

Morphometric Study of Right Suprarenal Gland in Andhra Pradesh Region

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ABSTRACT

BACKGROUND

Suprarenal gland is an essential endocrine gland, which is located above the upper pole of kidney. Specifically, right suprarenal gland can vary in shape and has important relations. It secretes several types of hormones, which are helpful to us. We wanted to study the various shapes, morphometric measurements, position of gland in relation to kidney, and distance between upper pole of kidney & base of the right suprarenal gland.

METHODS

In the present study, right suprarenal glands of 40 males and 10 females have been studied. We measured various morphometric parameters and compared them between the males & females.

RESULTS

The most common shape of right suprarenal gland is pyramidal in both sexes. Other shapes like oval, irregular, rectangular, semilunar are also observed, but in very few cases. Among various measurements, side to side width of gland & thickness of gland are more in males whereas remaining measurements like length of gland, length of the extension part of gland, breadth at the base of gland, and weight of gland are more in females.

CONCLUSIONS

Even though the sample size is small, we observed some important variations in morphometry. This information is useful to clinicians like surgeons, endocrinologists, and radiologists.

KEYWORDS

Morphometry, Right Suprarenal Gland, Shape of Gland, Position of Gland

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BACKGROUND

Suprarenal gland is an important endocrine gland in humans as it secretes so many hormones which are essential to various bodily functions. The right suprarenal gland is usually pyramidal in shape, it resembles irregular tetrahedron.¹ Normally the gland is triangular & flattened.² The gland is pyramidal with concave base which is close to the surface of kidney against which it lies.³ Usually the gland is placed anterior to diaphragm and upper pole of right kidney. Anterior to gland, inferior vena cava & right lobe of liver are present.⁴ Usually in most of the cases right suprarenal gland is placed higher than the upper pole of kidney and it having a variable shape.^{5, 6} This creates lot of interest for doing the study on Morphometry of right suprarenal gland. In this morphometry, weight of the suprarenal gland is based on person's age, sex side of the gland, any disease of gland.⁷ Knowledge about the morphometry of right suprarenal gland is very informative to pathologists, surgeons, radiologists, endocrinologists in diagnostic, treatment methods of pathological conditions of suprarenal gland.⁸

METHODS

This is a prospective study conducted in the Department of Anatomy, Andhra medical college, Visakhapatnam, Andhra Pradesh, India, from the year 2016 to 2020 for a period of 5 years. In this present study, totally 50 right sided supra renal glands of male, female sex were assessed. Among these 40 are male, 10 are female. The right supra renal gland was exposed from the front and its distance between the upper pole of the kidney and the base of suprarenal gland is noted. The thorax and abdominal contents were then placed with anterior surface facing backwards and the gland was studied from posterior aspect also. Care was taken that kidney did not slip downwards. The distance between the base of the gland & upper pole of the right kidney was measured. Any extension from the base of the gland is exposed and its length is measured, later the gland is removed, and its weight is measured. In a gland following measurements were taken.

The following findings are measured with the help of digital vernier callipers-

- 1) side to side width.
- 2) above downward length.
- 3) thickness of gland.
- 4) length of extension part of gland.
- 5) breadth at the base of gland.

Quantitative data of the present study is usually expressed as mean and standard deviation. Difference in between 2 groups (males, females) with respect to continuous variables are analysed using Unpaired T Test. Most of the statistical tests are performed with SPSS VERSION 2.0 software. P value <0.05 is considered as statistically significant.

RESULTS

Shape of the Gland with /without Extension

In 50 supra renal glands, 40 are belongs to male & 10 are belongs to female. Initially we are observing the shape of gland, those are having a various shapes but most commonly we observe the pyramidal shape. Among the males, 48% of glands are pyramidal in shape, 14% of glands are pyramidal shape in females. In males, 40% of glands having a extension, 8% of glands are not having a extension. In females 12% of glands are having a extension, 2% of glands are not having an extension. Semilunar shaped gland is observed in 16% of males, 4% of females. In males 14% of glands are having an extension, only 2% of glands are not having an extension. In 4% of females, glands are having an extension. Rectangular shaped gland is observed in 8% of males, not in females. 6% of males are having gland with extension, in 2% of males, gland is not showing extension. Irregular shaped gland with extension is observed in 6% of males, 2% of females. Whereas oval shaped gland is observed in 2% of males only, not in females. Which are depicted in Table no: 1

Shape of Gland	With / Without Extension	Male (40)	Female (10)
Pyramidal	Without extension	4 (8%)	1 (2%)
	With extension	20 (40%)	6 (12%)
Semilunar	Without extension	1 (2%)	0
	With extension	7 (14%)	2 (4%)
Rectangular	Without extension	1 (2%)	0
	With extension	3 (6%)	0
Irregular	Without extension	0	0
	With extension	3 (6%)	1(2%)
Oval	Without extension	0	0
	With extension	1 (2%)	0
Total No.	Without extension	6 (12%)	1 (2%)
	With extension	34 (68%)	9 (18%)

Table 1. Shape of Gland with /without Extension in Male & Female Specimens

Various Measurements of Right Suprarenal Gland in Males (40), and Females (10)

Side to side width of a gland in males is 33.70 ± 7.194 , in females is 32.80 ± 6.303 . Whereas p value is 0.719, which is statistically insignificant. Above downward length of a gland is 32.40 ± 6.675 , 31.30 ± 8.354 consecutively in males, females. Whereas p value is 0.660, which is of statistically insignificant. Thickness of gland in males is 9.40 ± 1.997 , in females is 8.60 ± 2.221 , p value is 0.273, which is of statistically insignificant. Length of extension part of the gland in males, females are 9.05 ± 4.591 , 11.90 ± 5.238 consecutively value is 0.094, which is statistically insignificant. Breadth at the base of gland in males, females are 22.55 ± 5.238 , 24.60 ± 6.979 respectively. P value is 0.316, which is statically insignificant. Weight of the gland in a male specimen is 5.85 ± 0.975 , whereas in female specimens it is 6.90 ± 1.197 . p value is 0.005, it is statistically significant.

Among above all measurements, side to side width of gland & thickness of gland are more in males whereas remaining measurements length of gland, length of the extension part of gland, breadth at the base of gland, weight of gland are more in females. p value of weight of the gland is statistically significant, remaining all are insignificant. These values are represented in Table 2.

Measurements of Gland	Sex	Range of Measurement	Mean ± SD	P Value	df	t Value
Side to side width	Male (40)	26 mm -55 mm	33.70 ± 7.194	0.719	48	0.362
	Female (10)	28 mm – 48 mm	32.80 ± 6.303			
Above downward length	Male (40)	20 mm-50 mm	32.40 ± 6.675	0.660	48	0.443
	Female (10)	22 mm- 54 mm	31.30 ± 8.354			
Thickness of gland	Male (40)	5 mm-14 mm	9.40 ± 1.997	0.273	48	1.109
	Female (10)	4 mm – 12 mm	8.60 ± 2.221			
Length of extension part of gland	Male (40)	6 mm- 16 mm	9.05 ± 4.591	0.094	48	-1.708
	female (10)	8 mm-18 mm	11.90 ± 5.238			
Breadth at the base of gland	Male (40)	10 mm-30 mm	22.55 ± 5.388	0.316	48	-1.013
	Female (10)	12 mm-32 mm	24.60 ± 6.979			
Weight of the gland	Male (40)	4.00 gr-7.00 gr	5.85 ± 0.975	0.005	48	-2.910
	Female (10)	4.00 gr- 8.00 gr	6.90 ± 1.197			

Table 2. Various Measurements of Glands in Males (40), Females (10) Individually

(df – degree of freedom)

Measurements of Gland	N=50	Range	Mean	SD	P Value	df	t Value
Side to side width	Right glands	26 mm -55 mm	33.4924	6.98114	0.677 (P>0.05, Not. sig)	48	0.419
Above downward length	Right glands	20 mm-54 mm	32.2108	7.02031	0.616 (P>0.05, Not. sig)	48	0.505
Thickness of gland	Right glands	4 mm-14 mm	9.2448	1.98929	0.316 (P>0.05, Not. sig)	48	1.013
Length of extension part of gland	Right glands	0 mm- 18 mm	9.6258	4.80	0.095 (P>0.05, Not. sig)	48	-1.705
Breadth at the base of gland	Right glands	10 mm-32 mm	22.9558	5.71863	0.323 (P>0.05, Not. sig)	48	-0.999
Weight of the gland	Right glands	4 grams -8 grams	5.9792	1.05868	0.007 (P<0.05, Sig)	48	-2.827

Table 3. Measurements of Right Suprarenal Glands Specimens (No. 50)

(df – degrees of freedom)

Various Measurements of Right Suprarenal Gland (50)

In total no of specimens (50) average side to side width of gland observed is 33.49 ± 6.98 mm, Average above downward length is 32.21 ± 7.02 mm average thickness of gland is 9.24 ± 1.98 mm, Average length of extension part of the gland 9.62 ± 4.80 mm, Average breadth at the base of gland is 22.95 ± 5.71 mm, Average weight of gland is 5.97 ± 1.05 grams. Among all these measurements, p value of weight of the gland is statistically significant, whereas remaining all are statistically insignificant. Which are represented in Table no. 3

Position of Gland in Relation to Kidney

We are observing the position of suprarenal gland in relation to kidney in all male, female specimens. In 60% of specimens in male, 16% of specimens in female base of a gland is lying above the upper pole of kidney. In 18% of specimens in male, 4% of specimens in female, the base of a gland is lying just above to the upper pole of kidney. In 2% of specimens in male the base of gland is lying anterior to the upper pole of kidney.

Distance between Upper Pole of Kidney & Base of the Gland

We are measuring the distance in between upper pole of kidney & base of the gland. Based on the distance in between these 2 parts, we are dividing the range of distance into 3 categories i.e. in b/w 1 mm – 10 mm, in b/w 11 mm-20 mm, in b/w 21 mm - 35 mm. Among these 12% of specimens in male, 4% of specimens in female are having a distance in b/w 1 mm – 10 mm. 60% specimens in male, 14% of specimens in female are having a distance in b/w 11 mm – 20 mm. 8% of specimens in male, 2% of specimens in female are having a distance in between 21 mm – 35 mm.

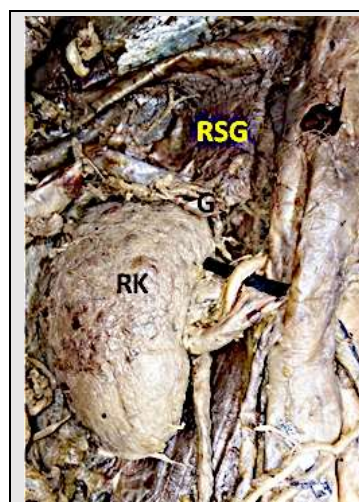


Figure 1. Pyramidal Shaped Gland with Wider Gap in b/w Kidney & Gland

(RK - Right Kidney, RSG- Right Suprarenal Gland, G – Gap)

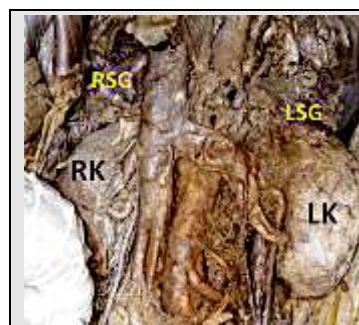


Figure 2. Semilunar Shaped Gland with Wider Gap between Gland & Kidney

(RK-Right kidney, RSG- Right suprarenal gland, LK-left kidney, LSG –left suprarenal gland)



Figure 3. Pyramidal Shaped Gland with Medial Extension

(RK - right kidney, RSG –right suprarenal gland, ME-Medial extension, IVC –inferior vena cava)

DISCUSSION

Morphometric measurements of right suprarenal gland are very important, as this information useful to find out any abnormalities of the gland. Findings of various morphometric measurements by the several authors are discussed here.

In the present study location of the gland is above to the upper pole of kidney in most of the cases i.e. 60% in males, 16% in females. Location of the gland is just above to kidney in 18 % of males, 4% of females; anterior to kidney in 2% of males, not in females. Whereas in study by Indar Jit and Neelam Banga et al.⁹

Gland is located above to kidney in 75.64% of cases, located just above to kidney in 23.27% of cases, located anterior to kidney in 1.09% of cases. Whereas in study by Maruti Ram Annamraju et al,¹⁰ the gland is located antero superior to kidney in most of the cases.

In my study predominant shape of gland is pyramidal in 62% of cases, semilunar in 20%, rectangular in 8%, irregular in 8%, oval in 2% of cases. According to study by Indar Jit and Neelam Banga et al pyramidal shape is seen in 86.66% of cases, triangular in 10%, semilunar in 3.33%. According to the study by Anand et al¹¹ predominant shape of gland is pyramidal.

Average Width of the gland in my present study is 33.49 ± 6.98 mm, where is in study by Maruti ram Annamraju et al, it is 3.268 ± 0.664 cm. Which is slightly more in my study. Literature regarding the width of the gland is very minimal.

In the present study Average Length of the gland is 32.21 ± 7.02 mm, where is in study by the Maruti ram Annamraju et al it is 2.972 ± 0.661 cm, in study by the Lam KY et al Mean length of the gland is 4.8 cm. My observations are lying in between these 2 studies.

Average thickness of the gland in present study is 9.244 ± 1.98 mm, where is in study by the Maruti ram Annamraju et al, the mean thickness of the gland is 0.584 ± 0.190 cm, which is more in my study. Where is in study by Indar Jit and Neelam Banga et al, mean thickness of the gland in male individuals is 6.48 ± 1.69 mm, in females it is 6.65 ± 1.72 mm. In the present study mean thickness of gland in males, and females was 9.40 ± 1.997 mm and 8.60 ± 2.221 mm respectively, which are higher than my findings.

In the present study, Average length of the extension part of the gland is 9.62 ± 4.807 mm, in males & females are 9.05 ± 4.591 mm, 11.90 ± 5.238 mm respectively. Whereas in study by the Indar Jit and Neelam Banga et al mean length of extension part of gland in males and females are 18.75 ± 4.90 mm, 17.48 ± 6.04 mm respectively; these findings are higher than my study findings.

Breadth at the base of the gland in present study is 22.95 ± 5.718 mm, in males & females are 22.55 ± 5.388 mm, 24.60 ± 6.979 mm. whereas in study by Indar Jit and Neelam Banga et al mean breadth at the base of gland in males, females are 22.67 ± 4.63 mm, 22.57 ± 4.34 mm respectively these findings are close to present study findings. Literature regarding this finding is very minimally observed in other studies.

Average Weight of the gland in the present study is 5.97 gr, whereas in study by the Maruthi ram Annamraju et al mean weight of the gland is 3.795 grams, comparatively the mean weight is more in present study. Whereas in Lam KY et al study it is 5.7 grams, which is close to my study. In a

study by Indar Jit and Neelam Banga et al, mean weight of the gland is 4.8 grams, which is less compared with present study. In Singh et al study,¹² mean weight of the gland is 9.54 grams which is very high compare with present study.¹³ grams is the mean weight of the gland in Folligan K et al study,¹⁴ which is very higher value than in present study. Mean weight of the present study (5.97 grams) is slightly higher than the study by the Kumar et al, Guyton and hall et al,¹⁵ Dilruba S et al¹⁶, Glass and mundy et al.¹⁷ In a study by the Studzinski et al,¹⁸ mean weight of the gland is 6.00 grams which is close to my present study mean weight i.e. 5.97 grams. In the present study mean weight of gland in males, females is 5.85 grams, 6.90 grams respectively, whereas in study by Indar Jit and Neelam Banga et al mean weight values are 4.80 grams, 4.99 grams respectively in males, females these are slightly higher in my study. In a study by Bagheri et al,¹⁹ mean weight is 4.00 grams regardless of age, sex which is less than in present study.

In this study mean weight is more in females than in males, which is of statistically significant, even in studies by the Indar Jit and Neelam Banga et al, Lam KY et al, Naronghai duo et al²⁰ the observation is same.

In the present study base of gland is lying anterior to upper pole of kidney in 2% of cases, base is lying just above the gland in 22% of cases, base is lying above to the gland in 76% of cases, whereas in study by Indar Jit and Neelam Banga et al, these are observed in 1.09%, 23.27%, 75.64% of cases respectively.

CONCLUSIONS

The present study is performed in 50 adult suprarenal glands of right side only. It was undertaken to study the variations in the measurements of males & females. Some of the important parameters which were not observed by authors previously, are measured in this study like position of gland in relation to kidney, distance in between base of gland, upper pole of kidney. Nearly 5 shapes of right supra renal glands were observed. Length, breadth at the base, weight of the gland are slightly higher in females, compared with males. Whereas, thickness of gland is more in male. Knowledge regarding the morphometry of suprarenal gland is important for early identification of various pathologies.

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