Assessment Of Renal Function In Pregnant Women Using Biochemical And Radiological Techniques In Nigeria.

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Citation

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Abstract

Background: Pregnancy is usually associated with increased vascular volume. This is usually considered physiologic rather than pathologic change because the condition easily resolves few minutes after delivery. Hypervolemic state will affect the concentrations of certain parameters thus reducing their usual predictive and diagnostic power. This work presents the findings of a study among women in a low resource setting in southeast Nigeria. The present study was designed to assess if the predictive and diagnostic powers of such biochemical parameters like serum urea, creatinine, uric acid, calcium and inorganic phosphate were compromised in pregnant women and possible diagnostic role. The use of ultrasonography may play in revealing the status of the kidney.Methodology: Thirty (30) pregnant women and twenty (20) non-pregnant women with no known history of renal problem were recruited for the present study. Blood samples were collected from all the participants and the serum components were extracted for the laboratory analyses of urea, creatinine, uric acid, calcium and inorganic phosphate while the ultrasound was used to obtain the ultrasonograhic status of the kidney, after obtaining an informed signed consent. Method for serum determination of urea was with diacetylmonoxine as modified by Wybenga (1971).Results: The findings showed no significant differences in mean (±SD), serum concentrations of urea; creatinine and uric acid between the pregnant woman and non-pregnant women ($p>0.1$ in each case). However, the ultra sonogram showed no difference in the mean parenchymal thickness of 1.9cm left and 1.91 ± 0.2cm^3. Mean renal length is 80mm and this is not lower than was found in other studies of non-pregnant adult females.Conclusions: The use of serum urea and creatinine for kidney functional screening has gained a widespread acceptability amongst diagnostic experts. However, in cases where there has been a high suspicion of possible kidney functional impairment with inability of any of the usually used biochemical parameter to reveal same, radiological techniques may be used to further confirm such suspicion. The present design being a pilot study did not observe any loss in predictive and diagnostic ability of serum urea, creatinine and uric acid in screening for the kidney functional integrity in pregnant women. Since both the pregnant and non-pregnant women were apparently healthy, the finding in the present study suggest normal functional kidney despite the known hypervolemia usually reported in pregnant women. Ultrasound showed normal cortico-sinus differentiation in all the patients.

BACKGROUND

Pregnancy is usually associated with increased vascular volume. This is usually considered physiologic rather than pathologic change because the condition easily resolves few minutes after delivery[10]. Hypervolemic state will affect the concentrations of certain parameters thus reducing their usual predictive and diagnostic power[7]. Therefore, it may not be proper in all cases to use references deduced from non-pregnant adults to infer in pregnant adult as this maybe misleading. Secondly, the use of radiological technique may help in determining the possible real state of certain organ function in pregnancy irrespective of hypervolemic state[11]. The present study was designed to assess if the predictive and diagnostic powers of such biochemical parameters like serum urea, creatinine, uric acid, calcium and inorganic phosphate were compromised in pregnant women and possible diagnostic role. The use of ultrasonography may play in revealing the status of the kidney.

METHODOLOGY

Subjects: Thirty (30) pregnant women and twenty (20) non-pregnant women with no known history of renal problem were recruited for the present study. They were aged between 20 and 45 years. Blood samples were collected from all the participants and the serum components were extracted for the laboratory analyses of urea, creatinine, uric acid, calcium and inorganic phosphate while the ultrasound was used to obtain the ultrasonograhic status of the kidney.

The pregnant women gave informed signed consent. Methods for serum determination of urea was with diacetylmonoxine as modified by Wybenga[8,12.]

STUDY AREA

The study was done at the Nnamdi Azikiwe University Teaching Hospital (NAUTH) Nnewi Anambra State, Southeast Nigeria. Nnewi is the second largest town in Anambra State in South East Nigeria and is a local government on its own. The Teaching hospital is the only tertiary health institution in Anambra State including Nnewi community and its environs. South Eastern Nigeria has a tropical continental climate with distinct wet and dry seasons. The average relative humidity is about 80% reaching 90% during rains.

Statistical Analysis: The variables were expressed as mean (±SD). The differences in mean were considered for significance using student's t-test.

Procedure: In brief, 0.01ml of each sample (diluted 1:1 with distilled water) was added to appropriately labeled test tubes containing 1ml of the mixed acid reagent and 1ml of diacetylmonoxine reagent. The mixtures in the various tubes were heated in boiling water for 20 minutes. The colour developed was read at 520nm against the reagent blank using the spectrophotometer. Similar procedure was used for the standard urea as for the sample. The concentration of urea in the various samples were thus determined. Determination of serum creatinine was by alkaline picrate reaction as described by Fabing et al[11]. In brief, 0.5ml of each sample (diluted 1:3 with distilled water) was added into test tubes containing 0.5ml of sodium tungstate and 0.5ml 0f 2/3N sulphuric acid, this process precipitates the proteins from the samples. After 5minutes centrifugation of the above solutions, 1.5ml of the supernatant is transferred into another sets of appropriately labeled test tubes containing 0.75ml of picric acid and 0.75mls of sodium hydroxide. After incubation for 15minutes, the absorbances of reaction colours were read at 520nm using the spectrophotometer. The creatinine standard solution was treated as explained for the samples. The concentrations of creatinine in the various samples were thus determined. Determination of serum uric acid by phosphotungstate method of Henry and Kim[10]. In brief, 1ml of each sample was added to appropriately labeled test tubes containing 8ml of distilled water. Into each test tubes was added 0.5ml of 2/3N sulphuric acid prior to centrifugation. After centrifugation, 3mls of protein free supernatants were added to other sets of appriopriately labeled test tubes containing 1ml of 14% $NaCO_3$ and 1ml of phosphotungstic acid. After 15minutes of incubation at room temperature, the colour reaction was read at 710nm against the reagent blank. The standard uric acid in the various samples were thus determined. The concentration of uric acid in the various samples were thus determined. Determination of serum calcium by EDTA titration as described by Baron and Bell[9]. In brief, 1ml of each serum sample was titrated with EDTA in the presence of an indicator. The end point of each titration is recorded. Similar procedure was used for standard calcium solution. The concentrations of calcium in sera of the participants were thus determined. Determination of inorganic phosphate by method as described by Gomorriet al (1942)[13]. In brief, into appropriately labeled test tubes containing 7.2mls of 10% trichloroacetic acid was added 0.8ml of each serum sample. After centrifugation, 0.5ml of each supernatant was transferred into appropriately labeled test tubes containing 1ml of ammonium molybdate solution and 1ml of metol solution. This reaction mixtures were allowed to incubate for 20minutes and their respective absorbances read at 660nm against reagent blank. The standard inorganic phosphate solution was treated as for the samples. The concentrations of the inorganic phosphates in the sera of the participants were thus determined.

Ultrasound Analysis: This was done at the radiology department of the tertiary health institution (NAUTH) located in Nnewi South East Nigeria. Renal ultrasound shows normal cortico-sinus differentiation in all patients[1]. Mean length of the kidneys is 110mm right and 116mm on the left.

RESULTS

The result showed no significant differences in mean (±SD), serum concentrations of urea; creatinine and uric acid between the pregnant woman and non-pregnant women ($p>0.1$ in each case) Table 1. However, the ultrasonogram showed no difference in the mean parenchymal thickness of 1.9cm left and 1.91 ± 0.2cm. Mean renal length is 80mm and this is not lower than was found in other studies of non-pregnant adult females.

Figure 1

Table 1: Mean ±SD serum concentrations of urea; creatinine and uric acid in pregnant and non-pregnant women.

Variable	Pregnant women (n= 30)	Non-pregnant women (n=20)	p-value
Serum urea (mmol/l)	3.80±1.34	4.17±0.95	>0.1(ns)
Serum creatinine (µmol/l)	68.64±7.48	69.96±9.96	>0.1(ns)
Serum uric acid (µmol/l)	250.03±30.91	251.00±29.92	>0.1(ns)

ns: non-significant.

DISCUSSION

This finding in the present study though limited by low number of participants, did reveal that serum concentrations of urea, creatinine and uric acid retained their predictive and diagnostic value in pregnancy, a more definitive technique that may reveal the impart of the hypervolemic physiologic state in pregnancy is revealed by the ultrasonogram.

In this preliminary report, a normal kidney sonogram is put side by side that of a pregnant patient. Enthusiasm for using renal parenchymal echogenicity in the diagnosis of renal disease has waxed and waned over the years. Increased parenchymal echogenicity in patients in patients with renal disease was first described in the late 1970s[2]. The early index for this biochemical change may rely on the mean parenchymal thickness[6]. This measures the cortex of the kidneys in at least three places viz; the upper pole, mid moiety and the lower pole, all devoid of the sinus as demonstrated on the legends (1 & 2). This is also useful in cases where ultrasound guided biopsies are needed to make meaningful diagnosis of a renal pathology. The mean renal parenchymal thickness (MRPT), normal for our environment is 1.91 ±0.2cm right and 1.95 ±0.19cm on the left. In this study, the Legends are in agreement with the work done in 2002 by Eze C. U et al [5] .The study suggests that for our population, kidneys with a renal length lower than 8.5cm and renal parenchymal thickness of 1.4cm or less should not be biopsied[5].

Obstruction of the lower aorta and the branches causes diminished blood flow to kidneys. Renal plasma flow and glomerular filtration rate begin to increase progressively during the first trimester[1]. This parallels the increases in blood volume and cardiac output. The elevations in plasma flow and glomerular filtration result in an elevation in creatinine clearance. After the 12 [th] week of gestation, progesterone can induce dilatation and atony of the renal calyces and ureters. With advancing gestation the enlarging uterus can compress the ureters as they cross the pelvic brim and cause further dilatation by obstructing flow[7]. Ours is a low resource center with no Doppler ultrasound facility, to observe and record the presence of renal artery dilatation or stenosis but a normal cortico-sinus differentiation was observed by all patients. The calyces were normal. The kidney size did not increase but remained at a mean of 110mm right and 116mm left respectively. There was no increase in echogenicity. The patients were nomo-tensive and renal changes associated in renal failure was absent sonograhically.

Hence critical assessment of the impart of hypervolemia of pregnancy on certain organ functions may need the high precision of radiological techniques in combination with biochemical evaluations.

CONCLUSION

The use of serum urea and creatinine for kidney functional screening has gained a widespread acceptability amongst diagnostic experts [2] . However, in cases where there has been a high suspicion of possible kidney functional impairment with inability of any of the usually used biochemical parameter to reveal same, radiological techniques may be used to further confirm such suspicion. The present design being a pilot study did not observe any loss in predictive and diagnostic ability of serum urea, creatinine and uric acid in screening for the kidney functional integrity in pregnant women. Since both the pregnant and non-pregnant women were apparently healthy, the finding in the present study suggest normal functional kidney despite the known hypervolemic usually reported in pregnant women. Ultrasound showed normal cortico-sinus differentiation in all the patients. Ultrasonographic evidence of renal failure lags behind the biochemical changes to the extent that before observable changes occur, serum urea, creatinine and electrolyte status would have indicated renal failure status.

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