Increased Urinary Excretion of Glycosaminoglycans in Pregnancy and in Diabetes mellitus: A Protective Factor against Nephrolithiasis

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Dear Sir,

In some paraphysiologic (pregnancy) and pathologic (diabetes mellitus) situations, urinary conditions exist which theoretically portend a high risk of urinary calculosis; in fact, hypercalciuria [1, 2], hyperuricuria [3] and urinary tract infections [4], as well as hypotonia of the excretory tracts [4], are often present. Nevertheless, the incidence of nephrolithiasis during pregnancy and in diabetes mellitus is low, and probably lower than that observed in the population at large [4–6]. Since the lithogenic processes are the consequence of an imbalance between urinary supersaturation, factors promoting and inhibiting crystallization, crystal growth and agglomeration, it is possible that the lower calculosis incidence in these two situations – despite the existence of evident risk conditions – is due to the presence of an important inhibitory activity in the urine of these subjects. Without doubt, the glycosaminoglycans (GAGs) are among the substances that contribute highly in inhibiting urinary lithogenesis [7, 8].

Actually, the urinary GAG excretion in diabetes mellitus and in pregnancy was frankly high compared to controls (table I); in agreement with literature reports, hypercalciuria is also present (table I). Thus the Ca/ GAG ratio, which may be taken as a possible marker of the urinary lithogenic imbalance, remains within the normal range, unlike findings in hypercalciuric calculous patients. However, it is worth recalling that the relative ‘weight’ of these substances when determining lithogenic risk is different. In fact, while calcium is classified in the 5th place in terms of importance (favoring role), urinary GAGs occupy the 2nd place among the lithogenic risk factors (inhibitory role) [7]. Therefore, the protective effect of the higher urinary excretion of GAGs in diabetes and pregnancy most probably exceeds what is expressed

Table I. Urinary GAG excretion and hypercalciuria in diabetes mellitus, pregnant subjects and controls

Number and sex

Age years

Calciuria mg/g creat.

Urinary GAG¹ mg/g creat.

Ca/GAGs

Pregnant subjects 1st trimester

9F

22–35

13.11 ± 6.69^a

58.03 ± 7.35

0.22 ± 0.12

2nd trimester

6F

20–30

19.50 ± 11.83^o

74.96 ± 25.59^b

0.26 ± 0.11

3rd trimester

10 F

23–33

11.62 ± 5.58

96.29 ± 22.06⁼

0.17 ± 0.15

Controls²

12 F

24–55

7.80 ± 4.09

51.09 ± 12.60

0.11 ± 0.11

Diabetic patients

10 F/8 M

20–50

13.03 ± 8.74^a

74.62 ± 27.19^e

0.17 ± 0.08

Hypercalciuric calculous patients

11 F/8 M

25–46

20.76 ± 5.67^e

39.78 ± 7.91^d

0.54 ± 0.17^e

Controls²

12 F/8 M

24–55

7.97 ± 5.64

48.59 ± 9.76

0.16 ± 0.10

Statistical analysis of data and corresponding controls was carried out using Student's t test. $ap < 0.05$; $bp < 0.02$; $cp < 0.01$; $dp < 0.005$; $ep < 0.001$.

1 Assayed according to Whiteman [9].

2 From Baggio et al. [10].

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by the simple Ca/GAGs ratio and assigns equal 'weight' to both substances.

It thus seems reasonable to conclude that the increased urinary GAGs excretion observed in diabetes mellitus and in pregnancy might concur in explaining the relatively low incidence of urinary calculosis in these conditions.

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