CAMPYLOBACTERIOSIS: A FOOD BORNE DISEASE WITH DIVERSE CLINICAL PRESENTATIONS

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Abstract - Campylobacteriosis is an important food borne acute infectious diarrheal disease. It mainly occurs through consumption of raw or undercooked poultry meat, unpasteurized milk and contaminated water. Campylobacter species have been isolated from chicken, turkey, duck, pork and beef. Campylobacter jejuni is responsible for 80-90% of all enteric Campylobacter infections, followed by C. coli for 5-10% cases. Clinical illness ranges from mild self-limiting, non-inflammatory diarrhea to severe inflammatory bloody diarrhea associated with bacteremia. Extra-intestinal infections like bacteremia, peritonitis, cholecystities, meningitis etc. have also been reported. Around 10% of immuno-compromised patients are at risk of bacteremia. An important post-infectious sequel of C. jejuni infection is Guillain-Barré syndrome (GBS), an acute neurological disease marked by ascending paralysis. GBS is incited by molecular mimicry between sialylated lipo-oligosaccharides of bacterial cell wall and ganglioside epitopes on human peripheral nerves, resulting in autoimmune-driven nerve damage. Culture is the gold standard for diagnosis of Campylobacter infection but its sensitivity is low in GBS patients. Serological and nucleic acid-based assays are used to improve the sensitivity. Development of resistance by Campylobacter spp. to macrolides and fluoroquinolones has resulted in treatment failure. Good practices like hand wash with soap, knowledge about cross-contamination in kitchen and poultry shops, avoidance of consumption of undercooked animal products, unpasteurized milk and untreated surface water can help in preventing the infection.

Key words - Antibiotic resistance, Campylobacter, Campylobacteriosis, Diarrhea, Guillain-Barré syndrome.

I. INTRODUCTION

Campylobacteriosis is a food borne acute gastro-intestinal infection caused by the genus Campylobacter. Campylobacters were recognized as human pathogens in late 1970s. There are more than 14 valid species in the genus; among them Campylobacter jejuni, C. coli, C. lari, and C. upsaliensis have acquired great public health importance (1). The infection occurs mainly by consumption of raw or undercooked poultry meat, unpasteurized milk and contaminated water.

Campylobacteriosis clinically presents with diarrhea, abdominal cramp/pain and fever within 2-5 days after exposure. Sometimes severe bloody diarrhoea with nausea and vomiting can occur. However, in immunocompromised individuals, Campylobacter can spread to bloodstream with serious life-threatening infection. Among all the species, C. jejuni is most frequently isolated in 80-90% of the infected individuals followed by C. coli in 5-10% of cases (2). The most important sequel of Campylobacter infection is Guillain-Barre syndrome (GBS), an acute demyelinating disease affecting myelin and axons of the peripheral nervous system (3). Although a lot of organisms have been implicated as triggering agents of GBS, C. jejuni is identified as the most common.

II. MORPHOLOGY AND GROWTH REQUIREMENTS

Campylobacters are Gram-negative and non-spore forming spiral, curved rods of 0.2 to 0.8 µm wide and 0.5 to 5.0 µm long with single polar unsheathed flagellum at one or both ends. Campylobacter species are micro-aerophilic and require an oxygen concentration of 5-6% for their optimal growth. Some species may require hydrogen; hence gas mixture containing 6% O_2, 6% CO_2 3%, H_2 and N_2 85% is the best combination. Campylobacters transform into spherical or coccoid bodies when cultures become old. Campylobacter species can be identified by growth at different temperatures (25ºC, 37ºC and 42ºC) and biochemical tests such as catalase, oxidase, hippurate and indoxyl acetate hydrolysis, triphenyl tetrazolium chloride and nitrate reduction, production of H_2S and susceptibility/resistance to different antibiotics.

III. EPIDEMIOLOGY

The epidemiology of Campylobacter infection differs between developing and developed world. In developing countries, Campylobacter infection usually presents with watery/mucoid diarrhoea, whereas in the developed countries, it presents with grossly bloody diarrhoea and abdominal pain, and often with fever (4). The annual incidence of Campylobacter infection in the United States is estimated 5 - 7% in patients with diarrhea corresponding to 2.5 million cases per year (5). As Campylobacter infection rarely requires hospitalization, the true incidence is likely to be much higher. Campylobacter is highly endemic in the developing countries because of poor sanitation and close human contact with animals. A North Indian study showed that Campylobacter enteritis was more frequent than combined Salmonella and Shigella infections in a rural community (4). Community

based studies estimated 0.4 diarrheal episodes per child (aged 1 to 4 year) per year corresponding to 40,000/ 100,000 children in Thailand, Mexico and Peru (6). Campylobacter infection rate was 13.5% in patients with diarrhoea in a rural community of North India (4).

Campylobacter spp. can be isolated from a variety of foods and water-based environmental sources. Campylobacteriosis is usually associated with consumption of raw or undercooked poultry meat or from cross-contamination of other foods. Chickens are the major source of infection. Survey of meats collected around the Washington DC in 1999 to 2000 found Campylobacter in chicken (70%), turkey (14.5%), pork (1.7%), and beef (0.5%) samples, and most of the isolates (70.8%) were C. jejuni (7). Infected chicken feces may contain up to 10^9 bacteria per 25 grams, which can rapidly spread to other chickens. Studies showed that 1.6%-3.1% vegetables were also contaminated with Campylobacter (8). Campylobacteriosis usually occurs in single, sporadic cases, but it can also occur as outbreaks. An outbreak occurred in Burlington, USA through contaminated community water supply affecting an estimated 3,000 persons (9). Contaminated shellfish had been implicated as a vehicle in dissemination of campylobacteriosis. Unpasteurized milk is a well-known source of a number of outbreaks. A large outbreak was reported in 1979 in the United Kingdom through infected milk affecting over 2,500 children (10).

IV. CLINICAL SPECTRA

Enteric infection is the most common but extra-intestinal infections and post-infection sequel can also occur. C. jejuni has been implicated for 80-89% of all enteric Campylobacter infections followed by C. coli in 5-10% cases. The other species are occasionally isolated. The clinical presentations include diarrhea ranging from mild, non-inflammatory, watery to severe and bloody form; other symptoms are cramping abdominal pain, fever and vomiting (4). Infants are at risks of dehydration and convulsion. Cases of toxic megacolon complicating Campylobacter infection had been reported.

The most important post-infection sequel is GBS, an acute demyelinating disease affecting myelin and axons of the peripheral nervous system. Such patients sometimes require mechanical ventilation (3). C. jejuni is identified as a major triggering agent of GBS. Occasional case reports due to C. upsaliensis had also been reported (11). It is estimated that approximately one in every 1,058 reported Campylobacter infections may lead to GBS (12). The pathogenesis of GBS is due to immune response elicited by the host against lipo-oligosaccharides of C. jejuni that cross-react with shared epitopes on nerve myelin (13,14). C. jejuni PEN19 serogroup was first associated with GBS in Japan; subsequently several other serogroups were also identified in Europe (15). C. jejuni infection can cause flare up of irritable bowel syndrome probably due to inter-current infections. Transient bacteremia can occur at early stage of Campyobacter gastroenteritis characterized by high fever and rigor. The survey by the Communicable Disease Surveillance Centre, London showed an average bacteremia rate of 1.5 per 1,000 intestinal infections with wide variations related to age [5.9 per 1,000 in patients aged > 65 years and 3 per 1,000 in children aged 1 to 4 years (16)]. In immunocompromised individuals especially in patients with acquired immunodeficiency syndrome bacteremia can occur in 10% of cases, which often can be severe and life threatening (17). There are reports of hemolytic uremic syndrome within few days following Campylobacter enteritis. Other miscellaneous focal extra-intestinal infections include peritonitis, hepatitis, cholecystitis, pancreatitis, meningitis etc.

V. DIAGNOSIS

Culture-based methods are the gold standards for diagnosis of Campylobacter infection. Selective media used for isolation include blood-free charcoal cefoperazone deoxycholate agar, semi-solid blood-free motility medium, and blood-containing media such as Campy-CVA, Blaser-Wang and Skirrow media. These agar-based methods are less suitable for animal and environmental samples and patients with GBS. Enrichment broth cultures such as Preston enrichment broth, Campy-thio and Campylobacter enrichment broths have been used to enhance the recovery of Campylobacter from stool, animal and environmental samples (18). Another approach is filtration technique followed by culture on solid media.

Latex agglutination test is used for rapid identification of Campylobacter from culture. For detection of C. jejuni/ C. coli in stool samples enzyme-linked immunosorbent assay (ELISA) had been developed with sensitivity of 96% and a specificity of 99% (19). Crude antigenic extract based ELISA is being used in GBS patients for diagnosis of antecedent Campylobacter infection (20).
Nucleic acid-based detection methods are used for specific detection of C. jejuni and C. coli in stool samples of gastroenteritis patients. A multiplex polymerase chain reaction (PCR) for mass screening of Campylobacter directly from chicken faeces has been developed (21). Using fla gene-based PCR C. jejuni infection was detected in 19.0 - 22.5% of GBS patients (20, 22). PCR-ELISA assays could differentiate among C. jejuni, C. coli, C. upsaliensis, C. helveticus, C. fetus, C. hyointesitinalis and C. lari (5). Real-time PCR has been used for quantitative

detection of Campylobacter in food and raw-meat (23), milk and water (24).

VI. PREVENTION AND TREATMENT

Following practices may help in reducing the infection and disease burden: i) all poultry and animal products should be cooked thoroughly, ii) hand wash with soap before preparing food and after handling raw foods of animal origin, and contact with pet faeces, iii) prevention of cross-contamination in the kitchen by using separate cutting boards for foods of animal origin and other foods, iv) avoiding consumption of unpasteurized milk and untreated surface water. Fluid replacement therapy is adequate in most cases of diarrhea caused by Campylobacter. However, in some severe and recurrent infections, antibiotic therapy is indicated. C. jejuni and C. coli are intrinsically resistant to penicillins, cephalosporins, trimethoprim, rifampicin and vancomycin. Antibiotics such as azithromycin or erythromycin and fluroquinolone are frequently used for treatment, which can shorten the duration of symptoms. Tetracycline or doxycycline and selective beta-lactams are the other alternatives. Significant increase in resistance to macrolides and fluoroquinolones among Campylobacter spp. is recognised as an emerging public health problem and it calls for susceptibility testing to initiate appropriate therapy. In India, 71.4% Campylobacter strains were resistant to flouroquinolone and 6.1% to erythromycin; 30.6% were multidrug resistant (4). Entry of such isolates into the food chain could cause a significant threat to public health.

CONCLUSION

Over the years Campylobacter has emerged as the most common bacterial enteric pathogen worldwide. The infection is usually self-limiting but occasionally it can be severe and life-threatening. In such cases, early diagnosis and initiation of appropriate antibiotic therapy can help rapid recovery. Disease burden is higher in developing countries because of poor sanitation and unhygienic conditions. Infection occurs through consumptions of raw or undercooked poultry meat, untreated water, raw milk or milk products and contact with pet feces. Appropriate preventive measures can help in reducing the disease burden.

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