

ULTRASONOGRAPHIC NORMOGRAM OF FETAL KIDNEY CIRCUMFERENCE AND FETAL ABDOMINAL CIRCUMFERENCE RATIO FOR EARLY PRENATAL DIAGNOSIS

K.K. Roy
S. Mittal
K. Buckshee

ABSTRACT

Serial ultrasound scans were done in 300 fetuses between 16 to 24 weeks of gestation to establish the normogram of fetal kidney circumference (FKC) and fetal abdominal circumference (FAC) ratio (FKC/FAC). Of 300 fetuses, 150 fetuses were in the high risk group for fetal malformation and 150 patients were in the control group. The value of FKC/FAC varied from 0.27 to 0.30 from 16 to 24 weeks of gestation. No statistical difference was observed in the value of FKC/FAC in high risk and low risk (control) cases ($p > 0.05$). The value of FKC/FAC greater than or equal to 0.5 at 20 weeks or more was pathological for enlarged kidney. In 4 cases of multicystic kidney, the value of FKC/FAC ranged from 0.50 to 0.52 which was approximately 6SD above the normal mean ratio for that period of gestation.

Key words: Prenatal diagnosis. Ultrasound, Fetal kidney circumference. Fetal abdominal circumference.

Ultrasonography has become a major tool to delineate fetal phenotype *in utero* and numerous congenital malformations can be detected at an early period of gestation(1). Serial monitoring of fetal kidney circumference and abdominal circumference ratio can provide early prenatal diagnosis of enlarged kidney disorders(2-5).

Early diagnosis allows optimum management regarding continuation or termination of pregnancy, offers the opportunity to develop specific intrauterine therapy, influences choice of timing and mode of delivery and provides immediate neonatal care by specialists. The study of the normograms of FKC/FAC in Indian fetuses is not reported yet. Thus, this study was conducted with the aim of standardization of the norms of FKC/FAC between 16 to 24 weeks of gestation for early detection of fetal enlarged kidney.

Material and Methods

A total of 300 pregnant women attending antenatal clinic at the All India Institute of Medical Sciences were included in the study. Patients were divided into two groups. Group-I patients included 150 pregnant women with no high risk factors for fetal malformation and Group-II patients included 150 pregnant women who were at high risk for congenital malformation. The various high risk factors included were pregnancy with oligohydroamnios, congenital malformation in the previous baby,

From the Department of Obstetrics and Gynecology, All India Institute of Medical Sciences, New Delhi 110 029.

Reprint requests: Dr. Kallol Kumar Roy, Assistant Professor, Department of Obstetrics and Gynecology, All India Institute of Medical Sciences, New Delhi 110 029.

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unexplained still births, pregnancy complicated with diabetes or abnormal glucose tolerance, pregnancy with increased maternal serum alfa feto protein and pregnant patients with history of viral infection in the first trimester.

Serial ultrasonography was performed in three sittings, first at 16 to 18 weeks, second at > 18 to 20 weeks and finally at >20 to 24 weeks of gestation. Taking the fetal aorta as a reference, fetal lie was ascertained. Transverse scan was then performed at right angles to the long axis of the fetus until umbilical vein was identified. Fetal kidneys could be seen on either side of the spine inferior to the stomach (Fig. 1). Efforts were made to include both kidneys in the same scan. The

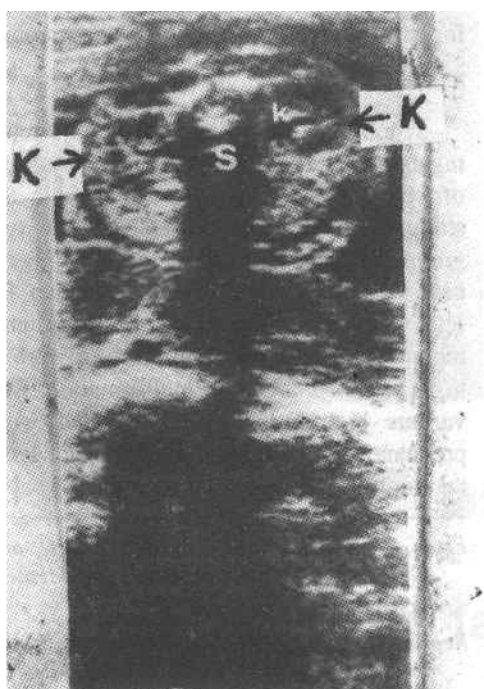


Fig. 1. Ultrasonography showing fetal kidney and spine. K-Fetal kidney at 18 weeks of gestation. S-Fetal spine.

fetal kidney circumference (FKC) and fetal abdominal circumference (FAC) were measured and their ratio was calculated. Next the transducer was focussed on fetal bladder to see any overdistension. The fetus was also scanned for other congenital malformations.

Results

The mean values of normograms of fetal kidney circumference (FKC), fetal abdominal circumference (FAC) and the ratio of FKC and FAC of 300 patients at 16-18, > 18-20 and >20-24 weeks of gestation are shown in Table I. The ratio of FKC and FAC varied from 0.27 to 0.30 from 16th to 24th week of gestation. No statistical difference in the value of FKC/FAC was found in high risk and low risk (control) cases ($p > 0.05$).

The values of FKC, FAC and FKC/FAC in 4 detected cases of multicystic kidney are given in Table II. A mean value of FKC/FAC ratio greater than or equal to 0.5 at 20 weeks or more was suggestive of enlarged kidney (Fig. 2).

Discussion

With increasing knowledge and widening operator expertise in ultrasound scanning, it is possible to detect enlarged fetal kidney disorders at an early period of gestation by serial monitoring of fetal kidney circumference (FKC) and fetal abdominal circumference (FAC) ratio. Normal fetal kidneys can be identified at 15th to 16th week of gestation(5-7). In our study in 90% patients, both kidneys could be identified at 16th to 18th week of gestation. The detection of enlarged multicystic kidney disease with typical sonographic picture of multicystic abdominal mass has been reported(8-10). Hobbins *et al.*(2) reported the normo-

TABLE I - Mean Value of FKC/FAC in High Risk and Low Risk Patients (Total Number of Patients = 300)

Variable	16-18 weeks		> 18-20 weeks		>20-24 weeks	
	High risk	Low risk	High risk	Low risk	High risk	Low risk
FKC (cm)						
Mean	2.8	2.8	3.6	3.5	5.2	5.2
SD	0.62	0.64	0.74	0.70	0.81	0.79
FAC (cm)						
Mean	10.2	10.1	12.2	12.2	17.2	17.1
SD	1.56	1.48	1.88	1.84	1.76	1.72
FKC/FAC						
Mean	0.27	0.27	0.29	0.29	0.30	0.30
SD	0.02	0.03	0.03	0.03	0.03	0.02

The mean value of FKC/FAC varies from 0.27 to 0.30 from 16 to 24 weeks of gestation.

FKC : Fetal kidney circumference.

FAC : Fetal abdominal circumference.

TABLE II - Value of FKC, FAC and FKC/FAC in Detected Multicystic Kidney

Variable	Case 1	Case 2	Case 3	Case 4
FKC(cm)	9.5	8.6	10.1	9.1
FAC (cm)	18.4	17.2	19.2	18.2
FKC/FAC	0.51	0.50	0.52	0.50
Gestation (wks)	20	20	20	24

In 4 detected cases of multicystic kidney the value of FKC/FAC > 0.5.

FKC : Fetal kidney circumference.

FAC : Fetal abdominal circumference.

gram of FKC/FAC ratio. This study revealed that the value greater than or equal to 0.4 after 20 weeks of gestation suggested enlarged kidney. Grannum *et al.*(3) showed that the ratio KC/AC remained constant throughout pregnancy (0.27-0.30) and in case of enlarged kidney, the KC/AC was more than 0.45 after 18 weeks of gestation. Cambell's study(4) showed that FKC/FAC of 0.5 at 18 weeks or more was suggestive

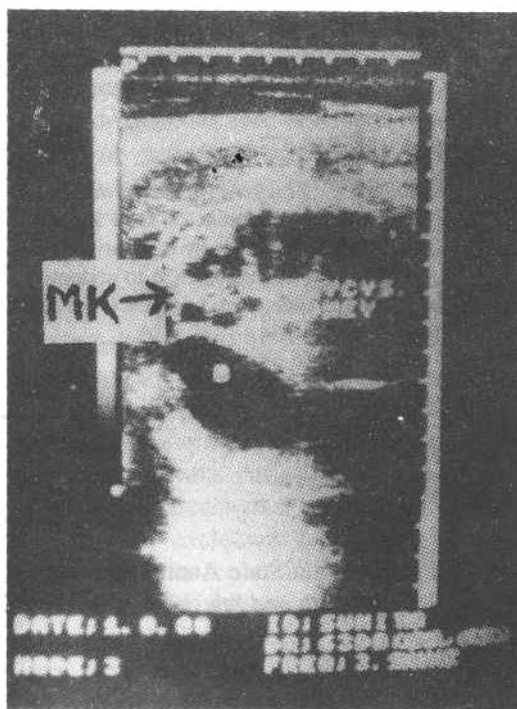


Fig. 2. Ultrasonography showing a multicystic kidney. MK-Multicystic kidney at 20 weeks of gestation.

of enlarged kidney. In our study, the value of FKC/FAC increased slightly from 0.27 to 0.30 with the advancement of pregnancy from 16 to 24 weeks of gestation. Four cases of multicystic kidney disease were detected at 20 to 24 weeks of gestation where FKC/FAC ranged from 0.50 to 0.51. The ratio greater than or equal to 0.5 after 20 weeks of gestation was, therefore taken to be suggestive of pathological enlargement of fetal kidney. The normograms of FKC/FAC provided will be a useful parameter for early diagnosis and timely optimum management of fetal enlarged kidney.

REFERENCES

1. Elejalde BR, de Elejalde MM. Fetal phenotypic analysis. *Indian J Pediatr* 1986, 53: 477-488.
2. Hobbins JC, Romero R, Grannum P, Berkowitz RL, Cullen M, Mahoney M. Antenatal diagnosis of renal anomalies with ultrasound. *Am J Obstet Gynecol* 1984, 148: 868-877.
3. Grannum P, Bracken M, Silverman R, Hobbins JC. Assessment of fetal kidney size in normal gestation by comparison of ratio of kidney circumference to abdominal circumference. *Am J Obstet Gynecol* 1980, 136: 249-254.
4. Campbell S. Ultrasound visualization of congenital malformation. *Brit Med Bull* 1983, 4: 322-329.
5. Hadlock FP, Deter RL, Carpenter R, Gonzalez ET, Park SK. Sonography of fetal urinary tract anomalies. *Am J Radiol* 1981, 137: 261-267.
6. Helin I, Persson PH. Prenatal diagnosis of urinary tract anomalies by ultrasound. *Pediatrics* 1986, 78: 879-883.
7. Lawson TL, Foley WD, Berland LL, Clark KE. Ultrasonographic evaluation of kidneys: Analysis of normal size and frequency of visualization as related to stage of pregnancy. *Radiology* 1981, 138: 153-156.
8. Main D, Mennuti MT, Cornfeld D, Coleman B. Prenatal diagnosis of adult polycystic kidney disease. *Lancet* 1983, 2: 337-338.
9. Ashe RG, Cambell N, Dornan JC. Antenatal detection of renal abnormalities. *Ir J Med Sci* 1992, 161: 626-629.
10. Barth RA, Guillot AP, Capeless EL, Clemmons JJW. Prenatal diagnosis of autosomal recessive polycystic kidney disease: Variable outcome within one family. *Am J Obstet Gynecol* 1992, 166: 560-561.