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Protein/Creatinine Ratio Interest in Renal Impairment Screening among Hypertensive Expectant Mothers in Sub Saharan Africa

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Abstract

***Objective:** Determine the prevalence of renal impairment after calculating protein/creatinine ratio among expectant mothers with renal vascular disease.*

***Method:** It was a descriptive cross-sectional study conducted in the Obstetrics and Gynecology University Clinic (CUGO) of CNHU-HKM from April 3, 2017 to August 3, 2017. Patients included in this study wereexpectant motherswho reported to the hospital for either antenatal or emergency consultation in CUGO, with high of blood pressure ≥ 140/90 mmHg. They all gave their informed consent to take part in this clinical research.Non-probabilistic sampling was conducted, and expectant mothers meeting our inclusion criteria were included in the study.*

Data were collected on paper using the questionnaire, and then entered into Epi-Data version 3.1. Then, Epi-Data 2.2.2.182 and OpenEpi 3.01 were used for data analysis.

***Outcomes:** Among the 105 expectant mothers selected, 69 met our inclusion criteria.Theexpectant mothers aged ranged from 14 to 42 years, with mean age estimated at 28 ± 6.5 years. Globally, 7.41% of the expectant mothers had hypertension. Referral was the leading mode of admission to hospital. Headache was reported as themost frequent reason for consultation by 40.6% of patients. Hypertension occurred predominantly after 20 weeks gestation with approximately 71% of patients. Preeclampsia was the major diagnosis (approximately 68% of cases). Dipstick proteinuriawas significant for 46 expectant mothers,i.e. 66.6% of cases. For all cases, renal impairment was confirmed by using protein/creatinine ratio.*

***Conclusion:** Protein/creatinine ratio helps to diagnose renal impairmentearly enoughin case of renal vascular disease.*

Keywords: *renal impairment, hypertension, protein/creatinine ratio.*

Introduction

Pregnancy-related hypertensive disorders exacerbate 10% of all pregnancies and cover a wide range of conditions, namely: preeclampsia, eclampsia, chronic and gestational hypertension. Preeclampsia is a specific disorder clinically characterized by pregnancy-related hypertension and proteinuria occurring after 20 weeks gestation [1]. In normal practice, screening is carried out through dipstick at each prenatal visit.

However, this semi-quantitative method is not error-free [2]. Several studies have been conducted on expectant mothers with a renal vascular disease at HKM Teaching Hospital (CNHU-HKM)in Cotonou, Benin. However, none of them has ever addressed the issue of renal impairmentamongexpectant mothers through proteinuria. We thereforeinitiated a study on renal impairmentscreening among these women, by using protein/creatinine ratio (PCR) which has better specificity [3]. The objectives of this study were to determine the frequency of preeclampsia and renal impairmentprevalence during this medical condition, through PCR.

Materials and Methods

It was a cross sectional descriptive study conducted over 4 months, from April 3, 2017 to August 3, 2017. This research focused on expectant mothers with renal vascular disease, seen in the gynecology and obstetrics University Clinic (CUGO) of Cotonou overthe study period. Patients included in this study were expectant mothers who came to the hospital for either antenatal or emergency consultation in CUGO, with high of blood pressure ≥ 140/90 mmHg. They all gave their informed consent to take part in the clinical research. The following individuals were excluded from the study: expectant mothers who developed renal vascular disease with urinary tract infection, diabetic expectant mothers, or those who refused to take part in the study. Non-probabilistic sampling was conducted, and expectant mothers meeting our inclusion criteria were included in the study. The dependent variable of interest was protein/creatinine ratio (PCR). The followings were considered as independent variables:

- Demographic data: age
- Pregnancy-related data: pregnancy term, period of occurrence of hypertension
- Clinical data:
  - Mode of admission to hospital
  - Reason for consultation
  - Personal history: medical (diabetes, hypertension, preeclampsia/eclampsia), surgical (C-section), obstetrical and gynecological
  - family history (diabetes, hypertension, preeclampsia/eclampsia, kidney failure)
  - Physical signs: BP, edema, state of conscious ness, headache, blurred vision, tinnitus, urine dipstick

For data collection, we used the followings:

- Pre-designed data processing form
- Consultation records, intensive care admission registers and
- Medical records of expectant mothers

Data collection material included:

- Urine dipstick for Multistix 10 SG SIEMENS 2161 instant semi-quantitative assay
- 60 ml tubes filled with 30ml each, for collecting urine to be sent to the laboratory for protein and creatinine quantitative assay
- 2-8 degrees urinary samples storage bag for conserving urine before sending it to the laboratory

The data processing form was filled out by a 7th year medical student, given that this studywas conducted as part of Doctor of Medicine (M.D.) thesis defense.

For each patient,two urine tubes were used for sample collection: one for carrying outinstant dipstick test and the other for lab analysis.

Urine samples were sent to the laboratory everyday in a storage bag, at 7am for sample of patients seen in consultation during night shift, and 4 pm for samples collected day time.

Assays are carried out the same day.

Protein and creatinine assay was carried out with MINDRAY BS 200 biochemistry analyzer.

Both creatinine and proteinuria were expressed in mg/L by the laboratory.

Protein/creatinine ratio expressed in mg/mmol, was calculated according to the following formula:

PCR = Proteinuria (mg/L) x 1000 / creatinine (mg/L) x 8.84.

A comparison of the two methods was made.

Data collected on paper using the questionnaire were entered into Epi-Data Version 3.1. They were then analyzed with Epi-Data Analysis 2.2.2.182 and Open

Epi (Open Source Epidemiological Statistics for Public Health) 3.01. Statistical results were expressed in mean or percentage.

This academic-based research was conducted in strict compliance with the principles of good clinical practice (GCP). Students provided their free and informed consent in writing. Confidentiality was strictly observed during data collection. All information collectedas part of this study were treated anonymously.

Results

During our study period, CUGO consulted 1,417 expectant mothers, 105 of whom were hypertensive. Actually, 69 of them met our inclusion criteria, including 21 in prenatal consultation (PNC), 15 in the delivery room and 33 in the intensive care unit. 36 expectant mothers were excluded as they developed urinary tract infection (20 cases), diabetes (16 cases): flow diagram, see **Figure 1**

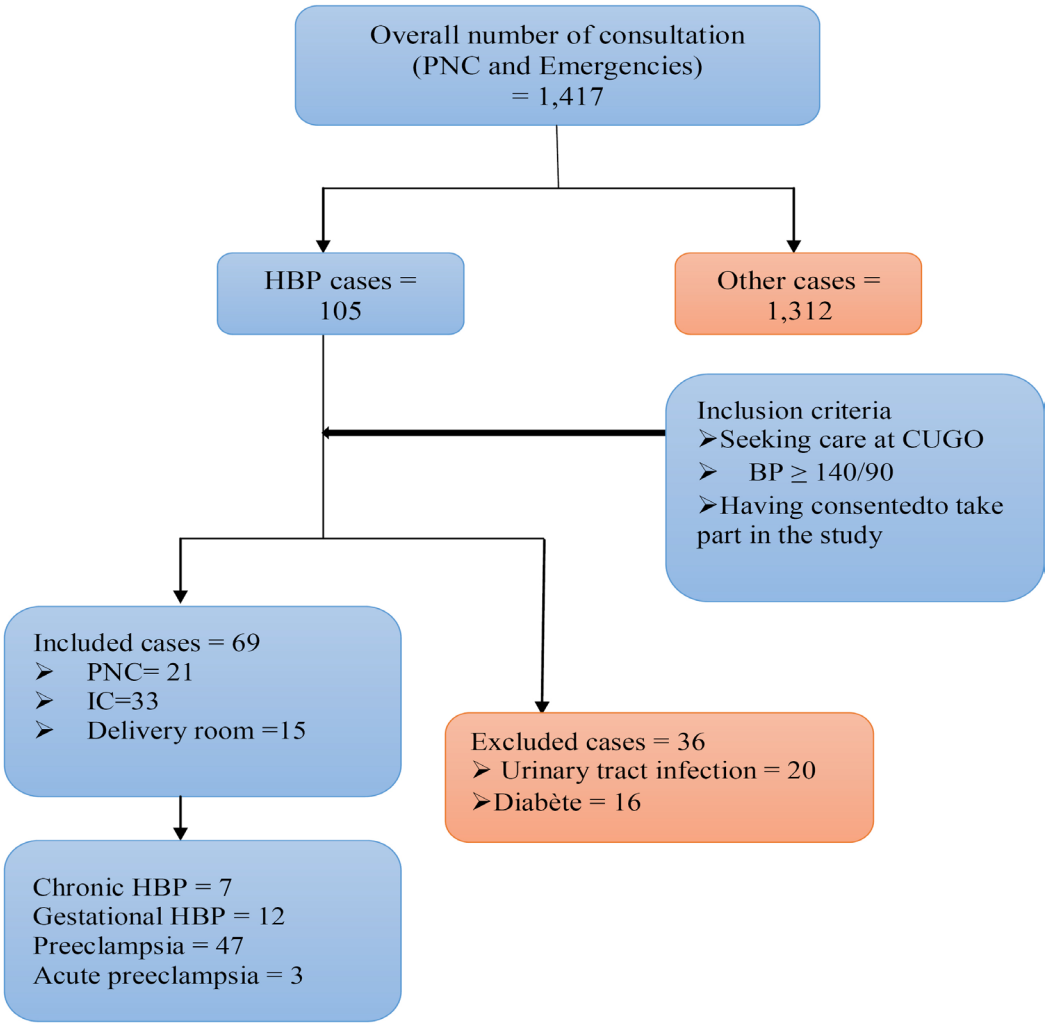

Fig 1. *Flow diagram*

Sociodemographic Characteristics

Age

Expectant mothers age ranged from 14 to 42 years, with mean value estimated at 28 ± 6.5 years. The most represented age group was 25-29 years (34.8% expectant mothers).

Clinical Characteristics

Mode of Admission to Hospital, Reasons for Referral and Consultation

Of all the expectant mothers, 39 (56.5%) had been referred from peripheral health facilities,whereas 30 (43.5%) had reported to hospital on their own.

The major reason for referral was eclampsia and severe preeclampsia in a proportion of 46% and 41% respectively. About 8% of expectant mothers were referred for intermenstrual bleeding.

The most frequent reason for consultation was pregnancy monitoring (70% of cases), followed by pelvic pain, low back pain and headache, which each accounted for 50% of the reasons for consultation.

Case History

21 expectant mothers had hypertension and 6 of them diagnosed with a history of preeclampsia. Among them, 14 underwent C-section.

Family history was mostly high blood pressure (33.3%), followed by diabetes (13.0%), kidney failure (5.8%) and preeclampsia (2.9%).

Gestational Age and Type

The majority of expectant mothers (75.4%) were in the third trimester of pregnancy.

Monoembryonic pregnancies accounted for 95.7% of cases.

Period of Occurrence of Hypertension and Blood Pressure Profile

For 71% of expectant mothers,HBP occurred after the 20thweek of amenorrhea. **Figure 2** shows expectant mothers distribution according to the period of HBP occurrence.

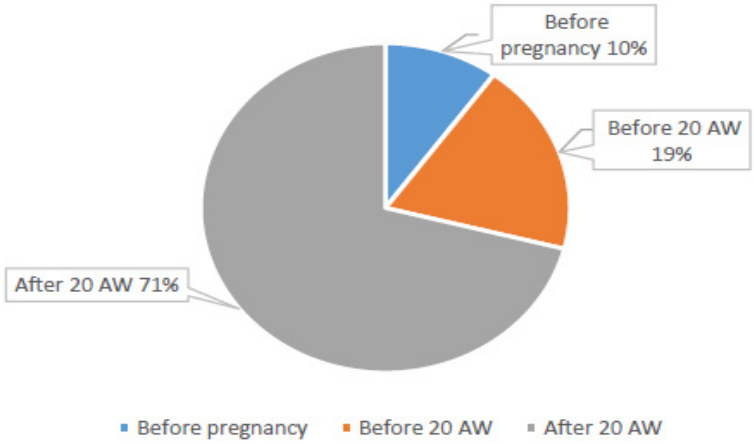

Fig 2. *Expectant mothers distribution according to the period of HBP occurrence.*
AW: Amenorrhea Week

The majority of expectant mothers (64% of cases) had critical HBP(TA> 160/110 mmHg) on admission.

- Symptoms of eclampsism: of the 69 respondent expectant mothers, 21 i.e. 30.4% had symptoms of eclampsia, including 21 (100%) with headache and 15 (71.4%) dizziness.
- Complications: The most common complication was eclampsia in 26.1% of cases followed by retro-placental hematoma (4.3%) and HELLP syndrome (1.4%).

Clinical and Paraclinical Characteristics of Urine Samples

- Macroscopic appearance of the urine: macroscopic hematuria was recorded among 7 (10.1%) expectant mothers.
- Upon urine test strip (UTS), significant proteinuria was found in 47.8% of cases. See **table I**.

Table I. *Expectant mothers distribution according to the outcome of UTS*

Urine albumin strip test	Number	%
Negative	15	21.7
Trace	8	11.6
1+	13	18.8
2+	15	21.7
3+	18	26.1
Total	69	100.0

Protein/Creatinine Ratio

Protein/Creatinine ratio revealed significant proteinuria in all expectant mothers. The distribution of expectant mothers according to protein/creatinine ratio is shown in **Table II**.

Table II. *Expectant mothers distribution according to Protein/Creatinine ratio*

PCR	Number	%
30-300	9	13.0
>300	60	87.0
Total	69	100.0

Comparative Study

Relationship between the Selected Type of Hbp and Protein/Creatinine Ratio

47 expectant mothers were diagnosed with preeclampsia, representing 3.3% prevalence compared to the total number of expectant motherswho reported to CUGO during our study period. See **table III**

Table III. *Renal impairment distribution by type of HBP*

Type of HBP	RPC	
	30-300 N(%)	**>300 N(%)**
Chronic HBP	2(2.9%)	5(7.2%)
Gestational HBP	2(2.9%)	10(14.5%)
Preeclampsia	5(7.2%)	42(61.0%)
Severe preeclampsia	0(0.0%)	3(4.3%)
Total	9(13.0%)	60(87.0%)

Relationship between PCR and dipstick proteinuria (table IV)

Table IV: *Cross-checking results from UTS and PCR*

Urine albumin strip test	PCR	
	30-300N(%)	**>300 N(%)**
Negative	2(2.9%)	13(19.0%)
Trace	1(1.4%)	7(10.0%)
+	0(0.0%)	13(19.0%)
++	4(5.8%)	11(16.0%)
+++	2(2.9%)	16(23.0%)
Total	9(13.0%)	60(87.0%)

Relationship between PCR and preeclampsia symptoms (table IV)

Table V: *Preeclampsia symptoms according to PCR*

Preeclampsia symptoms	PCR		
	30-300 N(%)	**>300 N(%)**	**Total N(%)**
Yes	1(4.7%)	20(95.3%)	21(100.0%)
No	8(16.7%)	40(83.3%)	48(100.0%)
Total	9(13.1%)	60(86.9%)	69(1000.%)

Discussion

The prevalence of pregnancy HBP was 7.41% in this study. This rate ranges from 6 to 10% of the proportions reported in US studies [4].

In our series, 3.3% of all expectant mothers attending CUGO developed preeclampsia. This rate is close to data reported in a study published by **Filipek et al** [5].

In fact, 20-29 (49.3%) age group was the most vulnerable, making HBP pregnancy a real public health issue.

In our study, we noted that more than half of expectant mothers were referred (56.5%). Most often, these expectant mothers come for consultation in the complications stage (30.4% of cases) due to poor prenatal consultation in peripheral health centers. The most common complications were eclampsia (26.1%) and retro-placental hematoma (4.3%). These two major complications of preeclampsia were also reported by **Bhattacharya et al** [6], but in lesser proportions than ours. This difference can be explained by the lack of technical facilities in the peripheral health centers and the fact thatexpectant mothers are mostly referred late; that is to say at the stage of complications.

In our study, 30.4% of expectant mothers had personal history of HBP and 8.7% preeclampsia, while family history of HBP accounted for 33%.

These histories are risk factors for renal vascular diseases as reported in several studies [7,8].

In our series of studies, 67.7% of respondents developed kidney failure following urine dipstick, while Protein/Creatinine ratio showed that 100% of expectant mothers had kidney failure. This rate is within the range of 70-100% reported by several authors [2, 3, 9].

In our series, dipstick proteinuria could not diagnose 33.3% of preeclampsia cases, which without PCR would have remained undetected. In India in the year 2001, **Amin et al** [10] recorded 47% of undiagnosed cases of urine test strip among whom 23.5% had a significant PCR. In Japan, in the year 2015, **Baba et al** [9] recorded 77.9% with the help of PCR and 65.3% with urine test strip. Long-term urine test strips used to determine proteinuria among expectant mothers

proved to be ineffective with expectant mothers with renal vascular disease not only because of its poor precision, but also its semi-quantitative nature and the large number of expectant mothers with insignificant proteinuria upon using this method.

Conclusion

In our series, the prevalence of hypertension during pregnancy was 7.4%, and among these expectant mothers, 68.1% had preeclampsia. Kidney damage was detected through PCR. Urine Test Strip could not help to detect all cases of proteinuria among hypertensive expectant mothers. In countries with limited means of paraclinical examinations, protein/creatinine ratio would be the recommended assessmentfor expectant mothers for early detection, in order to mitigate the impact on kidneys, pending further studies involvinga greater number of expectant mothers.

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