Risk Factors and Significance of Gentamicin Resistant Positive Urine Culture in Patients Undergoing Urological Surgery: A Short Report

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Key Words

Preoperative urine • Gentamicin resistance • Amikacin • Antibiotic Prophylaxis • Sepsis

Abstract

We assessed patients who had pre-operative urine that grew gentamicin-resistant bacteria but were given gentamicin prophylaxis because urine result was not available. Our aim was to identify postoperative-sepsis rates, risk factors to acquire resistant-bacteria, and to optimize our prophylactic regime. Total 4,933 pre-operative urine-samples were reviewed and those positive for *E.coli*, *Klebsiella* or *Proteus* (n = 979) were analysed. Forty-four (4.4%) had gentamicin-resistant bacteria. Of those, 8 were immunosuppressed, 38 (86%) had a recent urological procedure and 29 (66%) had received recent antibiotics. Eighteen (41%) had a urinary catheter and 11 (25%) had double J stent. Three patients (7%) developed post-operative sepsis/febrile urinary tract infection. Although the majority of gentamicin-resistant samples represent colonization, the incidence of post-operative sepsis was significant. Amikacin may be a superior alternative. Our new protocol aims to pre-operatively identify patients at risk of prophylaxis failure with gentamicin and select amikacin as an alternative.

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Introduction

Gram-negative antimicrobial resistance prevalence has increased, rendering ineffective many traditional antibiotics [1].

Pre-operative urine sample identifies patients at risk from multi-drug-resistant colonization. But results may not be available and this exposes patients to the risk of sepsis. Another subgroup with sterile urine but with multi-resistant bowel/perineal colonization provides a challenge as the risk of sepsis is not apparent. Moreover, a positive pre-operative urine sample may represent clinically insignificant colonization, and treatment can promote the emergence of resistant strains.

Our current prophylaxis protocol recommends preoperative gentamicin for all urological procedures with or without co-amoxiclav. In this study, we retrospectively assessed patients who had gentamicin-resistant positive pre-operative urine sample that grew gram-negative bacteria and were given gentamicin as prophylaxis. Our aim was to identify those who developed postoperative urinary infection/sepsis and assess its severity. We also sought to identify risk factors predisposing patients to acquire resistant bacteria. Our goal was to develop a risk stratification model to optimize our antibiotic prophylactic regime.

Materials and Methods

We retrospectively reviewed the results of 4,933 pre-operative urine samples between 2006 and 2011. Gentamicin (with or without co-amoxiclav) was the default prophylactic antibiotic. Positive pre-operative urine cultures for *E. coli*, *Klebsiella pneumoniae* and *Proteus mirabilis* (the three most predominant Gram-negative species) were further analysed to identify gentamicin resistance. Potential risk factors for developing gentamicin-resistant bacteria were classified as: (1) General risk factors, i.e. past medical history, (2) Specific urological risk factors, i.e. history of urological procedure (3) Prior resistant urine culture results (4) The type of surgical procedure and the potential for bacterial contamination.

Results

Of 979 pre-operative urine samples, 196 (20%) were positive for *E. coli*, *Proteus* and *Klebsiella*, and 44 patients had gentamicin-resistant positive culture; mainly *E. coli*. Analysing this subgroup, 13 had a previous positive gentamicin-resistant urine sample. Regarding potential risk factors for resistance 8 revealed diabetic or immunosuppressant/steroid therapy, asthma/respiratory disease ($n = 6$), neuropathic bladder ($n = 14$), urological cancer ($n = 12$). Thirty-eight (86%) had undergone a recent urological procedure (within 1 year). Twenty-nine (66%) had received antibiotic therapy in that year and 18 (41%) had an indwelling catheter, 11 (25%) had double J stent in-situ, 4 (9%) were intermittently self catheterizing, and 3 (5%) had an ileal conduit.

Only 3 patients (7%) with gentamicin-resistant gram negative pre-operative urine sample developed post-operative sepsis or febrile urinary tract infection and all were treated successfully.

Discussion

Since the report of catheter fever in the Lancet in 1883 [2], infections related to urological procedures are well recognised. Prophylactic antibiotics in certain procedures e.g. transurethral resection of prostate (TURP) is well established but is less robust for other procedures [3]. In a meta-analysis of 6,239 patients assessing prophylactic antibiotic use in TURP [4], a significant decrease in septicemia was noted. Our study identified 2/7 patients who developed septic complications (30%) after TURP when urine was positive preoperatively. This is significant for our subgroup of TURP patients. Our overall 7% sepsis rate was lower which suggests that many of these resistant bacteria cultures represent colonisation.

Gentamicin is losing its therapeutic effectiveness because of increased resistance [5–7]. Previously we demonstrated a climbing gentamicin resistance rate of 0.7% per year [8]. There is a need to consider an alternative drug such as amikacin [9]. In our study gentamicin resistance was documented in 13.5% of cultures positive for *E. Coli*, 8.6% in *Klebsiella* and 5.8% in *Proteus*. There was no resistance to amikacin, probably due to the exclusive use of gentamicin. In the absence of new Gram-negative antibiotic treatment options, amikacin provides vital additional antibiotic sensitivity to gentamicin-resistant organisms. We propose it would be more prudent to apply a risk factor based approach to deciding which patients need amikacin, and who could receive adequate prophylaxis with gentamicin. This situation requires ongoing surveillance as some aminoglycoside modifying enzymes can produce resistance to both gentamicin and amikacin.

Both general and specific urological risk factors for infectious complications can be identified [3] but our knowledge is insufficient and this aspect should be in the focus of future studies [10]. We cannot fully explain why only some patients develop significant infective complications, and for a similar operation there is variation in the risk of infection [3].

Our study identified risk factors in our patients with gentamicin resistant bacteria and we now include these criteria to select patients for amikacin. Most relevant risks were: previous urological procedure in the past year, recent antibiotic therapy (3 months), indwelling catheter, a double J stent, self catheterisation or urological diversion. Twenty-seven percent of our patients had previous gentamicin-resistance documented. The procedure type: endourological or open, clean or clean/contaminated, are used to determine the duration of prophylaxis.

Conclusion

Although the majority of positive gentamicin resistant gram negative urine samples in our study may represent colonization, the incidence of post-op urinary sepsis (7%) was significant. Our current risk stratification aims to identify pre-operatively patients likely to need amikacin, as opposed to those who can receive adequate prophylaxis with gentamicin. In doing so, we hope to preserve the efficacy of amikacin in an era of ever evolving Gram-negative resistance.

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