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Usefulness of Urinoculture to Patients With Dementia and Femoral Neck Fracture at Admission to Hospital: Preliminary Results

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Abstract

Introduction: While preoperative urinary tract infection (UTI) has the potential to cause bacteremia and postsurgical acute prosthetic joint infections (APJIs), the influence of asymptomatic bacteriuria (AB) in these infections remains unclear. So the majority of guidelines not recommend the treatment of AB prior to the surgery. However, as patients with dementia usually cannot explain the symptoms of dysuria, the differential diagnosis between AB and UTI may be very difficult in this group of patients. The principal aim of the study was to compare the rate of positive urine culture at admission in patients with femoral neck fracture with and without dementia and secondarily try to assess the connection of positive urinoculture and postoperative acute gram-negative PJI. **Methods:** All patients with a femoral neck fracture underwent a urine culture on hospital admission and were prospectively recorded. Variables such as sex, age, institutionalization, dementia and other comorbidities, PJI rate, and in-hospital death were collected. The results of cultures were retrospectively revised. Patients who received postoperative antibiotics or had been diagnosed with UTI during hospital stay were excluded. Statistical comparisons between patients with and without dementia were performed using SPSS software version 17. **Results:** A total of 148 patients were included (52 with dementia). The rate of positive urine culture was 32% (n = 16) in patients with dementia and 11.5% in patients without dementia ($P = .003$). Of these 16 patients with dementia and positive urine culture, 2 (12.5%) developed an acute gram-negative PJI, whereas there were no cases in the group without dementia ($P = .011$). **Discussion:** The only difference between UTI and AB is the expression of symptoms by the patient. However, as patients with dementia have difficulties to explain UTI symptoms, some UTI may be underdiagnosed. **Conclusion:** Patients with dementia have a statistically higher rate of presurgical positive urine culture compared with patients without dementia.

Keywords

femoral neck fracture, dementia, bacteriuria, gram-negative infection, urinoculture

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Introduction

Postoperative urinary tract infection (UTI) is a well-documented independent risk factor for acute prosthetic joint infection (APJI), whereas preoperative UTI has the potential to cause bacteremia and postsurgical wound infections. Thus, the majority of guidelines recommend to treat these infections as soon as possible prior to surgery. However, the relationship between prior asymptomatic bacteriuria (AB) and APJI[1] is unclear. Moreover, due to the low number of APJI caused by gram-negative bacilli (GNB) in the group of patients who underwent elective arthroplasty implantation, the cost-effectiveness analysis of routine urine screening would not be justified.[2]

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The only difference between UTI and AB is the expression of symptoms by the patient. However, some participants, such as patients with dementia, have difficulties in describing these symptoms and the diagnosis of UTI may be a challenge.[3,4] Consequently, in theory, a number of UTI that play a role in APJI may be underdiagnosed. The higher rate of APJI caused by GNB in patients with femoral neck fracture and dementia when compared with elective surgery patients[5,6] is also in agreement with this theory. Although in some cases falls could be the presenting symptom of an UTI in patients with dementia, to our knowledge, there are no previous articles that evaluate the utility of systematic and routine urine screening prior to surgery in patients with a femoral neck fracture and particularly focused on patients with dementia.

The principal aim of the study was to compare the rate of positive urine culture (UC) at admission in patients with femoral neck fracture with and without dementia. Secondarily, we tried to evaluate its possible relationship with postoperative acute gram-negative PJI.

Materials and Methods

Patients and Variables

A cohort multicenter study was designed and approved by the ethical board of the 2 centers enrolled into this project. All patients who presented a femoral neck fracture in the emergency service were initially invited to participate in the study. However, only patients (or a legal representative) who accepted and signed an informed consentment document were included. Patients who had received antibiotics within 2 weeks before the fracture were excluded.

Variables collected included—age, gender, location (right or left), presurgical American Society of Anesthesiologists (ASA) score, fall in nursing home (institutionalized patients), time from admission to surgery, duration of surgery, and type of prosthesis implanted. The following comorbidities were also recorded—dementia, diabetes mellitus, active treatment with oral corticoids, chronic pulmonary disease, hepatic cirrhosis, chronic renal failure, and rheumatoid arthritis. Final results of urinoculture, rate of APJI, the microbiologic etiology of PJI, and the rate of in-hospital dead were also collected.

Surgical Techniques

All surgeries were performed in a standard, nonlaminar air-flow operating room. Patients were placed in lateral position on the healthy side. Based on the criteria of each surgeon, an anterolateral transgluteal or posterolateral approach was used. In elderly patients with low Barthel score,[7] Austin Moore hemiarthroplasty was implanted. In patients with a better quality of life and independent in daily activities, bipolar hemiarthroplasty was performed. If these younger patients had radiological signs of arthritis, a total hip replacement was chosen. Cement without antibiotics was used in all the cases in which a cemented prosthesis was implanted.

Microbiological Methods

A urine sample was obtained from all patients with a femoral neck fracture just before surgery. The urine sample was taken using transitory urinary catheter under aseptic conditions in preanesthetic room. The urine was plated in a semi–selective medium (agar cystine lactose electrolyte deficient [CLED]) using a calibrated loop of 0.001 mL. The identification and antibiogram were performed by MicroScan WalkAway (Siemens Healthcare, Erlangen, Germany) and the results informed in colony formed units (CFUs). The criteria for considering positive urinoculture were 10^5 CFU/mL. Patients who received postoperative antibiotics or had been diagnosed with UTI during the hospital stay were excluded.

Criteria for APJI Diagnosis

The clinical diagnosis of APJI was based on Tsukayamas criteria[8,9]—local inflammatory signs, purulent drainage through the wound, and elevated C-reactive protein during the first 4 weeks after joint arthroplasty. A surgical debridement was performed in all patients with clinical diagnosis of APJI. During the surgery, several different samples (synovial fluid inoculated into blood flask, periprosthetic tissue samples, and swabs) were taken to obtain a microbiological diagnosis.

Statistical Methods

Statistical comparisons between patients with and without dementia were performed using the SPSS software version 17 (SPSS Inc., Chicago, Illinois). Categorical variables were compared using the χ^2 test or Fisher exact test when necessary, and continuous variables were compared with the Student *t* test. Statistical significance was defined as a 2-tailed $P < .05$.

Results

A total of 148 patients were included (52 with dementia), comprising a majority (71.6%; n = 106) of women. There were 4 APJIs—2 due to gram-positive cocci and 2 due to GNB (Table 1). There were no variables associated with a higher rate of APJI (Table 2). When comparing patients with and without dementia (Table 3), the following 3 statistically significant differences were observed: (1) the rate of positive UC was higher in patients with dementia, (2) with regard to the origin of patients, the majority of patients with dementia came from nursing homes, and (3) the ASA score was higher in patients with dementia. However, neither ASA 3-4 nor the origin of the patients was associated with a statistically significant higher rate of positive UC, whereas only dementia was associated with the presence of bacteria in the urine at admission—32% (n = 16) versus 11.5% ($P = .003$). When we analyzed the subgroup of patients with positive UC and dementia (16 patients), we found that 2 (12.5%) developed an acute gram-negative PJI, while there were no cases in the group without dementia. In other words, the presence of positive UC at admission was associated with a higher rate of APJI due to GNB only in

Table 1. Patients With Acute Prosthetic Joint Infection.

Patient Number	Age	Gender	Cemented Stem	Dementia	UC	MO of Infection
3	83	F	Y	Y	*Escherichia coli*	MS-*Staphylococcus aureus* Proteus subspecies
40	79	F	N	N	Neg	MR-*S aureus*
70	85	F	Y	N	Neg	MR-CNS
87	78	F	N	Y	*Pseudomonas aeruginosa*	*P aeruginosa*

Abbreviations: CNS, coagulase-negative *Staphylococci*; F, female; MO, microorganism; MR, methicillin-resistant; MS, methicillin-sensitive; N, no; UC, urine culture; Y: yes; S aureus, Staphylococcus aureus; P Aeruginosa, Pseudomonas aeruginosa.

Table 2. Univariable Analysis of Patients With Acute Prosthetic Joint Infection.

	Acute PJI (n)		
Variables	Y (4)	N (144)	*P*
Age (year), mean (SD)	81.25 (3.3)	81.61 (8.2)	.93
Females (%)	4 (100)	102 (71.8)	.57
Left side fracture (%)	3 (75)	68 (48)	.36
Fall in nursing home (%)	2 (50)	25 (17.7)	.16
Days from admission to surgery, mean (SD)	2.25 (1.5)	2.57 (1.8)	.72
ASA 3-4 (%)	2 (50)	72 (55)	1
Cemented stem (%)	2 (50)	55 (49.5)	1
time of surgery (min), mean (SD)	66.7 (7.6)	78.1 (26)	.45
Diabetes mellitus (%)	0	48 (33.8)	.3
Rheumatoid arthritis (%)	0	3 (2.1)	1
Chronic renal failure (%)	0	16 (11.3)	1
Cirrhosis (%)	0	6 (4.2)	1
Corticoids (%)	0	7 (4.9)	1
COPD (%)	0	23 (16.2)	1
Urinoculture positive (%)	2 (50)	25 (17.9)	.16
Dementia (%)	2 (50)	49 (34.5)	.61
In-hospital mortality (%)	0	3 (2.1)	1

Abbreviations: COPD, chronic obstructive pulmonary disease; SD standard deviation.

Table 3. Univariable Analysis of Patients With Dementia.

	Dementia		
Variables	Y (52)	N (96)	*P*
Age (year), mean (SD)	82.8 (8.1)	81 (8.1)	.19
Females (%)	40 (76.9)	66 (68.8)	.34
Left side fracture (%)	23 (44.2)	50 (52.1)	.36
Fall in nursing home (%)	24 (46.2)	3 (3.2)	<.001
Days from admission to surgery, mean (SD)	2.52 (1.7)	2.57 (1.8)	.86
ASA 3-4 (%)	37 (80.4)	37 (41.6)	<.001
Days of hospitalization, mean (SD)	9.85 (4,5)	10.36 (6.9)	.64
Diabetes mellitus (%)	16 (30.8)	34 (35.4)	.59
Rheumatoid arthritis (%)	1 (1.9)	2 (2.1)	1
Chronic renal failure (%)	6 (11.5)	11 (11.5)	1
Cirrhosis (%)	1 (1.9)	5 (5.2)	.66
Corticoids (%)	2 (3.8)	5 (5.2)	1
COPD (%)	8 (15.4)	16 (16.7)	1
Positive urine culture (%)	16 (32)	11 (11.5)	.003
Acute PJI (%)	2 (3.9)	2 (2.1)	.61
GN-PJI (%)	2 (3.8)	0	.12
In-hospital mortality (%)	2 (3.8)	3 (3.1)	1

Abbreviations: COPD: chronic obstructive pulmonary disease; GN, gram-negative; PJI, prosthetic joint infection; SD standard deviation.

patients with dementia (12.5% vs 0%, $P = .011$). Finally, in 1 of these 2 cases, the GNB isolated from the intraoperative cultures taken during the debridement surgery coincided with the one isolated from the urine (Table 1).

Discussion

Dementia is a very common comorbidity in patients with femoral neck fracture, being the most frequent one in some previously reported series.[10] Therefore, patient with dementia and hip fracture suffer significant morbidity and mortality.[11] So it is mandatory to evaluate and treat this type of patients carefully. However, to our knowledge, our study is the first to evaluate the difficulty in UTI diagnosis in patients with femoral neck fracture and dementia and its potential impact on post-surgical complications especially gram-negative APJI.

The difference between UTI and AB is only based on the expression of symptoms by the patients. However, as patients with dementia have difficulties in explaining the UTI symptoms,[3,4] some UTI may be underdiagnosed. The results of our study corroborated this hypothesis because we found a higher rate of positive UCs in patients with dementia compared with patients without—32% (n = 16) versus 11.5% ($P = .003$). It is important to diagnose patients with UTI because peroperative UTI is a well-documented and previously reported risk factor for hematogenous PJI. Besides, previous studies[5,6] have described a higher rate of APJI due to GNBs in patients with femoral neck fracture compared with patients with osteoarthritis who underwent an elective hip replacement. However, to our knowledge, there are no previous articles that evaluate the utility of urine screening prior to surgery in patients with a femoral neck fracture and particularly focused on patients with dementia.

The relationship between AB prior to surgery and APJI remains unclear—several authors described a statistical connection between these 2 entities,[12-14] while others did not.[15,16] However, most of these studies were retrospective, focused on primary and elective arthroplasty and evaluated the global rate of APJI and not those caused only by gram-negative bacteria. In our opinion, AB and UTI may play a role only in PJI due to

GNB not due to gram-positive ones. Despite the low number of cases, the incidence of GN-PJI in patients with dementia and UC positive was 12.5% ($P = .011$). Moreover, there were no other differences between these 2 groups (Table 3) that could explain this finding.

Several hypotheses could explain the contamination of the wound by microorganism from urinary tract—(1) A prior contamination of the hematoma by translocation of bacteria from the urine mucosa to the blood flow.[5] The presence of urinary catheter (usually related with patient with dementia) may play a role, increasing the risk of these ''micro-bacteremia''. (2) A direct contamination from the skin of the patient during surgery. or (3) A postoperative contamination of the wound by urine. In the latter, incontinence and the use of diapers associated with a lot of patients with dementia may also play an important role.

The major drawback of our study was the limited number of patients included and the low percentage of infection. This fact makes it difficult to interpret our results. However, the 2 cases of gram-negative APJI were in the group of patients with dementia and positive urinoculture. Another limitation was that urinalysis was not performed—the pyuria usually is present in patients with UTIs so perhaps it would have been helpful for early diagnosis of patients with urinoculture positive. Finally, dementia was not defined or qualified according to a concrete and accepted criterion. Additional studies with a larger number of patients and evaluating other potentially important variables such as urinalysis, incontinence, and the presence of urine catheter are needed to further investigate and confirm our results.

Conclusion

In this study, patients with dementia have a statistically higher rate of presurgical positive UC comparing with patients without dementia. A number of UTI may be underdiagnosed because of the difficulty of some patients with dementia to explain their symptoms. The cases of postoperative gram-negative PJI were reported in patients with dementia and positive UC. However, more studies with larger samples are necessary to confirm this relationship between bacteriuria, dementia, and gram-negative PJI.

Authors' Note

Lluís Font-Vizcarra is involved in communications and reprint requests.

Declaration of Conflicting Interests

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