

EVALUATION OF HYDRONEPHROSIS, DURING PREGNANCY IN NIGERIAN WOMEN

*OI Oyinloye, **AA Okoyomo

Departments of *Radiology, University of Ilorin Teaching Hospital, Ilorin, ** Obstetrics and Gynaecology, Federal Medical Centre Lokoja Nigeria.

ABSTRACT

Objective: Hydronephrosis is common during pregnancy. However, pattern of dilatation and effect of urinary tract problems are still largely controversial. The study aims to determine, the pattern of dilatation of the collecting system during pregnancy, effect of urinary tract problems and parity on the degree of dilatation, in our environment.

Materials and Methods: Subjects were 135 women with singleton pregnancy (Gestational age of 12-40 weeks) and 43 non- pregnant women of child bearing age, referred to the ultrasound unit of Federal Medical centre Lokoja, Nigeria, for routine obstetrics sonography. Duration was, from January 2004 to may 2004. The pelvicalyceal diameters were measured and classified into mild, moderate or severe dilatation.

Result: Hydronephrosis of pregnancy was found to have an incidence of 93.4% on the right side and 84.4% on the left side. A linear relationship was established between gestational age and mean pelvicalyceal diameters for both kidneys. Mean pelvicalyceal diameter was higher in women with urinary tract problems than those without, and this was statistically significant for the right kidney. ($p > 0.05$). No association was however found with parity.

Conclusion: Hydronephrosis is common in pregnancy with a right sided predominance. Pelvicalyceal diameter increases gradually throughout pregnancy with advancing gestational age. Urinary tract problems seem to cause increase in pelvicalyceal diameter while parity has no influence.

Key Words: Pregnancy, hydronephrosis, ultrasound.

(Accepted 30 January 2009)

INTRODUCTION

Pregnancy is associated with dilatation of the collecting system of the kidneys. It involves the calyces, renal pelvis, and ureters. Dilatation is usually more pronounced in the right kidney compared to the left side, absence of involvement of the ureters below the pelvic brim, and regression of the dilatation several weeks postpartum¹⁻⁴. This pattern has been termed physiological hydronephrosis of pregnancy^{2,5}. A lot of controversies surrounds the pattern of dilatation throughout pregnancy and there is no good consensus in the literature on criteria's to define hydronephrosis of pregnancy and how a clinician may distinguish between physiological and pathological degrees of dilatation at each stage of pregnancy^{2,6}.

To the best of our knowledge, no study has been done in our environment to determine the pattern of dilatation of the collecting system of the kidneys during pregnancy.

Our study would also aim to determine the effects of urinary tract problems, and parity on the degree of

pelvicalyceal dilatation during the course of pregnancy.

MATERIALS AND METHOD

Subjects consisted of 135 women with singleton pregnancy (Gestational age of 12-40 weeks) referred to the ultrasound unit of Federal Medical centre Lokoja, Nigeria, for routine obstetrics sonography, from January 2004 to may 2004, and 43 non-pregnant women of child bearing age.

All 178 subjects emptied their urinary bladder before scanning to remove the possible effect of full-bladder on upper urinary tract dimensions.

Renal ultrasound (US) was performed using a Siemens Sonoline SX system with a mechanical linear array scanner and a 3.5MHz probe.

Patients were in the prone position and the kidneys scanned in the longitudinal plane from lateral to medial edge. To assess the degree of hydronephrosis, we measured the maximum separation of the echolucent renal pelvi-calycal complex in millimetres from leading edge to leading edge (Fig 1). A system of grading as detailed by peake et al was used.

Grade 0: Normal size, renal pelvi-calycal diameter 0-5mm

Grade I: Mild dilatation, renal pelvi-calyceal diameter 6-10mm.

Grade II: Moderate dilatation, renal pelvi-calyceal diameter 10-15mm.

Grade III: Severe dilatation, renal pelvi-calyceal diameter \geq 16mm.

For purpose of analysis, the right and left kidneys were considered separately, and pregnant subjects were divided into groups of five weeks time span.(i.e.11-15 weeks and 16-20 weeks etc) Statistical analysis was done using statistical package for social sciences (SPSS) version 11.

Mean pelvicalyceal diameters between patients with Urinary tract problems and no urinary tract problems, Primiparous and multiparous patient, were compared using the student t tests with $p < .05$, considered significant.

Positive criterias for urinary tract history includes, hematuria, dysuria, episodic flank pain, positive laboratory findings on urinalysis, and urine culture.

Relationship between gestational age and pelvicalyceal diameters was also compared using the pearsons correlation coefficient.

RESULTS

Incidence of hydronephrosis

In the 43 non-pregnant women of child-bearing age used as control subjects, 85% of the right kidney and 83% of the left kidney showed grade 0 hydronephrosis with the remaining 15% on the right and 17% on the left showing grade 1 hydronephrosis. Out of the 135 pregnant subjects, 93.4% of the right kidney and 84.4% of the left kidney showed at least mild hydronephrosis.

A greater incidence of severe hydronephrosis was also noted on the right side(20.7%), than the left side.(8.1%).(table 1).

Pattern and range of hydronephrosis.

Table 2 shows the mean pelvicalyceal diameter of the right and left kidneys and corresponding GA range. These are represented by the scatter graphs in fig 2 and fig 3 respectively.

In fig 2, a good positive correlation ($r = 0.93$ and p value = 0.008) was obtained for the right kidney. This clearly indicates a linear relationship between gestational age and pelvicalyceal diameter for the right side. In fig 3, a good positive correlation was also obtained for the left kidney indicating also a linear relationship between gestational age and pelvicalyceal diameter for the left side. ($r = 0.98$ and $p = 0.001$).

Effect of renal or urinary tract problems.

The mean pelvicalyceal diameters for those subjects, with history of UTI or problems were calculated.

Table 3 shows the mean pelvicalyceal diameter for both groups.

Mean pelvicalyceal diameter was higher for pregnant

women with history of UTI for both kidneys, than those without.

However, this finding was statistically significant on the right side($p < 0.05$), while on the left it was not. ($p > 0.05$).

Effect of parity on hydronephrosis.

Mean pelvicalyceal diameter was slightly higher for the multiparous subjects than the primiparous patient. However, no significant difference was found between the 2 groups for both kidneys, ($p > 0.05$) for both. (Table 4)

Table 1: Pelvicalyceal Dilatation in Pregnancy: Incidence of Severity.

Grade	Right kidney	Left kidney
0	13(9.6%)	21(15.6%)
1	40(29.6%)	53(39.3%)
11	40(29.6%)	53(37.0%)
111	28(20.7%)	11(8.1%)
Total	135(100%)	135(100%)

Table 2: Mean Pelvicalyceal Diameter and Gestational Age.

Gestation (weeks)	Mean Pelvicalyceal Diameter for right Kidney(mm)	Standard Deviation	Mean Pelvicalyceal Diameter for left Kidney(mm)	Standard Deviation
11-15	7.4	4.2	6.5	4.8
16-20	10.6	5.8	8.4	3.7
21-25	10.9	5.4	8.4	3.5
26-30	10.8	5.1	9.5	4.1
31-35	13.6	5.3	11.2	4.0
36-40	13.7	6.0	12.2	4.3

Table 3: Urinary Tract Problems and Pelvicalyceal Diameter.

	Number	Mean Calyceal Diameter(Mm)	Std Deviation
No urinary Tract Problems	94 Rt	11.06	4.76
Urinary tract Problems.	39 Rt	14.23	6.73
No urinary Tract Problems	94 Lt	9.39	3.82
Urinary tract Problems.	39 Lt	11.64	4.52

Rt Right kidney.

Lt- left kidney.

Table 4: Parity and Pelvicalyceal Diameter.

	No	Pelvicalyceal Diameter(mm)	Std Deviation
Multiparous (Rt kidney)	95	12.34	5.79
Primiparous (Lt kidney)	40	11.22	4.91
Multiparous (Lt kidney.)	95	10.31	4.44
Primiparous. (Lt kidney)	40	9.27	3.31

Figure1:Renal Scan Showing Severe Pelvicalyceal Dilatation. (18mm)

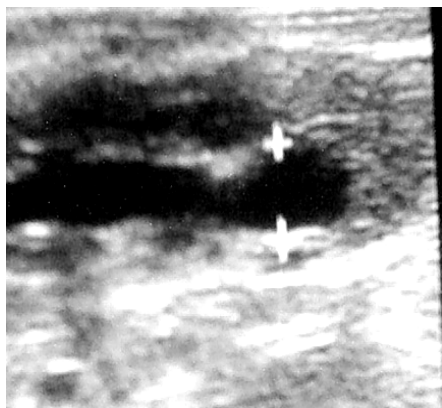


Figure 2:Scatter Graph of Gestational Age(GA) by Pelvicalyceal Diameter for the Right Kidney.

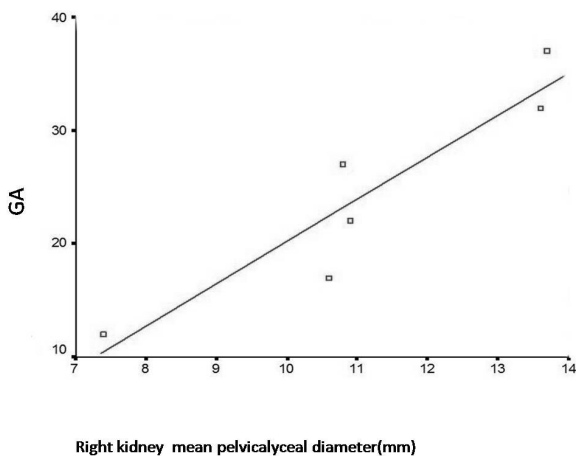
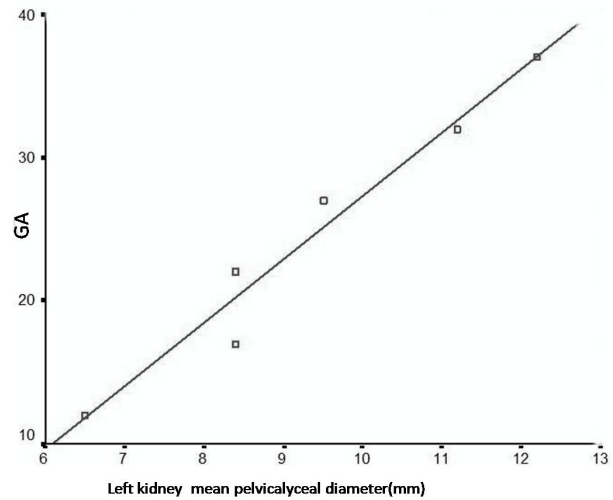


Figure3: Scatter Graph of Gestational Age(GA) By Pelvicalyceal Diameter for the Left Kidney.



DISCUSSION

The potential adverse effects of radiation on the foetus, often complicate traditional diagnostic imaging modalities like Intravenous urogram(IVU) and computed tomogram(CT) in evaluating hydronephrosis in pregnancy.

Therefore, renal ultrasound which is free from ionizing radiation is standard in evaluating signs of hydronephrosis in pregnancy.⁷

The incidence of pelvicalyceal dilatation in this study was 93.4% on the right and 83.4% on the left. This findings is similar to previously reported in other studies of 60-100% for both kidneys, with a greater incidence on the right^{1,4}.

Reasons proffered for hydronephrosis in pregnancy, include compression of the gravid uterus on the ureters,(mechanical theory)^{1,2,8}.This is thought to cause a partial obstruction to the flow of urine, increased pressure in the proximal ureter, and subsequent development of ureteral and calyceal dilatation.

The smooth muscle relaxing effect of progesterone,which is analogous to the smooth relaxation effect on the uterus by high level of progesterone (hormonal theory),is also thought to be a possible mechanism for hydronephrosis of pregnancy^{9,10}. The frequency of occurrence being higher on the right side, is thought to be due to dextrorotation of the uterus to the right side and relative protection or the right ureter by the sigmoid colon.The right ureter also crosses the iliac vessels more proximally ,and, therefore lie on the less distensible proximal iliac artery¹¹. In this study, it was difficult to determine the exact onset of hydronephrosis,since there was insufficient number of subjects between zero and 12 weeks. However, the

pattern of hydronephrosis of pregnancy observed in this study, is a gradual increase in dilatation throughout pregnancy, with hydronephrosis seen as from 12 weeks GA.

Gestational age and pelvicalyceal dimensions showed a positive correlation for both kidneys.(fig1 and 2).this findings are in agreement with the findings of fried et al and Peake et al.

Some authors have however observed a different pattern. Erikson et al found a maximal diameter to occur between 24-28 weeks, they attributed their findings to maximal compression of the gravid uterus which was wedged in the pelvis at this time, together with a competent abdominal musculature⁸.

There has been controversy on how to delineate between physiological and pathological degrees of dilatation during pregnancy^{2,6}. This becomes more intriguing when a patient develop symptoms of urinary tract infection, superimposed on the hydronephrosis, which has been termed symptomatic hydronephrosis of pregnancy.

There was some association between urinary tract problems and pelvicalyceal diameter, especially in the right kidney. The mean pelvicalyceal diameter was found to be higher for both kidneys in women with urinary tract problems, than does without. The observation was found to be statistically significant for the right kidney. It was also observed that the highest mean pelvicalyceal diameter obtained in this study in the course of pregnancy (13.7mm), was less than the mean pelvicalyceal diameter for does with urinary tract problems(14.2mm).Our findings differ from Peake et al², who found no association between history of urinary tract problems and degree of dilatation.

We believe from our findings that patient with symptomatic hydronephrosis generally have higher mean pelvicalyceal diameters than does that do not have, especially in the right kidney. Therefore renal ultrasound may play a role in delineating physiologic hydronephrosis from pathologic hydronephrosis ,and determine those in which further investigations like intravenous urogram, and computed tomography will be indicated.

We found no association between parity and degree of dilatation in this study. These findings are in agreement with others^{1,2}.

CONCLUSIONS

Our study showed hydronephrosis of pregnancy to be very common in pregnancy and predominantly right sided. It gradually increases in degree with advancing GA.

We also observed that the severity tends to be more in the background of underlying urinary tract problems, and therefore, renal ultrasound during pregnancy can serve as a clinical application for non-

invasive delineation between physiologic from pathological hydronephrosis of pregnancy.

Parity, however does not seem to affect the degree of hydronephrosis.

REFERENCES

1. **Fried AM, Woodring JH, Thompson DJ.** Hydronephrosis of pregnancy: a prospective sequential study of the course of dilatation. *J Ultrasound Med* 1983;2:255-9.
2. **Peake SL, Roxburgh HB, Langlois SL.** Ultrasonic assessment of hydronephrosis of pregnancy, *Radiology*,1983;146:167-170.
3. **Valón VP, Sánchez BF, Pallas CY, et al.** Symptomatic hydronephrosis during pregnancy *Arch Esp Urol.* 2005;58:977-82.
4. **Cietak KA, Newton JR.** Serial qualitative maternal nephrosonography in pregnancy. *Br J Radiol* 1985; 58: 399-404.
5. **Waltzer WC.** The urinary tract in pregnancy.*J urol*1981;125:271-276.
6. **Watson WJ, Brost BC.** Maternal Hydronephrosis in Pregnancy: Poor Association with Symptoms of Flank Pain .*Amer J Perinatol* 2006; 23: 463-466.
7. **McArthur T, Chad SC, Michael AM.** Hydronephrosis during pregnancy *The American Journal of Emergency Medicine* . 2007;25: 482-483.
8. **Erikson LM, Nicholson SF, Lewal DB, Frischke L.** Ultrasound evaluation of hydronephrosis of pregnancy.*J Clin Ultrasound* 1979;7:128-132.
9. **Clayton JD, Roberts JA.** The effect of progesterone on ureteral physiology in a primate model. *J Urol* 1972;107: 945-948.
10. **Berman LB.** The pregnant kidney.*JAMA.*1974;230:111-112.
11. **Ofer F, Beny A, Ronni G, Joseph B. Lessing, M Kupferminc.** The management of symptomatic hydronephrosis in pregnancy. *BJOG* 2002; 109 :1385-1387.