases (3.75%).

In one specimen left suprarenal gland and kidney was discarded because of decomposition.

Middle Suprarenal Artery

It was earlier shown that the middle suprarenal artery arises from the aorta at the level of superior mesenteric artery^{3,4,5,6}.

In some instances the artery is double. In some it is absent⁶. Present study also shows origin of middle suprarenal from proximal part of inferior phrenic, from first part of renal artery, double in 2 cases (2.50%) and multiple in 3 (3.75%) and absent in 4 cases (5%).

Inferior suprarenal artery

It was earlier shown that inferior suprarenal artery normally arises from the renal artery^{3,4,5,6,7}. In the present study it is shown that in 70 specimens (87.5%) the inferior suprarenal artery was arising from renal artery. Out of 5 cases the inferior suprarenal artery on the right side was absent in 1 (1.25%) and on left side it was absent in 4 specimens (5%). Out of 5 cases the variation on the right side was found in 3 (3.75%), left side it was seen in 1 case (1.25%), and on both the sides in 1 specimen (1.25%).

In the present study inferior suprarenal artery is found to be absent in specimen no:23 on the right side and specimen no: 9, 2, 11, 43 on the left side.

In the present study specimen no : 14 showed the origin of right inferior suprarenal artery from accessory renal artery on the right side in 1 cases accounting for 1.25% agreeing with the study of Hollinshed with presentations but not with percentage^{2,3}.

Merklin and Michel's states that inferior suprarenal artery may also arises from the aorta just below or above the origin of renal artery^{6,7}. In present study, in specimen no: 1 (1.25%) the origin is from the posterior aspect of the aorta below the level of renal artery on left side. In specimen no: 11, 5 the origin is from the junction between aorta and renal artery on the right sides.

In 23% of cases the inferior suprarenal artery is double, one arising from aorta and other from the renal artery near the hilus of the kidney⁸. In present study, specimen no:1 on the left side and specimen no: 14 on the right side shows double inferior suprarenal artery. In specimen no: 9 and 13 (2.66%) on the right side and specimen no: 2 on the left side multiple inferior suprarenal arteries were found.

In the specimens where the present study shows that there is no branch given by the renal artery to the gland – requires further study by radiographic observation whether the superior polar artery in these cases supplies the gland because of the absence of inferior suprarenal artery has not been mentioned by any other author previously.

Inferior suprarenal artery can arise from aorta.^{6,9,10} Present study also shows the origin of inferior suprarenal artery from aorta in 2 (2.5%) cases on both the sides.

In specimen no: 1 where accessory gland is present on left side shows two accessory suprarenal arteries arising from superior polar (renal) artery.

In the foetal specimen it is seen that the superior and middle suprarenal arteries are more constant than the inferior suprarenal arteries¹⁶.

In foetal specimens the variations are more in inferior suprarenal artery. The inferior suprarenal artery is arising from aorta in 12 specimens (15%).¹⁶

Suprarenal vein:

Supernumerary veins are as common as supernumerary arteries, at the level of suprarenal gland and kidney, because of the development of subcardinal, supracardinal, azygos venous line and their intercommunications with each other and with the posterior cardinal vein. So variations occur as a result of persistence and regression of embryonic vessels.

Cunningham's Text Book of Anatomy and Gray's Anatomy, describes that the suprarenal gland is drained by a single large central vein which emerges through the hilus –on the right side^{3,11}. After a very short course it joins the inferior venacava; the left enters the left renal vein behind the body of pancreas, after receiving the inferior phrenic vein.

Anatomy for Surgeons by Hollinshed – states about the single central vein emerging through hilus^{2,3,16}. The right vein runs medially to open into inferior venacava, or at the junction between inferior venacava and right renal vein or rarely in the right renal vein. The left vein runs downwards, joins with the inferior phrenic vein and opens into left renal vein. The findings of "Essentials of Human Anatomy" by Russell T. Woodburne 1961, Callender's surgical Anatomy by Barry J. Anson and Maddock 1959, correlates with the above description^{12, 13}.

Text book of Human Anatomy of W.J. Hamilton 1976 states about the length of left suprarenal vein which is about 2 cm which opens into left renal vein¹⁵. Morris Human Anatomy states about the diameter of vein which is about 5 mm, and length of right suprarenal vein about 1 to 5 mm and left suprarenal vein about 2 to 4 cm. He also states about small veins corresponding to arteries – which drain into – inferior phrenic vein and renal vein.

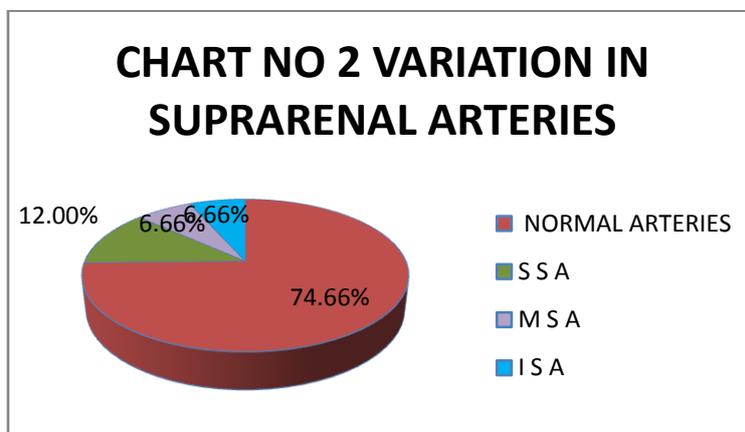
In the present study the length of the right suprarenal vein varies from no extra glandular course i.e., 0 to 1.2 cm and the length of the left suprarenal vein from 0.2 to 2.3 cm.

F.R.C. Johnstone In specimen no : 6 there were 2 suprarenal veins on left side 3 suprarenal veins on right side – all opened into inferior vena cava(1.25%).¹⁴

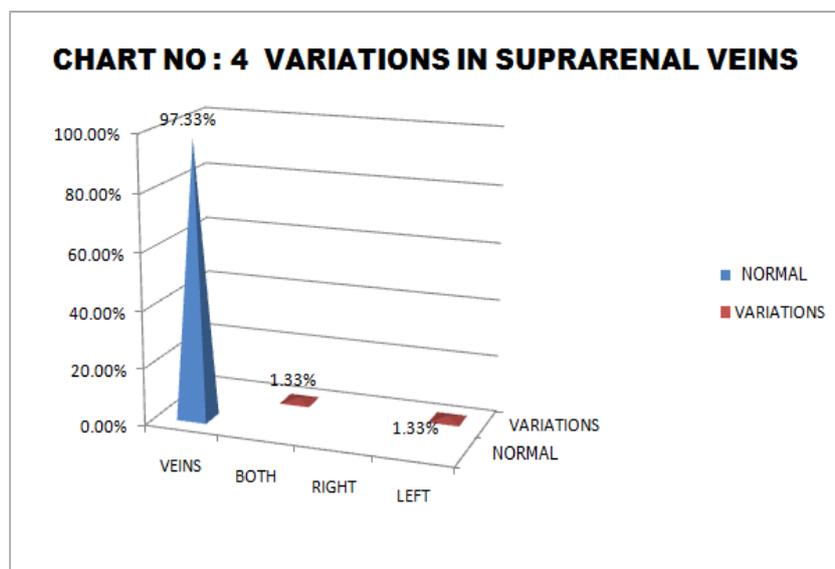
In the present study out of 80 specimens, 71(88.78%) specimens were found to have a single right suprarenal vein, all of them draining into the inferior vena cava. In specimen no: 33 there are two suprarenal veins (1.25%) on left side draining into the renal vein and in specimen no: 6 there are three suprarenal veins

(1.25%) on right side all of them draining into the inferior venacava and two suprarenal veins on the left side one draining into the left renal vein and another into the inferior venacava.

NORMAL ARTERIES	VARIATIONS (25.34%)		
	S.S.A	M.S.A	I.S.A
56	09	05	05
PERCENTAGE (74.66%)	12.00%	6.66%	6.66%



VEINS		NO. OF SPECIMENS	PERCENTAGE
NORMAL		73	97.33%
VARIATIONS (2.66%)	BOTH	01	1.33%
	RIGHT	-----	-----
	LEFT	01	1.33%



VI. Summary And Conclusion

The present study was undertaken to investigate the source of origin and number of arteries supplying the suprarenal gland and also mode of termination of suprarenal veins – its length and relation to inferior venacava, renal vein and gonadal veins.

The usual pattern of origin of superior, middle and inferior suprarenal arteries from inferior phrenic, aorta and renal arteries is found in the present study. There was a conspicuous variations in the origin of the superior suprarenal, middle and inferior suprarenal arteries. Multiplicity of the origin of superior, middle and inferior suprarenal arteries and anastomoses between them were also observed.

In the case of suprarenal veins normally right vein drains into inferior venacava and left vein drains into renal vein, which could be concur upon. Number of veins on the left side as well as on the right side in few specimens it is found to be double and in some multiple and all of them drain into inferior venacava, which indicates that an anatomist or a surgeon should be very vigilant while dissecting the vessels of the suprarenal gland for their respective purpose.

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