Calciuria and preeclampsia


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Abstract

Urinary calcium excretion has been reported to be diminished in preeclampsia. The objective of the present study was to determine urinary calcium excretion in pregnant patients with chronic arterial hypertension (CAH) and preeclampsia (PE), and in normotensive patients (N). Forty-four pregnant patients (gestational age, 20-42 weeks; 18 CAH, 17 PE, 9 N) were evaluated for calciuria, proteinuria, plasma uric acid and blood pressure. Patients with PE (82 ± 15.1 mg/24 h) showed significantly lower calciuria (P<0.05) than the group with CAH (147 ± 24.9 mg/24 h) and the N group (317 ± 86.0 mg/24 h) (P<0.05, Student t-test). Plasma uric acid was significantly higher in the PE group (6.1 ± 0.38 mg/dl) than the CAH group (5.0 ± 0.33 mg/dl; P<0.05), which also presented higher proteinuria levels, although the difference was not statistically significant. Diastolic and systolic blood pressure did not differ between the PE (164 ± 105 mmHg) and CAH (164 ± 107 mmHg) groups. Calciuria was significantly lower in the group with preeclampsia than in the group with chronic arterial hypertension. We conclude that calciuria can be a further factor for identifying preeclampsia.

Introduction

Hypertension occurs in 5 to 10% of our pregnant patients, corresponding to the major cause of maternal mortality in our midst as well as around the world (1). One way to reduce the impact of arterial hypertension on maternal mortality is to establish the correct diagnosis of preeclampsia, and to proceed with an early intervention when it is diagnosed (2). The classical clinical manifestation of preeclampsia is diagnosed when the pregnant patient presents high blood pressure levels (>140/90 mmHg) after the 20th week of gestation (without a previous history of arterial hypertension) along with the presence of significant proteinuria (>300 mg in 24 h) (3).

Today these clinical signs are considered to be a late manifestation of a disease that has been present since the first trimester of gestation. Due to this “diagnostic delay”, many tests have attempted to establish the diagnosis of preeclampsia as early as possible, often even before the patient presents arterial hypertension (4). Tests reported for the early diagnosis of preeclampsia are Doppler ultrasound assessment of maternal and fetal circulation (5-7), uric acid concentration (8), the supine pressure test (9-11), the angiotensin test (12), microalbuminuria (13), plasma fibronectin concentration (14), plasma antithrombin activity (15), calciuria and other tests, all of which are of debatable efficacy and practicality.

One of the difficulties of day-by-day obstetrical practice has been the differential diagnosis of chronic hypertension and pre-
eclampsia, especially when the hypertensive patient presents proteinuria. Based on the observation that urinary calcium excretion is reduced in pregnant patients with preeclampsia, the authors determined the difference in calcium excretion between pregnant patients with the diagnosis of preeclampsia and pregnant patients with chronic arterial hypertension.

**Material and Methods**

We carried out an observational, transversal, controlled and prospective study in pregnant patients treated at the maternity clinic of the Hospital de Clínicas de Porto Alegre. Eligible patients had gestational ages from 20 to 42 weeks and arterial hypertension of 140/90 mmHg or higher. Patients who had established concomitant clinical disorders (diabetes mellitus, urinary infection, renal disorder, or epilepsy) as well as twin gestations were excluded from the study. All patients had normal serum creatinine (<0.9 mg/dl).

Patients were allocated to three groups, whose data were crossed and analyzed. Group I consisted of patients with a clinical diagnosis of preeclampsia (PE) while group II consisted of patients with a diagnosis of chronic arterial hypertension (CAH) without preeclampsia. The classification followed the guidelines of the American College of Gynecology and Obstetrics (3). Group III corresponded to a control group of non-hypertensive patients with gestational age from 20 to 42 weeks and with similar criteria for exclusion. The analyzed variables were 24-h urinary calcium, 24-h proteinuria, arterial pressure, and plasma uric acid.

Data were analyzed by the Student t-test for independent samples and the Fisher test with the level of significance set at 5%. The results are reported as means ± SEM. Data were stored and analyzed using the EPI-INFo program. The study was approved by the Research and Ethics Committee of the Hospital de Clínicas de Porto Alegre.

**Results**

The average diastolic and systolic blood pressure levels did not differ significantly between group I (PE) and group II (CAH), although they were higher than in the control group, which did not have arterial hypertension. In group I, the average proteinuria ratio was higher than in group II, although not statistically significant.

The distribution of calciuria and proteinuria between the groups and their inverse relation are shown in Figure 1. Figure 2 shows the inverse relation between calciuria and uric acid.

Plasma uric acid was significantly higher (6.1 ± 0.38 mg/dl) in group I (P<0.05) than in group II (5.0 ± 0.33) and group III (3.1 ± 0.15). In group I (PE) the average calciuria ratio (82 ± 15.1 mg/24 h) was significantly lower than the average (147 ± 24.9 mg/24 h) for group II (CAH) (Table 1).

**Discussion**

Calciuria is a condition which has been
studied in the detection of preeclampsia. Marya et al. (16) point out that urinary calci- 
cium excretion tends to increase in all preg-
nant patients, probably because of the in-
crease in effective glomerular filtration rate. 
As also observed in the present study, 
Taufield et al. (17) found a significantly 
lower mean urinary calcium level in patients 
with preeclampsia and in hypertensive pa-
tients with preeclampsia (42 and 72 mg in 24 
h, respectively), than in groups with chronic 
hypertension, and transitory hypertension and 
in normotensive patients (223, 248, and 313 
mg/24 h, respectively).

Huikeshoven and Zuijderhoudt (18) con-
cluded that the measurement of urinary cal-
cium excretion is of value for the study of 
pregnant patients with arterial hypertension, 
both in terms of 24-h excretion and in the 
calciuria/creatinuria ratio of a single urine 
sample.

Sanchez-Ramos et al. (19) suggest that 
patients with preeclampsia present a signifi-
cantly lower total urinary calcium excretion 
(129.7 mg/24 h) than that observed for nor-
motensive patients (293.9 mg/24 h) or for 
patients with pregnancy-induced hyperten-
sion (232.2 mg/24 h) (P = 0.0001). These 
data reflect a higher average than our data. 
Anai et al. (20) demonstrated that the aver-
age urinary calcium excretion is signifi-
cantly lower in the group of patients with pre-
eclampsia (44.3 mg/24 h) than in the group 
of patients with fetal growth retardation. 
Raniolo and Phillipou (21) determined that 
the calciuria/creatinine ratio was not signifi-
cantly different between groups of normo-
tensive pregnant patients (0.52 ± 0.32), pa-
tients with preeclampsia (0.49 ± 0.32) and 
patients with pregnancy-induced hyperten-
sion (0.57 ± 0.40). The detection of calciuria 
is often contradictory, reflecting the need for 
new data.

Urinary calcium excretion has been al-
ready studied as a predictive test of pre-
eclampsia. Sanchez-Ramos et al. (22) found 
a relative risk of 9.4 of predicting preeclampsia 
when the patient shows urinary calcium 
excretion lower than 195 mg/24 h. Baker and 
Hackett (23) did not find significantly pre-
dictive values in the measurement of the 
albumin/creatinine and/or calcium/creatinine 
 ratio in relation to the diagnosis of preeclampsia. Conde-Agudelo et al. (24) established 
that urinary calcium excretion produces con-
tradictory and inconclusive findings for the 
predictive diagnosis of preeclampsia.

The present new results showed lower 
urinary calcium excretion in the group with 
preeclampsia than in the group with chronic 
arterial hypertension. A 24-h calciuria less 
than 100 mg/24 h may confirm a suspected 
preeclampsia. Thus, the measurement of 
calciuria could be used as a further test to 
differentiate between chronic arterial hyper-
tensive disease and preeclampsia in preg-
nant patients.

| Table 1 - Calciuria and hypertension in gestation. |
| PE = Preeclampsia; CAH = chronic arterial hypertension; N = non-hypertensive controls. Data are reported as means ± SEM. *P<0.05 between groups I and II, II and III, and III and I. +P<0.01 between groups III and I (Student t-test). |
| I (PE; N = 17) | II (CAH; N =18) | III (N; N = 9) |
| Calciuria (mg/24 h) | 82 ± 15.1* | 147 ± 24.9* | 317 ± 86.0* |
| Proteinuria (mg/24 h) | 1395 ± 654.5 | 326 ± 75.9* | 63 ± 18.8* |
| Uric acid (mg/dl) | 6.1 ± 0.38* | 5.0 ± 0.33* | 3.1 ± 0.15+ |
| Systolic (mmHg) | 164 ± 5.2 | 164 ± 4.2* | 115 ± 2.4+ |
| Diastolic (mmHg) | 105 ± 3.2 | 107 ± 3.0* | 74 ± 4.1+ |
References


