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Original Article

Obesity and iron deficiency anemia as risk factors for asymptomatic bacteriuria

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ABSTRACT

Background: Few studies examined the risk factors of asymptomatic bacteriuria, showing contradictory results. Our study aimed to examine the association between different clinical and laboratory parameters and asymptomatic bacteriuria in internal medicine patients.
Materials and methods: 330 consecutive hospitalized subjects, asymptomatic for urinary tract infections (UTIs), underwent to microscopic examination of urine specimens. 100 subjects were positive for microscopic bacteriuria and were recruited into the study. At the quantitative urine culture 31 subjects of study population were positive while 69 subjects were negative for bacteriuria.
Results: The analysis of clinical characteristics showed that the two groups of subjects (positive and negative urine culture for bacteriuria) were significant different ($p < 0.05$) about obesity (76.7% vs 42% respectively), metabolic syndrome (80.6% vs 44,9%), cholelithiasis (35.5% vs 13,2%) and iron deficiency anemia (80.6% vs 53,6%). The univariate analysis showed that only obesity, cholelithiasis and iron deficiency anemia were positively associated with positive urine culture for bacteriuria (Odds Ratios [OR] = 3.79, $p = 0.0003$; OR = 2,65, $p = 0.0091$; OR = 2.63, $p = 0.0097$; respectively). However, the multivariate analysis by logistic regression showed that only obesity and iron deficiency anemia, independently associated with positive urine culture for bacteriuria (OR = 3.9695, $p = 0.0075$; OR = 3.1569, $p = 0.03420$ respectively).
Conclusions: This study shows that obesity and iron deficiency anemia are independent risk factors for asymptomatic bacteriuria.

1. Introduction

Urinary tract infections (UTIs) are one of the most common infections for which antibiotics are prescribed. The presence of bacteria in the urine culture of an asymptomatic patient is known as asymptomatic bacteriuria. Asymptomatic bacteriuria is common, with varying prevalence by age, sex, sexual activity, and the presence of genitourinary abnormalities [1,2]. In this study we investigated the association between asymptomatic bacteriuria and further clinical and laboratory parameters.

2. Methods

330 consecutive subjects admitted to Department of Internal Medicine at the University Hospital of Palermo between January 2012 and December 2012, asymptomatic for UTIs, underwent to microscopic examination of urine specimens. 100 subjects were positive for microscopic bacteriuria and were recruited into the study. At the quantitative urine culture 31 subjects (19 females and 12 males) were positive while 69 subjects (46 females and 23 males) were negative for bacteriuria. Then two groups were individualized in the study population according to the positive or negative urine culture.

All the subjects underwent complete examination of urine. Microscopic analysis was performed on midstream urine and urine was cultured incase of positive microscopic analysis for bacteriuria. The cut-off for significant bacteriuria in our laboratory was 4000 or more microorganisms per microliter (μL) of urine.

The diagnosis of asymptomatic bacteriuria is based on the results of urine culture with specimen collected to minimize contamination. For asymptomatic women, two consecutive voided urine specimens with the same bacterial strain $\geq 10^5$ colony-forming units (CFUs) per milliliter (mL) of urine define bacteriuria. For asymptomatic men, a single voided specimen with $\geq 10^5$ CFUs/mL defines bacteriuria. For men or women, a single catheterized urine specimen with a single species $\geq 10^2$ CFUs/mL [1,2].

The metabolic syndrome (MetS) is defined as having a cluster of at least 3 of the following characteristics: elevated fasting glucose

Abbreviations: UTIs, urinary tract infections; OR, odds ratios; μL, microliter; mL, milliliter; dL, deciliter; μg, micrograms; mg, milligrams; CFUs, colony-forming units; BMI, body mass index; BPH, benign prostate hyperplasia.

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≥100 mg/dL or taking medications for elevated glucose; abdominal obesity, given as waist circumference: males > 102 cm, females > 88 cm; elevated triglycerides ≥150 mg/dL; reduced HDL-C (high-density lipoprotein cholesterol) < 40 mg/dL in males and <50 mg/dL in females; elevated blood pressure systolic ≥130 mmHg and/or diastolic ≥85 mmHg or antihypertensive drug treatment in a patient with a history of hypertension [3].

History of atherosclerosis, in our study, is defined as documented presence of atherosclerotic plaques in aorta or in the supra-aortic, coronary or legs' arteries.

2.1. Other cut-off in our laboratory

Neutrophilic leukocytosis = 11000 or more leucocytes per μl of blood with neutrophils ≥ 75%; iron deficiency: serum iron < 50 micrograms (μg)/deciliter (dL); anemia: hemoglobin < 12 g/dL.

2.2. Statistical analysis

Categorical variables are presented as percentages and continuous variables as mean +/− 1 standard deviation. Group differences were assessed using Student's t-test for continuous variables and Chi-square test for categorical variables. The association between different clinical and laboratory parameters and asymptomatic bacteriuria was examined by univariate analysis and multivariate logistic regression analysis. A p value < 0.05 was considered to be statistically significant. Data was analyzed using MedCalc software version 11.3.0.0.

3. Results

The clinical and laboratory parameters of the study subjects are reported in Table 1. In the group with positive urine culture there was not statistically significant difference between males and females (38.7% vs 61.3%; p = 0.1271). Patients with positive urine culture, compared with those with negative urine culture, had a higher significant prevalence (p < 0.05) of obesity (76.7% vs 42%), metabolic syndrome (80.6% vs 44.9%), cholelithiasis (35.5% vs 13.2%) and iron deficiency anemia (80.6% vs 53.6%). Univariate analysis for asymptomatic bacteriuria was performed with all the variables listed in Table 1, but none of them showed a statistically significant association with positive urine culture for bacteriuria, except obesity, cholelithiasis and iron deficiency anemia, which were positively associated with positive urine culture for bacteriuria (Odds Ratios [OR] = 3.79, p = 0.0003; OR = 2.65, p =0.0091; OR = 2.63, p = 0.0097; respectively) (Table 2).

The multivariate logistic regression analysis (Table 3) showed that only obesity and iron deficiency anemia were positively and independently associated with positive urine culture for bacteriuria (OR = 3.9695, p = 0.0075; OR = 3.1569, p = 0.03420 respectively).

In the positive urine culture group (n = 31) isolated bacteria were as follows: *Escherichia coli* 17, *Enterococcus faecalis* 6, *Klebsiella* spp. 4, *Pseudomonas* spp. 2, *Proteus mirabilis* 2. Their antibiotic sensitivity was as follows: in *E. Coli* group, 5 pathogens were sensitive to ciprofloxacin, 4 to levofloxacin, 3 to norfloxacin, 2 to fosfomycin, 2 to ertapenem, and 1 to sulfamethoxazole/trimethoprim; in *E. faecalis* group, 2 pathogens were sensitive to piperacillin/tazobactam, 2 to ampicillin/sulbactam and 2 to levofloxacin; in *Klebsiella* spp. group, 3 pathogens were sensitive to ertapenem and 1 to ciprofloxacin; *Pseudomonas* spp. and *P. mirabilis* were sensitive to ciprofloxacin.

4. Discussions

UTIs are not only a major health issue but also an economic cost [4,5] and, for this reason, a better characterization of their risk factors is important. It is well established that diabetes per se is associated with increased prevalence of asymptomatic bacteriuria, but this wasn't confirmed in our study. The two groups (positive and negative urine culture) were homogeneous about the diabetes and the components of the metabolic syndrome, except obesity (Table 1). Sure enough, they were significantly different about obesity and metabolic syndrome but at the univariate analysis only obesity showed a positive and statistically significant association with positive urine culture. This, probably, was due to the following reason: in the group with metabolic syndrome and positive urine culture (n. 25), 12 subjects had impaired fasting glucose (48%) while 22 subjects were obese (88%). Also univariate and multivariate analysis showed that other pathological conditions in addition to those metabolic were involved in the development of asymptomatic bacteriuria and that these conditions found their highest expression in obesity.

At present, the relationship between obesity and asymptomatic bacteriuria is poorly clear and few studies have investigated this issue. What literature that does exist, though, is consistent with our findings. Geerlings et al. have demonstrated that asymptomatic bacteriuria was independently associated with body mass index (BMI) [6]. Bamgbade

Table 1
Baseline characteristics of patients.

	Urineculture positive n. 31	Urineculture negative n. 69	p Value
Females n(%)	19(61.3%)	46(66.6%)	0.7740
Males n(%)	12(38.7%)	23(33.4%)	0.7740
Mean age	67.9+/−15	72.5+/−17	0.2133
Atherosclerosis n(%)	19(61.3%)	43(62.3%)	0.89
Hypertension n(%)	28(90.3%)	52(75.4%)	0.1462
Diabetes n(%)	16(51.6%)	29(42.0%)	0.4996
Central obesity*n(%)	23(76.7%)	29(42.0%)	0.0027
MetS n(%)	25(80.6%)	31(44.9%)	0.0019
Cirrhosis n(%)	2(6.5%)	10(14.4%)	0.4206
Cholelithiasis n(%)	11(35.5%)	9(13.2%)	0.0205
ARF n(%)	6(19.4%)	5(7.2%)	0.1446
CRF n(%)	17(54.8%)	41(59.4%)	0.8321
Nephrolithiasis n(%)	14(45.2%)	31(44.9%)	0.84
Urinary catheter n(%)	21(67.7%)	49(71.1%)	0.922
Iron deficiency n(%) anemia	25(80.6%)	37(53.6%)	0.018
Neutrophilic n(%) leukocytosis	12(38.7%)	32(46.4%)	0.6173
CRP (mg/dL)	6.9+/−9	6.3+/−8	0.7930
TG (mg/dL)	137+/−60	113+/−61	0.0826
HDL-C (mg/dL)	40+/−16	44+/−18	0.2604
LDL-C (mg/dL)	89+/−30	101+/−42	0.1485
T-C (mg/dL)	156+/−35	169+/−49	0.2204

Abbreviations
ARF = acute renal failure; CRF = chronic renal failure; CRP = C reactive protein; HDL-C = high density lipoprotein-cholesterol; LDL-C = low density lipoprotein-cholesterol; MetS = Metabolic Syndrome; T-C = Total-cholesterol; TG = triglycerides; and Central obesity* = (M ≥ 102, F ≥ 88 cm).