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ORIGINAL ARTICLE

Susceptibility to rifaximin and other antimicrobial agents of bacteria isolated from acute gastrointestinal infections in Mexico☆,☆☆

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KEYWORDS
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Abstract
Background: Bacterial resistance may hamper the antimicrobial management of acute gastroenteritis. Bacterial susceptibility to rifaximin, an antibiotic that achieves high fecal concentrations (up to 8,000 μg/g), has not been evaluated in Mexico.
Objective: To determine the susceptibility to rifaximin and other antimicrobial agents of enteropathogenic bacteria isolated from patients with acute gastroenteritis in Mexico.
Material and methods: Bacterial strains were analyzed in stool samples from 1,000 patients with diagnosis of acute gastroenteritis. The susceptibility to rifaximin (RIF) was tested by microdilution (< 100, < 200, < 400 and < 800 μg/ml) and susceptibility to chloramphenicol (CHL), trimethoprim-sulfamethoxazole (T-S), neomycin (NEO), furazolidone (FUR), fosfomycin (FOS), ampicillin (AMP) and ciprofloxacin (CIP) was tested by agar diffusion at the concentrations recommended by the Clinical & Laboratory Standards Institute and the American Society for Microbiology.
Results: Isolated bacteria were: enteropathogenic *Escherichia coli (E. coli)* (EPEC) 531, *Shigella* 120, non-Typhi *Salmonella* 117, *Aeromonas spp.* 80, enterotoxigenic *E. coli* (ETEC) 54, *Yersinia enterocolitica* 20, *Campylobacter jejuni* 20, *Vibrio spp.* 20, *Plesiomonas shigelloides* 20, and enterohemorrhagic *E. coli* (EHEC 0:157) 18. The overall cumulative susceptibility to RIF at <100, <200, <400, and <800 μg/ml was 70.6, 90.8, 99.3, and 100%, respectively. The overall susceptibility to each antibiotic was: AMP 32.2%, T-S 53.6%, NEO 54.1%, FUR 64.7%, CIP 67.3%,

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CLO 73%, and FOS 81.3%. The susceptibility to RIF <400 and RIF <800 μg/ml was significantly greater than with the other antibiotics ($p < 0.001$).
Conclusions: Resistance of enteropathogenic bacteria to various antibiotics used in gastrointestinal infections is high. Rifaximin was active against 99-100% of these enteropathogens at reachable concentrations in the intestine with the recommended dose.

PALABRAS CLAVE
Rifaximina;
Resistencia bacteriana;
Susceptibilidad bacteriana;
Antibióticos;
Gastroenteritis;
Sobrepoblación bacteriana intestinal

Susceptibilidad de las bacterias aisladas de infecciones gastrointestinales agudas a la rifaximina y otros agentes antimicrobianos en México

Resumen
Antecedentes: La resistencia bacteriana puede dificultar el tratamiento antimicrobiano de las gastroenteritis agudas. La susceptibilidad bacteriana de los enteropatógenos a la rifaximina, un antibiótico que alcanza altas concentraciones fecales (hasta 8,000 μg/g) no se ha evaluado en México.
Objetivos: Determinar la susceptibilidad a rifaximina y a otros antimicrobianos de bacterias enteropatógenas aisladas de pacientes con gastroenteritis aguda en México.
Material y métodos: Se analizaron las cepas bacterianas en las heces de 1,000 pacientes con diagnóstico de gastroenteritis aguda. Se probó la susceptibilidad a la rifaximina (RIF) con microdilución (< 100, < 200, < 400 y < 800 μg/ml), la susceptibilidad a cloranfenicol (CLO), trimetoprim-sulfametoxazol (T-S), neomicina (NEO), furazolidona (FUR), fosfomicina (FOS), ampicilina (AMP) y ciprofloxacino (CIP) se probó por difusión-agar a las concentraciones recomendadas por CLSI y ASM.
Resultados: Las bacterias aisladas fueron: *Escherichia coli (E. coli)* enteropatógena (EPEC) 531, *Shigella* 120, *Salmonella* no-*typhi* 117, *Aeromonas* spp. 80, *E. coli* enterotoxigénica 54, *Yersinia enterocolitica* 20, *Campylobacter jejuni* 20, *Vibrio spp.* 20, *Pleisiomonas shigelloides* 20 y *E. coli* enterohemorrágica (EHEC 0:157) 18. La susceptibilidad global acumulada a RIF < 100, < 200, < 400, < 800 μg/ml fue del 70.6, el 90.8, el 99.3 y el 100%, respectivamente. La susceptibilidad global a cada antibiótico fue: AMP 32.2%, T-S 53.6%, NEO 54.1%, FUR 64.7%, CIP 67.3%, CLO 73%, FOS 81.3%. La susceptibilidad a RIF < 400 y < 800 μg/ml fue significativamente mayor que con los otros antimicrobianos ($p < 0.001$).
Conclusiones: La resistencia de las bacterias enteropatógenas a antimicrobianos utilizados en gastroenteritis es alta. La rifaximina fue activa contra el 99-100% de las bacterias en concentraciones alcanzables en el contenido intestinal con las dosis recomendadas.

Introduction

Acute diarrhea is an important health problem, mainly in the developing countries. Despite the decrease in mortality rates from this disease in the last decade in various countries, including Mexico[1–3], acute gastroenteritis continues to be a health problem due to its high morbidity. In Mexico, it is the second most common infectious disease, only preceded by respiratory diseases, with more than 5 million new cases per year[4].

Despite the presence of certain clinical signs, it is difficult to determine the causal agent of acute diarrhea in a patient based solely on clinical findings. Acute gastroenteritis is often due to a viral infection, especially in children under 5 years of age[1], whereas bacterial infection is more habitual in older children and adults. The most frequently detected enteropathogenic bacteria in patients with endemic gastroenteritis are *Escherichia coli* (*E. coli*) (EPEC, EIEC, EHEC, ETEC), *Campylobacter jejuni* (*C. jejuni*), *Shigella spp, Salmonella spp, Yersinia enterocolitica* (*Y. enterocolitica*)[5–8], and less frequently, *Aeromonas spp, Vibrios spp*[9–12], and *Pleisomonas shigeloides* (*P. shigeloides*)[13–15]. The number of cases vary in relation to geographic region, patient age, and the season of the year in which the study was conducted.

The aims of therapeutic management of patients affected with gastroenteritis are to preserve life, relieve symptoms, prevent complications, cut the disease short, and prevent the spread of the pathogenic agents to the population. Oral rehydration is the standard treatment in acute gastroenteritis and antimicrobial agents are indicated in severe or prolonged cases, when shigellosis or cholera