



Sexual Dimorphism on Renal Development According to Gestational Age in Human Aborted Fetuses

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Abstract

In order to find and prevent the unknown pathologies of kidneys in infants, there is a necessity to examine the fetal growth of kidneys in utero. As a part of this a study was conducted, 50 dead fetuses were collected among which 30 are male and 20 are female. The weight, length, breadth of their kidneys is calculated with related to their each gestational age. It was found that male fetal kidneys increased in size and weighed more than female. The morphological parameters of fetal kidneys are tabulated or better understanding. Bilateral Renal agenesis and poly cystic kidney disease are the most common renal anomalies in new born infants. It is difficult to treat these conditions and lot of infants ended up with death. We concluded that, decrease or increase in fetal kidney dimensions in utero, may have various fatal pathologies in infants after birth.

Keywords: Kidney; Gestational age; Morphometric analysis; Sexual dimorphism; Intra uterine growth Retardation

Introduction

Morphometric measurements of crucial organs like kidney, liver, brain, suprarenal gland etc. in growing fetuses were undertaken to access gestational age and for understanding their development at different gestational ages in normal and abnormal situations in male and female fetuses [1-20]. It is evident that Growth retardation in utero mainly affects the normal growth and function of kidneys, which tends to increase the risk of hypertension in future [21-40]. Although some of the cases are genetically abnormalities, low protein diet, medications, toxic substances, increased renin levels, decreased blood flow also affect the development of kidneys [41-50]. Decreased number of nephrons is one of the major causes of underdevelopment of kidneys. Defective function of kidneys also impairs the function of other vital organs.

The objective of this study is to bring awareness for prevention of adverse conditions by measuring various dimensional differences in length, breadth and thickness among male and female human fetal kidneys at a particular gestation [51-64].

Materials and Methods

This work was conducted in the department of Anatomy SV Medical College, Tirupati in collaboration with the Departments of Obstetrics and gynecology of govt. Maternity Hospital and Department of nephrology, Sri Venkateswara Institute of Medical Sciences Hospital, Tirupati, AP, India and Vinayaka Missions Kirupananda variyar Medical College, Salem Poly Clinic, Akshaya Fertility Center and Saraswathi Nursing Home, Salem, TN, India. A total of 50 dead fetuses of both sexes in which 20 female and 30 male collected from places with relevant clinical history were utilized for the present study. A special data sheet was designed for recording various parameters observed. The fetal weight and external visible congenital anomalies were recorded. The fetuses were collected in 10% formalin solution. The fetuses were preserved by injecting 10% formalin solution in to the pleural, peritoneal and cranial cavities. The extremities were preserved by multiple injections technique.

Abdominal cavity of each fetus was opened and the position, shape, and size of the liver stomach, coils of intestine, spleen, pancreas, and

large intestine were observed and deviations if any were recorded and appropriate photographs taken. All the above-mentioned organs were removed by applying ligatures at the proximal and distal part of the gut to prevent spillage of gut contents. The retroperitoneal organs i.e., kidneys, suprarenal, and ureters, abdominal aorta and inferior vena cava and their branches were exposed by cleaning the adjacent tissue. The position and immediate relations of kidneys, hilar structures and their arrangement were observed. Both the kidneys with ureters and abdominal aorta with renal arteries up to their entries into the kidney were exposed and were removed from abdominal cavity as a single unit. The weight, length, width, thickness and number of lobulations of the kidneys were recorded and tabulated (Table 1). The kidney specimens collected were categorized according to the sex of the fetus into three groups Group I are male fetuses, Group II are female fetuses.

Results and Discussion

Females

Among 50 foetuses collected for this study 20 were female foetuses. Their gestational period ranged from 12-34 weeks. Weight of foetuses in this group ranged from 400 g to 2300 g with a mean weight of 809.1 g.

The weight of kidneys ranged from 1.4 to 13.67 g with a mean weight of 3.82 g on right side. Kidneys of the left side weighed between 1.47 to 14.17 g with a mean value of 3.88 g. Weights of individual kidneys on left side were more than right side. Mean weights of left kidneys were slightly more than right kidneys. Mean of the number of lobules were 17.73 on right side which was slightly more compared to 17.27 on left side.

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Sex	Side	Age in weeks	Weight of fetus (g)	Length (cm)	Width (cm)	Thickness (cm)	Lobules	Weight of kidney (g)
Male	RIGHT	27.73	1340.91	2.99	1.71	1.38	18.82	4.02
	LEFT	27.73	1340.91	3.0	1.86	1.44	17.73	4.1
	MEAN	27.73	1340.91	2.99	1.78	1.41	18.27	4.06
Female	RIGHT	25.27	809.10	2.85	1.62	1.38	17.73	3.82
	LEFT	25.27	809.10	2.86	1.64	1.36	17.27	3.88
	MEAN	25.27	809.10	2.85	1.63	1.37	17.5	3.85

Table 1: Observations on morphometric parameters at different gestational periods: According to sex of foetuses.

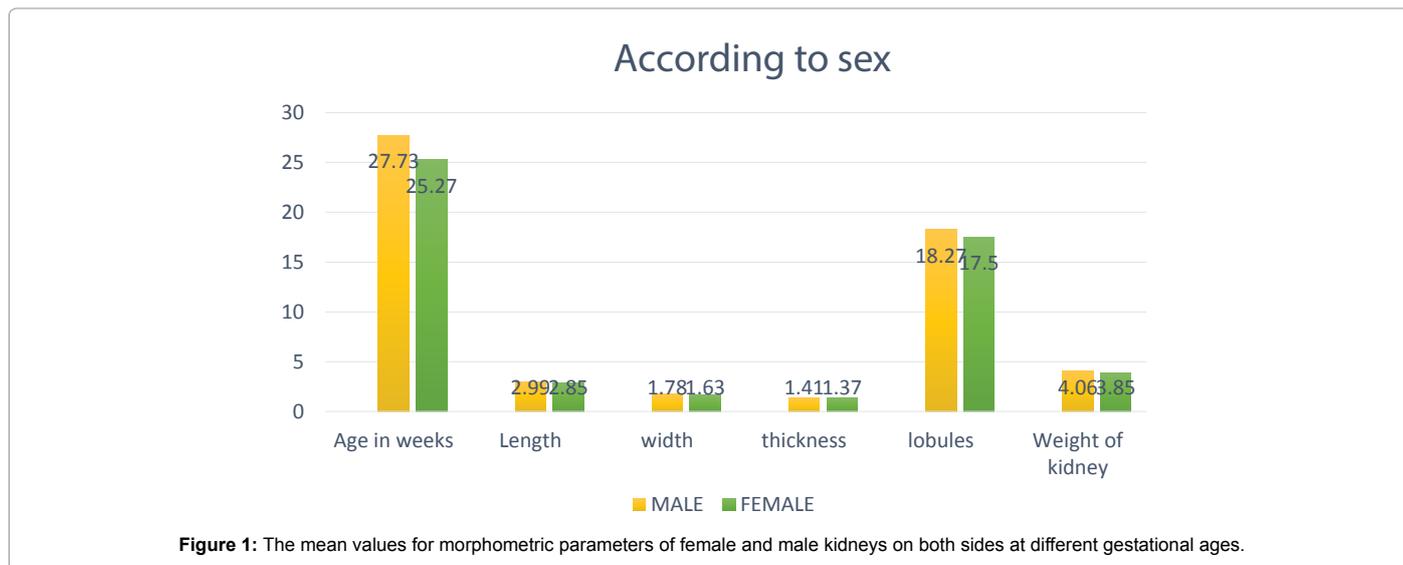


Figure 1: The mean values for morphometric parameters of female and male kidneys on both sides at different gestational ages.

Other morphometric parameters such as length, width and thickness were as follows:

Right side: 2.85 × 1.62 × 1.38 cm

Left side: 2.86 × 1.64 × 1.36 cm.

These values indicate that “there is marked increase in width and length of left kidneys while compared with the right side which were thinner compared to left side.

Males

Among 50 foetuses collected for this study 30 were male foetuses with the gestational periods ranging from 20-34 weeks. The fetal weight ranged from 600-2500 g with a mean weight of 1340.91 g.

In this group of kidneys individual weight ranged from 1.8 to 8.48 g and its mean was 4.02 g on the right side and ranged from 1.8 to 7.37 g with a mean of 4 g on the left side. Mean weights were greater on left side though we obtained higher individual weights on right side. Mean of the number of lobules was 18.82 on right side and 17.73 on left side.

Mean values for other morphometric parameters such as length, width and thickness is as follows:

Left side: 2.99 × 1.71 × 1.38 cm

Right side: 3 × 1.86 × 1.44 cm.

These values indicate that there is marked increase in left kidneys in length, width and thickness when compared with the right side.

Overall observations between the two groups (males and females) in this study by the mean values from both right and left side indicate

that there is a slight increase in the male morphometric parameters. Higher average weights of kidney (4.06 g) in males when compared to females (3.85 g) were observed in this study (Figure 1). The mean values for morphometric parameters of female and male kidneys from both right and left side. It indicates that there is a slight increase in the male morphometric parameters at different gestational ages.

Discussion

This study described the dimensional difference in male and female fetal kidneys. For an unknown reason male kidney on the right side are found to be little large than left kidneys at 27.73 weeks of gestational age. The period of maximum kidney growth occurs at 26-34 weeks of gestation. In literature very few studies are available on morphometric parameters of kidneys. Most of them were either text-book descriptions on an adult organ at dissection or on large sample of autopsied adult bodies or on a small sample of fetuses’ autopsied adult bodies or on a small sample of fetuses. Literature available on number of parameters and the type of statistical analysis performed were also less. Hence, comparison could not be made with reported literature for certain parameters of present study as they are first to be at certain age groups. The present study on morphology and morphometric of human fetal kidneys of prenatal age group was conducted to observe age related morphology and morphometric. Morphological parameters of location, relations, color and surface appearance of fetal kidneys are in agreement with those reported in the literature. When right and left kidneys compared in males, right kidney has more lobules than left one. Although the female has small kidneys, it was not statistically different.

Conclusion

The study is mainly conducted to observe the normal growth of the

renal development and variations with respect to the change in the sex of the fetus. There is no statistical significance observed in the study as the reduction in number in various objective parameters was observed due to the low fetal weight population obtained in female fetal samples.

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