The Normal Fetal Kidney Measurement in in Normal Pregnant Ladies

Mohamed Adam[1,2], Jumaa Yousif Tamboul[3,4,] Mohamed Yousef[3,4,] Abdelmoneim Sulieman,[4,5]

[1]Colleges of Applied Medical Sciences Radiological Science Department, King Khalid University Kingdom of Saudi Arabia P.O. Box 61481, Abha
2Alzaeim Alazhari University, Faculty of Radiological Sciences and Medical Imaging.P.O. Box1432 Khartoum Bahri 13311-Sudan.
[3]College of Applied Science, Taibah University. P. O. Box 30001, Almadinah Almunawarah, KSA
4College of Medical Radiologic Science Sudan University of Science and Technology P. O. Box 1908, Khartoum, Sudan
[5]College of Applied Medical Sciences, Radiology and Medical Imaging Department, Salman Bin Abdulaziz University, Alkharj, Saudi Arabia,
mohnajwan@gmail.com

Abstract: Accurate estimation of normal antenatal fetal kidneys size is of great importance, thus determination of normal measurements was help in early diagnosis and optimize fetal safety then reduce the high prenatal morbidity and mortality. The objectives of this study are: to rule out the normal fetal kidneys dimensions among Sudanese population and to develop a local standard with ultrasound as well as to detect the range of fetal kidneys size in third trimester among Sudanese population and comparing the results with the international standard. This study was carried out in Khartoum state Sudan at Al Ahfad center for familly health, AAU Radiobiology department, and Alsalam AL Raed hospital from 1-8-2012 until 1-11-2012, a total of 100 normal pregnant ladies with no previous delivery of fetus with congenital anomaly or obvious fetal disease at (28-40) weeks gestational age. The study demonstrated that the mean renal length of fetal kidneys in third trimester in Sudanese was 34.2 mm, 40.9 mm and 44 mm in premature, mature and full-term fetuses respectively. The mean renal width of fetal kidneys in third trimester was 18 mm,23 mm, and 25.5 mm in premature, mature and full-term fetuses respectively. The mean renal thickness of fetal kidneys in third trimester in was 17.6 mm, 22.2 mm, and 24.5 mm in premature, mature and full-term fetuses respectively. The mean renal volume of fetal kidneys in third trimester was 5.6 mm^3, 9.8 mm^3,and 10.5 mm^3, in premature, mature and full-term fetuses respectively. The study showed proportional relationship between gestational age and fetal weight. Concerning to the sex there was weak correlation. Comparing the international records the result of the study is more like the Netherlands population. It is recommended to implement this study in ultrasonography departments locally And to establish further studies using large sample volume taking in concern all other factors that affect fetal kidneys size.
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1. Introduction

Kidneys in the second and third trimesters typically have the same configuration as in postnatal life, their appearance depend on the gestational age at which the study is performed. (William et al 2003). A true estimation of gestational age (GA) plays an important role in quality maternity care such as assessment of fetal growth and to schedule the labor date. Any inaccurate estimation may lead to perinatal morbidity and mortality due to iatrogenic pre- or postmaturity. The first day of the last menstrual period (LMP) is used for pregnancy dating in a regular 28-day menstrual cycle. However, there is some evidence that about 30% of women forget their accurate LMP or misunderstand early pregnancy bleeding as normal menses (Wegienka et al, 2005, Waller et al 2000). Also, inaccuracy of estimation in pregnancy dating

may be as a result of delay ovulation due to hormone therapy or oligo-ovulation. The development of diagnostic ultrasound has opened new possibilities for more confident assessment of dating. GA can be estimated in the first trimester by ultrasonic measurement of diameter and volume of gestational sac as well as crown–rump length (CRL) (Bailey et al 2012, Sahota et al, 2009, Karki et al 2006, Lobo, et al 2011). Also, other biometric indices such as fetal biparietal diameter (BPD), femur length (FL) transcerebellar diameter (TCD), clavicle length (CL), foot length, and head circumference (HC) are used for GA estimation during different pregnancy trimesters (Lobo, et al 2011). Although fetal biometry measurements indicated accurate indices for GA estimation in the early second trimester, the biological diversity of size lead to change in accuracy of these

parameters as the age of fetus advanced and a true dating in late second or third trimester is difficult. So, some studies focused on the association of kidney size in a normal fetus with gestational age (Sampaio et al 1995, Konje, 2002). Interest in fetus life used to be focused, for centuries, on the studies of embryo and mechanical problems encountered by gynecologists at the delivery. Now a days, it is well known that the development of fetus is not proportional to the growth of it is organs, and that each stage in the fetus life is specific, (Slobodan et al 2005). The aim of this study was to determine the normal fetal kidneys measurements in third trimester among Sudanese population.

2. Material and Methods

The study populations of 100 cases, for evaluation of the fetal kidneys with ultrasound were randomly selected from a group of pregnant ladies at (28-40) weeks of pregnancy at Al Ahfad center for family health, AAU clinic, and Alsalam Alraed hospital, This is nonintervention descriptive study, was carried out over a period of three months from first of August to first of November 2012. Different types of ultrasound machines with low frequency, good penetration probes which are available in the area of the study will be used. Data collection sheet (structured questionaire) was used

Technique:

In this study after taking an informed consent the client, were scanned by routine sonographic evaluation, following the scanning protocol by

(Sandra Hagen-Ansert, MS, RDMS, RDCS) and findings of scan was recorded.

Data analysis:

Information's derived from data were collected from a comprehensive data base of sonographic examination, designed for the purpose of the study in addition to routine sonographic evaluation, and client examination including weight in grams and age in weeks, and gender, fetal kidneys measurements at length, width, thickness, and volume and social activity were recorded. The collecting data are fed into computer using Microsoft Excel. Means and percentages were recorded (ages, weight, and fetal sex) as independent variables. $P < 0.05$ was regarded as significant.

3. Results

The study populations of 100 cases normal Sudanese pregnant ladies at (28-40) weeks of pregnancy, for evaluation of the fetal kidneys using ultrasound.

51 cases (51%) their gestational ages range between (28 – 35) weeks, 42 cases (42%) their range of ages between (36 - 39) weeks, and 7cases (7%) their ages are 40 weeks. It was found that the client sex out 55 cases (55%) males. And 45 cases (45%) females. 51 cases (51%) their weights ranging between 2000 and 2400 grams. And 42 cases (42%) their weights ranging between >2400 and 3000 grams. Also 7 cases their weights are more than 3000 grams. Table (1)

Table (1): Shows values of different parameters in respect of age groups.

Fetus age group	Estimated fetal weight in grams	Average renal volume (mm³)	±SD	Correlation	Statistical significance
Premature	2000	5.6	1.3	o.925*	<0.001
	>200 up to 2400	5.8	1.1		
Mature	>2400 up t0 2550	9.3	1.4		<0.001
	>2550up to 3000	9.5	1		
Full-term	>3000 up to 3100	10.1	1.2		<0.001
	>3100	10.2	1.6		

Table (2): Shows the correlation between gestational age and average renal volume of the samples of the study.

Parameter	Fetus age group	Range of values		Mean value
		Minimum	Maximum	
Length in (mm)	Premature	31	39	34.2
	Mature	39	43	40.9
	Full-term	41	45	44
Width in (mm)	Premature	13	18	18
	Mature	19	25	23
	Full-term	23	28	25
Thickness in (mm)	Premature	12	20	17.6
	Mature	17	24	22.2
	Full-term	21	26	24.5
Volume in (mm³)	Premature	3.2	8.5	5.6
	Mature	7	11.7	9.8

Table (3): Shows the correlation of fetal gender and average renal volume of the samples of the study

Age group	Average Volume	± SD	Correlation	Statistical Significance
Premature	5.6	1.4		0.001
Mature	9.8	1.3	0.95*	0.000
Full-term	10.5	1.6		0.003

Table (4): Shows the correlation between estimated fetal weight and average renal volume of the samples of the study.

Gestational age in weeks	Average kidney volume(mm^3) ± SD		Correlation	Statistical significance
	Male	Female		
28	4.4± 2.3	4.3± 2.5	0.01	0.002
32	6.9 ±1.3	6.7 ±1.4		0.000
36	9.9 ±1.6	9.7±1.7		0.000
40	11±1.1	10.7± 2.2		0.02

4. Discussions

It was found that client age out of 100 cases were included in this study from normal Sudanese pregnant ladies. 51 cases (51%) their range of ages between 28 weeks and 35 weeks, 42 cases (42%) their range of ages between 36 weeks and 39 weeks, and 7cases (7%) their ages are 40 weeks.

The normal renal length in premature group ranged between 31 mm and 39 mm with mean approximately 34.2 mm, and between 39 mm and 43 mm in mature group with mean value of 40.9 mm approximately. Also ranging between 41 mm and 45 mm in full-term group with mean value approximately of 44mm.

The normal renal width in premature group ranging between 13mm and 18 mm, with mean value approximately 18 mm. And ranging between 19 mm and 25 mm,with mean value approximately 23 mm in mature group. And also ranging between 23 mm and 28 mm with 25.5 mm as mean value in full-term group.

The normal renal thickness in premature group, ranged between 12 mm and 20 mm with 17.6 mm as mean value, and ranged between 17 mm and 24 mm in mature group with mean value approximately 22.2 mm. It is ranged between 21 mm and 26 mm in full-term group with mean value approximately 24.5 mm.

The normal renal volume ranging between 3.2 mm up to 8.5 mm with mean value 5.6 mm, and 7 mm up to 11.7 mm with mean value 9.8 mm, and 7.9 mm up t0 14 mm with mean mean value 10.5 mm, in premature group, mature group, and full-term group respectively.

There is significant association or correlation was found in this study between gestational age and average fetal renal volume is found when volumes are compared across the 28 to 40 week range of gestational ages (p<0.001). Table (2).

It was found that the 55 cases (55%) males. And 45 cases (45%) females. The study was showed that there is no statistical significance (p<0.05) in kidney volume of certain age between different sexes was found. Table (3).

51 cases (51%) their weights ranging between 2000 and 2400 grams. And 42 cases (42%) their weights ranging between >2400 and 3000 grams. Also 7 cases their weights are more than 3000 grams.

The study was showed that there is significant difference in the average fetal renal volume is found when volumes are compared across the 2000 to >3000 grams range of fetal weights (p<0.001). Table (4). But there is no significant effect of fetal weight difference on the fetal kidneys volume is found in the same age group (r=0.00).

This study agreed with findings of the international previous study by Romero et.al1989)...

Conclusion

There was strong correlation between gestational age, fetal weight and fetal kidneys volume. There was weak correlation between the fetal gender and fetal kidneys volume. Further studies should be performed with taking large sample size to satisfy the measurements of the fetal kidneys.

Corresponding Author:
Dr. Mohamed Yousef
Department of Diagnostic Radiologic Technology, Taibah University College of Medical Radiologic Science, Tel: +96631028059, Fax: +9668475790,
E-mail ohnajwan@gmail.com

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