ORIGINAL ARTICLE

COMPARATIVE STUDY OF MANUAL AND ULTRASONOGRAPHIC MEASUREMENT OF FETAL RENAL LENGTH

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ABSTRACT

Background: There is linear increase in renal length with gestational age. This study was conducted to assess the reliability of fetal renal length obtained by ultrasonography with the manual measurement. **Methods:** In this cross-sectional study 100 pregnant ladies of 2nd & 3rd trimester were selected for sonographic renal length study on weekly basis. Thirty dead born fetuses of 2nd and 3rd trimester were studied. Their kidneys were dissected out and measured manually. Measurement of both samples was compared. **Results:** Insignificant differences were observed between the sonographically and manually measured renal length at each gestational week of pregnancy. **Conclusion:** Sonographically measured fetal renal length is accurate and useful tool for assessment of fetal renal growth and well being.

KEY WORDS: Fetal renal length, Sonography, Gestational age.

INTRODUCTION

For the last four decades, obstetric ultrasonography has substantially improved our understanding of fetal growth and development which enables us to study the changes in a variety of fetal anatomic growth parameters.[1]

Fetal biparietal diameter measurement and fetal renal length show a linear relationship with each other during 2nd and 3rd trimester of pregnancy.[2] There is also linear increase in renal length with gestational age.[3,4]

During the end of first trimester, the kidney is made of several loosely connected lobes, each with a thin cortex. During second trimester, the lobes fuse, becoming less distinct and the cortex thickens, leaving the kidney with a lobular contour that persists for several years after birth.[5-7] The kidneys begin to excrete urine at approximately 13 to 15 weeks of gestation.[8] By the second trimester, the kidneys become the major contributor to amniotic fluid volume.[5,6,9]

MATERIAL AND METHODS

Hundred pregnant ladies (sample I) of 2nd and 3rd trimesters were booked at antenatal clinics of gynae & obstetrics units of Govt. Lady Reading Hospital Peshawar. They were referred for ultrasonographic evaluation on weekly basis. Thirty dead born (abortuses /still born) fetuses (sample II) were obtained from the same units of hospital and were dissected for renal study measurement with the following inclusion criteria i.e., middle class with sufficient nutrition during pregnancy, age between 20-25 years, height between 5-5.4 feet, weight between 56-75 Kg, B.P ranging between 120/80—130/85 mmHg, multigravida and normal gynecoid pelvis. Exclusion criteria was primigravida, underweight or overweight, malnourished, diabetics, hypertensive and eclampsiacs.

For ultrasonographic renal measurement long axis of kidney i.e., renal length, the transverse scan was used between upper and lower poles and recorded in milimeters.[4]

For manual measurement, both the kidneys were dissected out of fetal abdomen, renal fascia removed along suprarenal gland. The renal length was recorded between two poles of kidney in millimeters.

RESULTS

Both sonographic (sample I) and manual measurement (sample II) of fetal renal length are shown in Table 1. It is observed in sample I that at the start of 2nd trimester, i.e. 13 week of gestation, renal length was 6.3 mm while at the end of 2nd trimester it reached to 32.5 mm. Unveiling that an increase of 26.2 mm has occurred in 2nd trimester and an increase of 6.3 mm has happened in first trimester. At the 37th week of gestation, i.e. in last trimester, the length of kidney was 42.1 mm, showing an increase of 9.6 mm. In a nutshell, major growth of kidney, i.e. 26.2 mm has been noticed

Table 1: Measurements of sonographic and manual renal length.

Gestational age (weeks)	Sonographic method (sample I)		Manual method (sample II)	
	Number of cases	Mean renal length (mm)	Number of cases (mm)	Mean renal length
13	4	6.3	_	_
14	5	10.9	_	_
15	3	13.0	4	13.0
16	4	15.5	_	_
17	5	17.8	4	17.5
18	3	21.8	2	21.2
19	6	22.2	_	_
20	3	24.8	_	_
21	5	25.5	3	25.2
22	4	26.6	_	_
23	4	29.4	_	_
24	4	30.4	4	30.4
25	4	32.5	2	32.2
26	5	33.8	_	_
27	5	34.4	2	34.5
28	3	34.5	4	34.5
29	2	35.9	-	_
30	2	37.8	2	37.5
31	3	37.8	1	37.6
32	4	40.8	_	_
33	4	41.3	_	_
34	4	41.9	1	41.8
35	4	41.9	_	_
36	5	42.0	1	42.4
37	5	42.1	_	_

in second trimester while 6.3 mm and 9.6 mm of kidney length was measured in first and last trimesters, respectively.

Manual measurement of kidney (sample II) shown in Table 1 reveals that at the 15th week of gestation, i.e. during second trimester, it was 13.0 mm which was exactly same to the length of kidney at that stage of gestation measured sonographically. It is further observed that in sample II, length of kidney at 25 week of gestation was 32.2 mm, nearly to that measured by sonography, viz. 32.5 mm. Renal length of sample II at 36 week of gestation was 42.4 mm, about same in length of kidney at 36 week measured sonographically, viz. 42.0 mm.

It can be concluded from the measurement of sample I and sample II, that there is progressive increase in measurement of fetal kidney length until 36 week of gestation with major developments noted in second trimester.

Table 2 displays comparative estimates of sample I and sample II. Standard deviation of both groups exhibits little biometric variations within the measurements of kidneys length of fetuses of each gestational week and t-values confirm that the dif-

Table 2: Comparison of sonographic and manual renal length.

Gestational age(weeks)	Mean renal length by sonography (mm)		S.D	Mean renal length by manual method (mm)		S.D	t-value
		Number of cases			Number of cases		
15	13.0	3	0.5	13.0	4	0.4	0.00
17	17.8	5	0.4	17.5	4	0.5	0.12
18	21.8	3	0.4	21.2	2	0.5	0.17
21	25.5	5	0.3	25.2	3	0.4	0.16
24	30.8	4	0.6	30.4	4	0.5	0.19
25	32.5	4	0.7	32.2	2	0.4	0.13
27	34.4	5	0.7	34.5	2	0.6	0.12
28	34.5	3	0.8	34.6	4	0.7	0.11
30	37.8	2	0.6	37.5	2	0.7	0.13
31	37.8	3	0.5	37.6	1	_	0.00
34	41.9	4	0.4	41.8	1	_	0.11
36	42.0	5	0.3	42.4	1	_	0.10

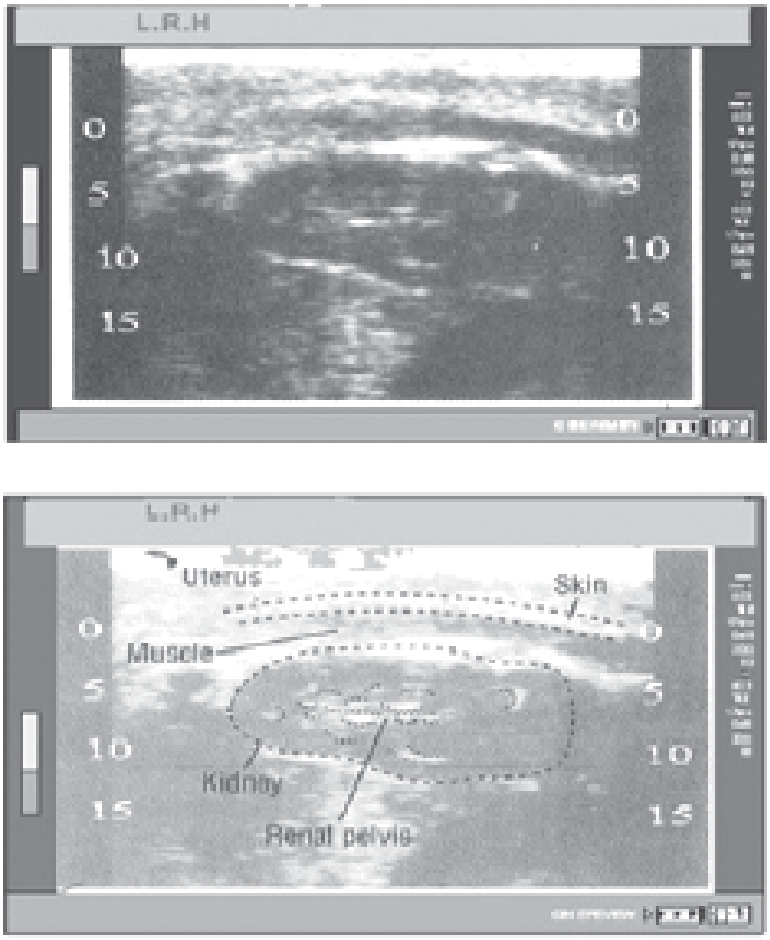

Fig. 1: Measurement of fetal renal length (35.9 mm) of the gestational age of twenty nine weeks (longitudinal scan)

Fig. 2: Photoragh showing manual measurement of renal length after removal of perinephric fat.

ference in the measurements of sample I and sample II is negligible, i.e. $p < 0.01$.

DISCUSSION

On sonography fetal renal structures cannot be reliably imaged during the early embryologic events of the first trimester. However in the majority of pregnancies, the developing kidney scan be seen by the early second trimester. Using articulated arm and water – path scanners, fetal kidneys can be seen by the 15th postmenstrual week in 50% of gestations and can be reliably imaged in 90% between 17 & 22 weeks.[10] Our own experience using higher resolution real time equipment, suggests that normal fetal kidneys are often visualized as early as 14 menstrual weeks and routinely seen by the 16 menstrual week.

Initially, the kidneys are visualized on transverse scans of fetal abdomen as paired hypoechoic structures adjacent to fetal spine.[11]

Normal growth of fetal kidney has been evaluated by several groups of researchers. There is exponential increase in renal weight from abortuses between 6 and 17 weeks.[12] The measurements of kidneys of still born fetuses show renal length to increase linearly with gestational age[3].It correlates with normal sonographic measurements.[13]

The renal length does not change significantly from 35 weeks of gestational age until term.[14] Our results in both the samples showed similar trend. There is a linear relationship of renal length to BPD.[2] Our observations showed similar results.

Delayed visibility may occur when factors such as maternal obesity or large uterine fibroids limit the fetal survey.[15]

Anomalies of genitourinary tract result from arrested development early in organogenesis, failure of normal ascent, obstruction of collecting system and abnormal formation of renal tubules. These anomalies are most often isolated but may also occur in association with or may cause other fetal structural abnormalities. Association between genitourinary and other organ system anomalies occur in a broad variety of inherited or sporadic syndromes including chromosomal abnormalities.[5,6,16,17] In addition urinary tract abnormalities that decrease urine production cause oligohydramnios especially it is severe when present prior to 20 weeks, pulmonary hypoplasia, facial defects including flattened nose and low set ears and club foot or other limb positional abnormalities may result.[18,19]

CONCLUSION

In the present study, the reliability of fetal renal length by ultrasonography was assessed by comparing the measurements of fetal renal length obtained by ultrasonography with that manual measurement. The statistical analysis showed in-

significant difference between two measurements. It is suggested that measurement of renal length by ultrasonography is an accurate modality used for the assessment of renal length and growth, fetal well being and to exclude intrauterine growth retardation.

Acknowledgements: Authors are indebted to Radiology Department of L.R.H for their technical support and Gynae & Obstetrics units for their help to conduct the research.

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