

Morphometrical Assessment of Suprarenal Gland in Fetuses of Different Gestational Age Groups

Khayati Sant Ram¹, Mahesh Sharma², Anshu Sharma³

¹ Assistant professor, Hind institute of medical sciences Lucknow

² Associate professor, Dept of Anatomy, Government Medical College & Hospital, Chandigarh

³ Associate professor, Dept of Anatomy, Government Medical College & Hospital, Chandigarh

Abstract- The study was made on morphometric parameters of human fetal suprarenal gland. The present study was carried out in the department of Anatomy, Government Medical College & Hospital, Chandigarh. The material for the study consisted of 30 spontaneously aborted human fetal specimens from 12th to 28th weeks of gestational ages. The suprarenal glands and kidney were taken from fetal specimens for morphological study. The measurements were done compass, scale and vernier caliper. The present study established a significant and positive correlation between the length, breadth and thickness of suprarenal gland. All the parameters were correlated to one another. Maximum increase of all the parameters were observed from gestational age of >15-20 weeks to >20-25 weeks.

It was observed in the present study that the commonest shape of right suprarenal gland was tetrahedral whereas the shape of left suprarenal gland was semilunar.

Index Terms- breadth, kidney, length, suprarenal gland, thickness.

Abbreviations- length of left suprarenal (L1), right suprarenal (L2), Breadth of left suprarenal (B1), right suprarenal (B2), Thickness of left suprarenal (T1), right suprarenal (T2) (in mm)

I. INTRODUCTION

The suprarenal gland plays an important role in maintenance of internal milieu. The slightest difference in its function may lead to an exponential alteration which can cost the life of a patient. The important causes of such a disturbance is occurrence of trauma and tumors of suprarenal gland¹.

The knowledge of the gland is important in many cases of female virilization, hirsutism, pseudohermaphroditism and hypertension in association with suprarenal cortical and medullary tumors¹. Morphologic, functional and maturational aspects of the human fetal suprarenal gland are unique.

Over the past years, the evaluation of fetal morphometrical growth parameters have been subject of increased awareness for the assessment of fetal growth and development. Some important parameters were used as standards like crown- rump length, biparietal diameter, head, chest and abdominal circumferences. In some studies fetal organs were also measured to see their gross development at various gestational ages. In this study the fetal suprarenal and kidneys length/breadth/thickness were measured. These measurements can give us indication of gestational age. Therefore an attempt was made to determine the

growth rate of fetal suprarenal gland in increasing gestational age.

Present study was undertaken also to determine the ratio of suprarenal gland to kidney in aborted fetuses in an Indian population. A comparison was made between these dimensions. The study will establish the gross development of suprarenal gland in human fetuses in North-West Indian population.

II. METHOD

The present study was carried out in the department of Anatomy, Government Medical College & Hospital, Chandigarh. The material for the study consisted of 30 aborted human fetal specimens from 12th to 28th weeks of gestational ages. The specimens were provided by the department of Obstetrics & Gynaecology Government Medical College & Hospital, Chandigarh for routine fetal autopsy. All fetuses were result of the intra uterine death or spontaneous abortion. All the fetuses had normal suprarenal gland morphology. Consent for autopsy and brief antenatal, medical, past history was taken from the parents to perform the study.

The fetuses were divided into four groups according to the gestational age:-

GROUPS	GESTATIONAL AGE	NUMBER OF FETUSES
A	11-15 weeks	5
B	>15-20 weeks	9
C	>20-25 weeks	10
D	>25 weeks	6

For all fetuses, the Crown Rump Length (CRL) was measured.

The right and left suprarenal glands were measured in 30 fetuses from the gestational age of 12th to 28th weeks. Linear measurements were taken with the help of vernier caliper, divider and compass. All the measurements were taken thrice and then average of them was taken.

The following morphometric measurements were taken on suprarenal gland: (Fig:1)

- 1) Length (L): The length was measured along the longest axis through a vertical plane.
- 2) Breadth (B): The breadth was measured as the widest point along a horizontal or oblique plane.

- 3) Thickness (T): The thickness was measured as the maximum distance between anterior and posterior surfaces.

Means of various measurements of fetal suprarenal gland for each group were taken. A graph was plotted with gestational age on x axis and measurements of length, breadth and thickness in millimeters on y axis.

Statistic evaluation- Statistical analysis was carried out using Statistical Package for Social Sciences (SPSSInc; Chicago, IL, version 15.0 for windows). All quantitative variables were estimated using measures of central location (mean, median) and measures of dispersion (standard error and standard deviation) and the data were presented in form of figures and tables. Correlation of each parameter with crown rump length was calculated using Pearson's correlation coefficient. Mann-Whitney U test was used to note sexual dimorphism. P value of <0.05 was considered significant

III. RESULT

There was gradual increase in length of the suprarenal gland from >15 week to >30 weeks of gestation. However the increase was not uniform in various gestational age groups. The maximum increase was seen between age group B and C. Minimum growth of was noticed between group C and D. The line graph plotted between the mean lengths of suprarenal gland showed parallel increase in both the lengths of suprarenal expect C-D (fig: 2).

There was different pattern of increase in breadth of suprarenal on both the sides. On right side minimum growth has been observed between group A-B. On left side maximum growth has been observed between group B- C (fig: 3).

There was constant but non uniform increase in thickness of right and left suprarenal gland. Minimum growth of thickness has been observed between group A- B on both the sides.

The line graph plotted between the mean thickness of suprarenal gland showed a parallel increase in both the thickness of suprarenal from group A-B and C-D. A sharp increase was observed from group B-C (fig: 4).

IV. CORRELATION BETWEEN VARIOUS PARAMETERS OF SUPRARENAL GLAND

Both the lengths showed positive correlation with the CRL. The correlation of left suprarenal length with CRL (Pearson coefficient of 0.656) was less than correlation of right suprarenal length (Pearson coefficient of 0.810) (Table: 2).

There was similar increase in the breadth of left suprarenal gland along with increase in length except in group B. The correlation between length and breadth of left suprarenal was seen to be significant with Pearson coefficient of 0.574.

The increase in the length of left suprarenal as well as the thickness of the left suprarenal gland was almost constant in all the age groups. The length of left suprarenal was roughly 2.01-2.66 times of the thickness of the gland and increases gradually with increase in gestational age groups. The correlation between

length and thickness of left suprarenal was excellent (Pearson's Coefficient 0.841).

Both the breadth and thickness of the left suprarenal gland showed minimum growth from Group A-B, maximum growth was seen from Group B-C. The correlation between breadth and thickness was seen to be strong and significant (Pearson coefficient 0.841).

Both the length and breadth of right suprarenal gland showed a constant increase with increasing gestational age. There was sharp increase in growth in group B-C. Length showed positive correlation with breadth of right suprarenal gland with Pearson coefficient of 0.805.

The length of right suprarenal gland was seen to be 2-3 times the thickness of the right suprarenal gland. A gradual increase was observed in thickness of right suprarenal with a sudden spurt of growth from group B-C. The ratio of length and thickness of right suprarenal remained roughly constant throughout the gestation with maximum ratio was seen to be 3:1 in group C and signified a more increase in thickness as compared to length of right suprarenal gland. The ratio remained roughly same in groups A and B. The correlation of length was seen to be strong with thickness (Pearson Coefficient 0.543) (Table: 3).

The breadth of right suprarenal gland was seen to be 2-3 times the thickness of the right suprarenal gland. The increase in thickness was seen to be gradual with increasing gestation and maximum from group B-C. Breadth showed a strong and positive correlation with thickness with Pearson Correlation of 0.841.

V. DISCUSSION

Some of previous studies have been done from ultrasound measurements. Only few studies have been conducted by direct measurements of the fetal suprarenal gland for the accurate estimation of the gestational age.

Few studies^{1,3} are available in the literature regarding dimensions of fetal suprarenal glands for comparison with the data of the present study.

In our study (Table :4) the length of right suprarenal gland showed an increase of 6.65 mm from group A-D whereas left suprarenal gland showed an increase of 8.07 mm from group A-D. The increase in length from group A to B was less in our study compared to Anand et al¹. All the observed lengths in our study were less compared to other studies^{1,3}. However, sudden increase in length was noticed in group C which is in accordance with other studies.

In the present study, length of right suprarenal gland was more compared to left suprarenal gland except in group D. Similar findings were observed by Anand et al¹ whereas in the study done by Norwalk et al³, length of left suprarenal gland was more. The breadth of right suprarenal gland in the present study was increased from 6.64 mm in group A to 14.02 mm in group D. Thus an increase of 7.38 mm whereas left suprarenal gland showed a total increase of 8.07 mm. The increase in breadth from group A to B was low (0.99mm) in the present study when compared to another study¹ (3mm) (Table: 5).

It was observed in the present study (Table:4,5) that the breadth of left and right suprarenal gland was less as compared to other studies^{1,3}. Except in group C-D where the breadth of left

suprarenal gland was more compared to another study¹. However, sudden spurt of growth was noticed in group C the same was observed by other authors^{1,3}.

In the present study it was observed that the thickness of the right suprarenal gland increased from 2.86 mm to 5.22 mm and the thickness of left suprarenal gland increased from 3.26mm to 6.29mm in group A-D. An increase of 3.0mm was observed in left suprarenal gland from group A to D. The increase in thickness was less in our study when compared to studies done by other authors^{1,3}. The sudden increase in thickness was seen in group C. The similar finding were observed in other studies^{1,3}. In the present study the thickness was more of left suprarenal gland as compared to Anand et al¹ who observed more thickness on right side (Table 4,5).

Elias et al² calculated the length of suprarenal gland in relation to length of the kidney. A strong linear correlation between suprarenal and kidney length was found. According to them length of suprarenal gland was on an average 27% of that of kidney and this relation remained constant with increased gestational age or kidney size.

The study done by Oppenheimer et al⁴ on USG showed the value of length of of 12mm in group D which was less when compared to the present study. In the fetus, comparison up to gestational age of 24 weeks is not possible by CT/USG, since visualization of suprarenal glands before 24 weeks of gestation is very difficult¹.

Oppenheimer et al⁴ had studied the relationship between suprarenal gland length and gestational age with ultrasound studies indicating a trend of increasing size with gestational age, similar findings were observed on fetal autopsy in the present study.

In the present study tetrahedral shape of suprarenal gland was common as compared to left side which was semilunar. Similar findings were observed on left side by Anand et al¹ but on right side the authors observed that 50% glands were tetrahedral and 50% triangular. Sangma et al⁶ observed that shapes of both right and left suprarenal glands were similar as tetrahedral or pyramidal till 18th week, thereafter left became semilunar.

The present study established a significant and positive correlation between the length, breadth and thickness of suprarenal gland. All the parameters were correlated to one another. It was observed that there was similar increase in breadth of suprarenal gland along with increase in length. Maximum increase was seen from group B-C. The increase in the length as well as increase in the thickness of the suprarenal gland was almost constant in all the age groups. The length of left suprarenal was roughly 2.01-2.66 times of the thickness. Length of right suprarenal gland was seen to be 2-3 times the thickness of the right suprarenal gland, maximum increase was shown from group B-C. The ratio of right suprarenal gland length and thickness remained roughly constant

throughout the gestation with maximum ratio seen to be 3:1 in group C. Maximum increase in breadth along with increase in thickness was observed from group B-C. No study was available to compare the present findings.

The knowledge of morphometry of the gland is important in cases of anencephaly, hirsutism, intrauterine growth retardation, premature birth and hypertension in association with suprarenal cortical and medullary tumors

REFERENCES

- [1] ANAND MK, ANAND C, CHOUDHRY R, SABHARWAL A (1998). Morphology of human suprarenal glands: a parameter for comparison. *Surg Radiol Anat* 20, 345-9.
- [2] ELIAS HAMD, STIGTER RH, WESTERS P, VISSER GHA (2004). Growth and size charts of the fetal adrenal gland. 2nd ed. Netherlands: Budde Elinkwijk Nieuwegain, 40-7.
- [3] NOWAK D, GÓRALCZYK K, ZURADA A, GIELECKI J (2007). Morphometrical analysis of the human suprarenal gland between the 4 th and 7 th months of gestation. *Ann Anat* 189, 575-82.
- [4] OPPENHEIMER DA, CARROLL BA, YOUSEM S (1983). Sonography of the Normal Neonatal Adrenal Gland. *Radiology* 146,157-60.
- [5] RAINEY WE, REHMAN KS, CARR BR (2004). Fetal and maternal adrenals in human pregnancy. *Obstet Gynecol Clin N Am* 31,817-35.
- [6] SANGMA GTN, IBOCHOUBA Y, DAMAYANTI N (2008). Development and Maturation of Suprarenal Glands in Human Fetuses. *J Anat Soc India*, 57: 1-7.

AUTHORS

First Author – Khayati Sant Ram MBBS, MD, Assistant professor, Hind institute of medical sciences Lucknow

Second Author – Mahesh Sharma MBBS, MD Associate professor, Dept of Anatomy, Government Medical College & Hospital, Chandigarh

Third Author – Anshu Sharma MBBS, MD Associate professor, Dept of Anatomy, Government Medical College & Hospital, Chandigarh

Correspondence Author – Khayati Sant Ram, Dept.: Dept of Anatomy, Hind institute of medical sciences, Lucknow, khayati_santram@yahoo.com

Institution Responsible For Research Support And/Or Financial Support

Government Medical College & Hospital, Chandigarh

Dissemination History (where applicable)

Section of the Journal to Which the Article is Addressed
Original Articles

Table 1: Morphometric parameters of Suprarenal gland † length of left suprarenal (L1), right suprarenal (L2),‡Breadth of left suprarenal (B1),right suprarenal (B2), !!Thickness of left suprarenal (T1),right suprarenal (T2) (in mm)

GRO UP	L1 RANGE	L1 MEAN ± S.D	L2 RANG E	L2 MEAN ± S.D	B1 RANG E	B1 MEAN ± S.D	B2 RANG E	B2 MEAN ± S.D	TI RANGE	T1 MEAN ± S.D	T2 RAN GE	T2 MEAN ± S.D
A	5.00-8.31	6.58±1.66	4.00-8.60	6.93±1.84	3.84-10.21	7.12±2.31	4.62-10.30	6.64±2.29	2.00-5.60	3.26±1.38	2.00-4.0	2.86±0.74
B	3.12-12.61	8.0±3.75	4.00-12.5	8.29±3.24	4.00-9.62	7.38±2.11	3.00-11.31	7.63±2.84	2.00-7.31	3.57±2.00	1.62-5.0	2.98±1.27
C	7.00-18.0	13.60±3.44	10.52-15.83	13.53±1.74	11.10-17.82	14.67±1.90	7.00-17.0	11.79±4.08	3.00-8.0	5.10±1.69	3.00-5.0	4.50±0.83
D	10.24-23.71	14.65±4.65	10.42-17.34	13.58±2.28	7.00-18.50	15.19±4.31	8.00-18.53	14.02±3.17	2.64-10.54	6.29±2.40	2.00-9.0	5.22±1.72

Table 2: Ratio of CRL with L1 and L2 , †CRL crown rump length

GROUPS	CRL	L1	L2	CRL:L1	CRL:L2
A	11.76	6.58	6.93	1.78:1	1.69:1
B	13.46	8.0	8.29	1.68:1	1.62:1
C	17.94	13.60	13.53	1.31:1	1.33:1
D	19.51	14.65	13.58	1.33:1	1.43:1

Table 3:- Correlation between various parameters of suprarenal gland

GROUPS	L1	B1	L1:B1	L1	T1	L1:T1	B1	T1	B1:T1	L2	B2	L2:B2	L2	T2	L2:T2
A	6.58	7.38	0.89:1	6.58	3.26	2.01:1	7.12	3.26	2.26:1	6.93	6.64	1.04:1	6.93	2.86	2.42:1
B	8.0	7.12	1.12:1	8.0	3.57	2.24:1	7.38	3.57	1.99:1	8.29	7.63	1.08:1	8.29	2.98	2.78:1
C	13.6	14.67	0.92:1	13.6	5.10	2.66:1	14.67	5.10	2.87:1	13.53	11.79	1.14:1	13.52	4.50	3.00:1
D	14.65	15.19	0.96:1	14.65	6.29	2.34:1	15.19	6.29	2.41:1	13.58	14.02	1.0:1	13.58	5.22	2.60:1

Table 4 : Comparison of right suprarenal gland parameters

Authors	Mode of examination	Right Suprarenal Gland											
		LENGTH				BREADTH				THICKNESS			
		A	B	C	D	A	B	C	D	A	B	C	D
Anand et al ¹ (1998,Delhi)	Manual	10	12	-	-	9.3	12.3	-	-	3.5	4.6	-	-
Nowak et al ³ (2007, Poland)	Manual	-	8.2	13.3	16.6	-	9.45	15.4	17.7	-	5.6	7.7	8.5
Oppenheimer et al ⁵ (1983,Stanford)	USG	-	-	-	12.0	-	-	-	-	-	-	-	-
Present study (2011)	Autopsy	6.93	8.29	13.53	13.58	6.64	7.63	11.79	14.02	2.86	2.98	4.5	5.22

Table 5 : Comparison of left suprarenal gland parameters

Authors	Mode of examination	Left suprarenal gland											
		LENGTH				BREADTH				THICKNESS			
		A	B	C	D	A	B	C	D	A	B	C	D
Anand et al ¹ (1998, Delhi)	Manual	8.5	-	15	19	8.5	-	10.25	10.25	3.0	-	5.2	6.0
Nowak et al ³ (2007, Poland)	Manual	-	8.4	13.8	16.8	-	10.7	16.1	18.5	-	5.9	8.8	9.5
Oppenheimer et al ⁵ (1983,Stanford)	USG	-	-	-	12.0	-	-	-	-	-	-	-	-
Present study (2011)	Autopsy	6.58	8.0	13.6	14.65	7.12	7.38	14.67	15.19	3.26	3.57	5.1	6.29

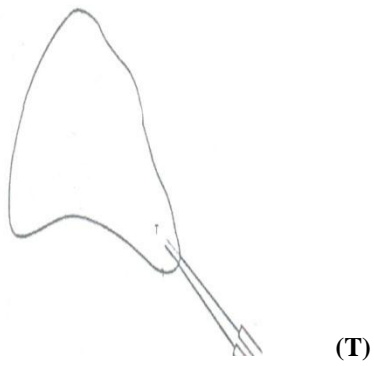
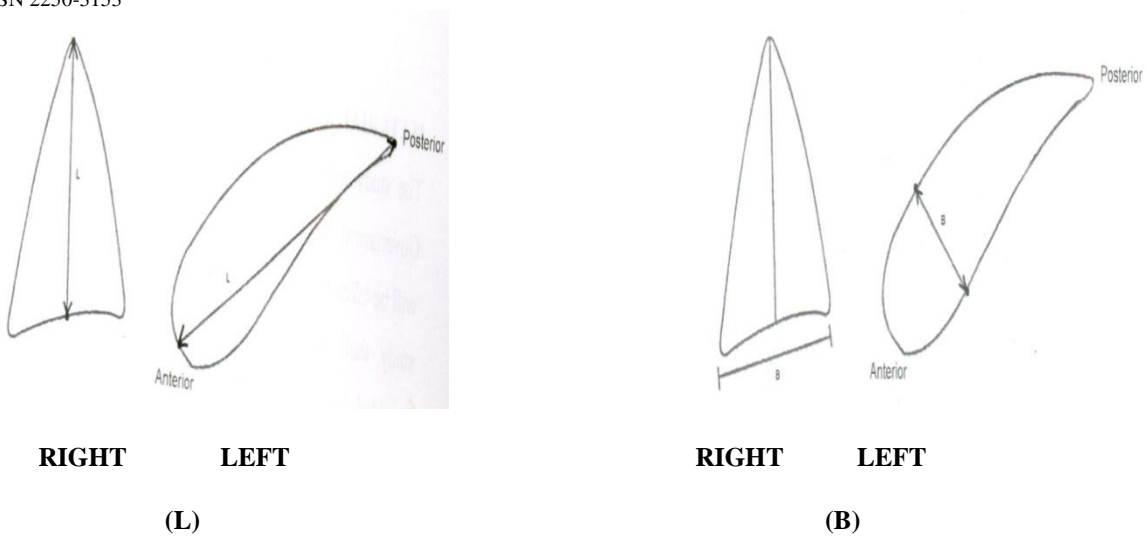


FIGURE 1:-ANATOMICAL PARAMETERS MEASURED ON SUPRARENAL GLAND ON EACH SPECIMEN:-LENGTH (L), BREADTH (B), THICKNESS (T).

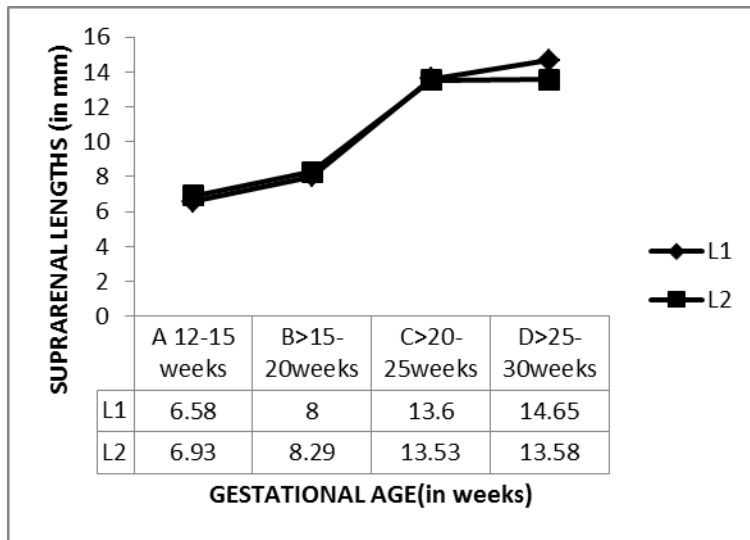


FIGURE 2: INCREASE IN RIGHT AND LEFT SUPRARENAL LENGTHS IN DIFFERENT AGE GROUPS

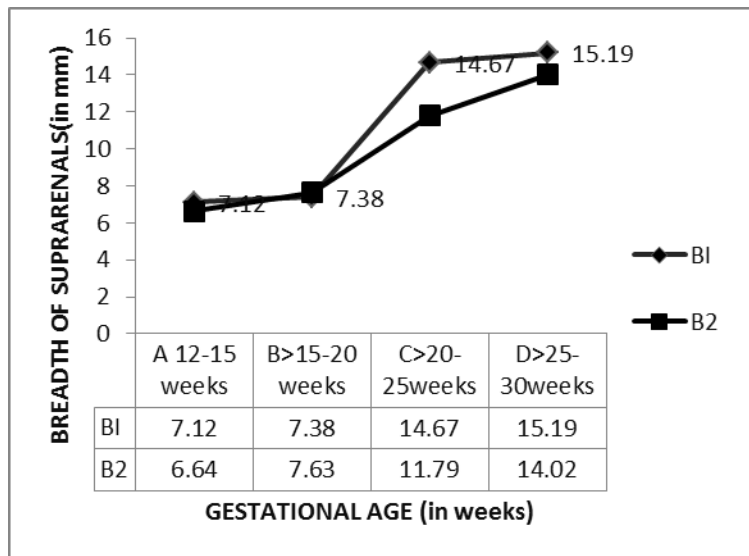


FIGURE 3: INCREASE IN RIGHT AND LEFT SUPRARENAL BREADTH IN DIFFERENT AGE GROUPS

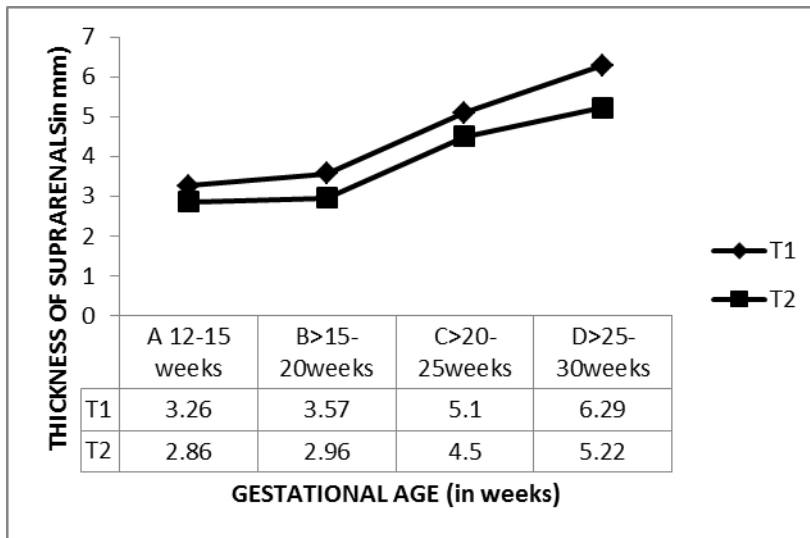


FIGURE 4: INCREASE IN RIGHT AND LEFT SUPRARENAL THICKNESS IN DIFFERENT AGE GROUPS