Community-acquired urinary tract infection etiology and antibiotic resistance in a Mexican population group

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ABSTRACT

INTRODUCTION: Urinary tract infections are the most common bacterial infections worldwide. Their etiology is predictable since *E. coli* is the principal pathogen (80-90%) and trimethoprim/sulfamethoxazole (TMP/SMX), ciprofloxacin, cephalosporins, nitrofurantoin and phosphomycin are the antibiotics most frequently used against this bacterium.

MATERIALS AND METHODS: Urine cultures reporting urinary tract infection made from December 2007 to January 2008 were reviewed. RESULTS: A total of 291 urine cultures were analyzed. The most frequent pathogen was *E. coli* (24.7%). Antibiotic sensitivity was 26% to ciprofloxacin, 85% to amikacin and 80% to nitrofurantoin.

DISCUSSION: Empirical antibiotic therapy is necessary for treating community-acquired urinary tract infection. Age, sex, associated disease; infectious agent and infection location are all factors that are taken into consideration. TMP/SMX continues to be the first-line antibiotic administered, unless a bacterial resistance index above 20% is shown.

CONCLUSION: Due to the high bacterial resistance to what we regard as first-line antibiotics in empirical management, alternatives with common antibiotics

RESUMEN

Introducción: Las infecciones de vías urinarias (IVU) son la causa más común de infecciones bacterianas a nivel mundial, su etiología es predecible ya que *E. coli* es el principal patógeno (80-90%) y Trimetroprim/Sulfametoxazol (TMP/SMX), ciprofloxacino, cefalosporinas, nitrofurantoina y fosfomicina son los antibióticos más utilizados para esta entidad.

Material y métodos: Se revisaron los urocultivos de noviembre y diciembre del 2007 y enero del 2008, con diagnóstico de IVU.

Resultados: Se analizaron 291 cultivos. El patógeno más frecuente fue *E. coli* (24.7%), la sensibilidad a ciprofloxacino fue de 26%, amikacina 85% y nitrofurantoina 80%.

Discusión: En IVU adquirida en la comunidad es necesaria antibioticoterapia empírica, la cual depende de la edad, sexo, enfermedades asociadas, agente infeccioso y localización de la infección. TMP/SMX sigue siendo el antibioticó de primera línea, a menos que se demuestre un índice de resistencia bacteriana mayor al 20%.

Conclusión: En vista del elevado número de resistencia bacteriana a los antibióticos que consideramos de primera línea como manejo empírico para las IVU, es conveniente buscar nuevas alternativas, tomando en cuenta
such as nitrofurantoin and phosphomycin should be considered.

**Key Words:** Urinary infection, bacterial resistance, *E. coli.*

**INTRODUCTION**

Urinary tract infections (UTI) are the most common bacterial infections worldwide. Approximately 150 million cases of these infections are diagnosed per year, representing an annual expenditure of up to 6 billion dollars (1). They are the principal cause of hospital admittance and are responsible for high morbidity and mortality rates (2). Bacterial infection etiology is predictable, given that *E. coli* is the principal pathogen (80-90%) and trimethoprim/sulfamethoxazole (TMP/SMX), ciprofloxacin, cephalosporins, nitrofurantoin and phosphomycin are the most commonly used antibiotics for treating this entity (1). The excessive use of antimicrobial agents has invariably resulted in the development of bacterial resistance which represents a worldwide health problem (3). Since the 1990s broad spectrum multi-resistant beta-lactamase producing enterobacteria have emerged in community-acquired UTI (4) and presently an even higher resistance of *E. coli* to fluoroquinolones (FQ) has been reported (5).

The pattern of community-acquired UTI resistance has yet to be widely studied (5). There is no evidence in our environment as to the etiology of community-acquired UTI resistance pattern. The present study was designed to investigate the etiology and resistance patterns of urinary pathogens in patients presenting with community-acquired UTI attended to at the Hospital Universitario “Dr. José E González” in Monterrey, Nuevo Leon, Mexico.

**MATERIALS AND METHODS**

Urine cultures from the months of November and December of 2007 and January of 2008 that had been sent to the bacteriology laboratory of the Hospital Universitario “Dr. José E González” with presumptive diagnosis of urinary tract infection were reviewed. Data were statistically analyzed with the SPSS 14.0 operative system and the Student t test was employed. Statistical significance was defined when \( P < 0.05 \).

**RESULTS**

A total of 299 cultures were analyzed. Six were negative, 2 were contaminated and 291 were positive. Infection predominated in women with a 74.82% average of cases. The pathogen *E. coli* was in first place (24.7%), followed by *Candida albicans*, *S. faecalis*, *S. aureus*, *K. pneumoniae* and *P. aeruginosa* (23.7, 13.4, 6.8, 6.5 and 6.1% respectively). There was a 26% sensitivity of *E. coli* to ciprofloxacin. However, 85% sensitivity was observed to amikacin and 80% to nitrofurantoin. The pathogen *S. faecalis* showed an 80% resistance to gentamicin (Images 1 and 2). The presence of *P. aeruginosa* in this sample was striking since it is considered to be an intrahospital pathogen. One hundred per cent of these patients had recently been admitted into hospitals for different reasons and 7% of them had had lower urinary tract catheter placement. Some had had continuous placement (57.14%), some intermittent (28.57%) and others only one (14.28%). Both pathogen sensitivity to imipenem and antimicrobial multi-resistance was found to be 44.44%. *K. pneumoniae* had a 90% resistance to amikacin and imipenen and 100% resistance to ampicillin and 60% to cefalotin (Image 3).
DISCUSSION

In the presence of community-acquired UTI the implementation of empirical antibiotic therapy is a necessity. This treatment varies according to patient age, sex, associated disease, infectious agent and whether the problem is in the upper or lower urinary tract (1). Up to the present date, TMP/SMX continues to be the first-line antibiotic, unless there is a bacterial resistance index higher than 20%. Fluoroquinolones were not first choice antibiotics in the present study. They have become very popular and have been the most frequently prescribed antibiotic for this pathology for the past two decades which is probably why there is such a high index of bacterial strains that are resistant to these drugs (1).

The increase in antibiotic use is one of the principal recognized causes of the increase in bacterial resistance to those same antibiotics (7) as demonstrated by Arslan et al. (2005)(1). These authors studied 611 urine cultures and found E. coli to be the most frequent causal agent and they also found it to be highly resistant to fluoroquinolones. They observed a direct relation between previous FQ use and the development of bacterial resistance to these antibiotics. Alana and cols. carried out a case-control study in 2006 to determine whether FQ exposure was a risk factor for developing FQ resistant E. coli urinary infections. They analyzed 102 cases and 132 controls and found that 45% of the cases developed FQ resistant E. coli UTI, confirming their hypothesis (5).

Gagliotti et al. (2008)(9) come to the conclusion that given the accelerated increase of FQ resistant E. coli, these antibiotics should be used exclusively in non-complicated UTI. In a 6-year observational study, Javier Ena et al reported a dramatic increase in broad spectrum beta-lactamase-producing E. coli in urine samples and have observed a large proportion of these infections in out-patients. They also observed a striking increase in resistance to various antibiotics and state that only imipenem and fosfocil maintained good antibiotic sensitivity (8). Very similar results were reported by Pitout et al. in March of 2008 (4).

The high index of resistance not only to FQs but to many other antibiotics used in our community is attention-getting. It is obvious that indiscriminate use and lack of adequate prescription control of the antibiotics themselves are the cause of this situation as reported in the literature. Another interesting fact is that in the present study P. aeruginosa was found to be the fourth cause of infection in our community. It is important to establish whether there was prior hospitalization and use of urethral catheters in these patients. In reference to this bacteria and its presence in the community, Al-hassan et al. (10) analyzed the prevalence and incidence of this bacteria in the community and reported an incidence of 6.4/100,000 inhabitants. There was a higher frequency in men than in women, especially in individuals over 50 years of age. They also reported 25.5% mortality in these patients, showing the importance of determining the cause of this high pathogen incidence in our community.

With this in mind, first- and second-line antibiotic UTI therapies are currently being evaluated. Nitrofurantoin is considered to be a good option for beginning empirical UTI treatment since a 2.3% resistance to it has been reported compared with an approximate 25% bacterial resistance to FQ (11).

CONCLUSIONS

In view of the high incidence of bacterial resistance to antibiotics that are considered to be first-line in the empirical management of UTI, it is necessary to seek new alternatives, taking into account common antibiotics such as nitrofurantoin and phosphomycin.
The present study shows the high resistance index to commonly used first-line antibiotics and therefore we suggest considering other options and promoting awareness about their correct use.

A multi-institutional study should be carried out with a larger number of patients and comprehensive follow-up in order to develop new therapeutic modalities.

BIBLIOGRAPHY