

Non-typhoidal Salmonella Gastroenteritis in Al Ain Hospital United Arab Emirates

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Abstract

Objectives: The purpose of this study was to identify serogroups and antimicrobial susceptibility of non-typhoidal *Salmonellas* from gastroenteritis patients among out- and in-patient population of Al Ain Hospital in Al Ain, United Arab Emirates during the period of 1st April 2007 to 30th April 2013.

Methods: A retrospective study was carried out through review of the stool specimen record sent for bacteriological culture to Clinical Institute of Laboratory Services at Al Ain Hospital from 1st April 2007 to 30th April 2013. Culture and antimicrobial susceptibility of the isolates were carried out by using standard laboratory procedures. Serotyping was performed using commercial anti-sera.

Results: During the study period of 6 years a total of 205 laboratory confirmed non-typhoidal *Salmonellas* were isolated from the stool of patients with diarrhea. The majority of these strains (69%) was from patients of 0-14 years of age. *Salmonella* group B was the most frequent serogroup (36%) followed by serogroup D (27%) and then *Salmonella* spp. (26%). *Salmonella* serogroups A & C were 1% and 10%, respectively. The most frequently detected antibiotic resistance was to Ampicillin (25%), Co-Trimaxazole (15%) and Chloramphenicol (5%). *Salmonella* group B was the most resistant. The majority were, however, susceptible to other drugs with low to very low resistance rates (5% to Ciprofloxacin, and 2% to Ceftriaxone). Overall, resistant strains were more prevalent among children (30%) than adults (23%).

Conclusions: *Salmonella* gastroenteritis is an important clinical condition in children more than in adults in the United Arab Emirates. *Salmonella* serogroup B, D and *Salmonella* spp. are prevalent strains causing gastroenteritis. Most of the *Salmonella* serogroups isolated in this study showed a high resistance to Ampicillin in comparison to other antibiotics. The emergence of resistance against Ceftriaxone among non-typhoidal *Salmonella* spp. is an alarming sign.

Keywords: Gastroenteritis; Ampicillin; Chloramphenicol

Methods

Introduction

The genus *Salmonella* contains over 2000 different antigenic types [1]. Non-typhoidal *Salmonella* (NTS) species are important foodborne pathogens with acute gastroenteritis being the most common clinical manifestation [2]. Transmission of *Salmonella* is generally via the fecal-oral route, with infection occurring following the consumption of directly or indirectly contaminated food products [3]. Infection with non-typhoidal *Salmonella* usually result in an acute but self-limiting gastroenteritis that does not require antibiotic therapy, though in the young, the elderly and the immunocompromised the symptoms may be more severe and can lead to septicemia, arthritis, meningitis and pneumonia [2,4]. Evidence of increasing antimicrobial resistance is of concern when treating *Salmonellosis* worldwide [5].

Therefore, this study was undertaken to determine the presence of non-typhoidal *Salmonella*, and their pattern of serogroups and antimicrobial susceptibility among patients suffering from gastroenteritis at the Al Ain Hospital in Al Ain, United Arab Emirates.

Al Ain Hospital is a 400-bed tertiary health care centre, situated in the eastern region of Abu-Dhabi in the United Arab Emirates. It is considered a referral centre as well as a primary health care facility. Patients reported with gastroenteritis from April 2003 through April 2009 were identified by review of the clinical stool culture records of the hospital microbiology laboratory. For isolation of *Salmonella* species, all stool specimens were cultured directly onto Xylose Lysine Deoxycholate (XLD) agar (Medysinal), Deoxycholate Citrate (DCA) agar (Medysinal), and Selenite F broth (Medysinal). After 4 hours incubation, the later was subcultured again onto DCA and XLD. Non-lactose fermenting (NLF) colonies were inoculated in the Urea agar (Medysinal) and Triple Sugar Iron (TSI) agar (Medysinal). After overnight incubation, organisms giving a negative Urea reaction, and positive TSI reaction (Alkaline/Acid+H₂S) were further identified by means of API 20E (Analytical Profile Index, Biomerieux, France), or Vitek II, Biomerieux, (France). Isolates biochemically confirmed to be *Salmonella* were serogrouped using specific antisera (MAST Assure).

Antibiotic susceptibility testing was determined by means of Kirby-Bauer disk diffusion method using the guidelines provided by Clinical Laboratory Standard Institute (CLSI), formerly known as National

Committee for Clinical Laboratory Standards (NCCLS) guidelines [6]. The antimicrobial agents routinely tested included Ampicillin, Chloramphenicol, Co-Trimaxazole, Ciprofloxacin, and Ceftriaxone.

Results

Only patients with diarrhea, vomiting or both with loose stools and positive for *Salmonella* culture were included. Stool samples with positive culture for *Salmonella* para typhi A, B, C or D were excluded. There were 205 laboratories confirmed Salmonella cases (Table 1). The majority of patients were children 0-14 years of age (69%). This was significantly higher compared with the rate for adults (31%). Male sex predominated 118 (58%). Two isolates (1%) were *Salmonella* serogroup A, 21 (10%) were *Salmonella* serogroup C, 54 (26%) were *Salmonella* spp. 55 (27%) were *Salmonella* serogroup D and 73 (36%) were *Salmonella* serogroup B (Table 2).

Age group	Salmonella Serogroups					Total
	A	B	C	D	Spp	
0-14 (children)	2	55	12	33	39	141
>14 (Adult)	-	18	9	22	15	64

Table 1: Age distribution of 205 patients with gastroenteritis by different Salmonella serogroups.

Salmonella serogroups	Number Identified	Percentage
Serogroup A	2	1
Serogroup B	73	36
Serogroup C	21	10
Serogroup D	55	27
Salmonella sp	54	26
Total	205	100

Table 2: Incidence of Salmonella serogroups isolated from patients with gastroenteritis.

The antibiotic resistance rate (Table 3) was highest with Ampicillin (25%), followed by Co-Trimaxazole (15%). Resistance against Ceftriaxone was seen only with *Salmonella* serogroup B, other groups did not show resistance against Ceftriaxone. One hundred forty six isolates (71%) were susceptible to every antimicrobial agent tested. The remaining strains were resistant to one or more of the antimicrobial agents tested. All serogroups show high susceptibility to Ceftriaxone except serogroup B. Overall resistant strains were more prevalent among children (30%) than adults (23%).

Discussion

Non-typhoidal *Salmonella* represent an important public health problem in many part of the world including UAE. An increase in the incidence of non-typhoidal *Salmonellosis* has been noted throughout the world [7] and the same trend can be expected in UAE. Another

important problem is the increase of antimicrobial resistance in *Salmonella*, as recently reported by several authors [8,9]. Our study was an attempt to identify the pattern of serogroups and antimicrobial susceptibility of non-typhoidal *Salmonellas*. A study conducted in Thailand, identified 394 cases of non-typhoidal *Salmonella* in children [10]. 459 cases were diagnosed in Spain for four years [11]. In Kuwait, 661 strains were isolated in a 3 years period [12]. During a period of 3 and 1/2 years a total of 412 non-typhoidal *Salmonella* were isolated from children of Saudi Arabia [5]. There were 56,660 reported cases of non-typhoidal *Salmonella* in California from 1990 through 1999 [4]. There were 136 *Salmonella* isolates at the Montreal Children's Hospital between June 1, 1971 and June 30, 1972 [13]. Based on the comparison of our data with those from other countries, the UAE seems to be lower incidence of non-typhoidal *Salmonella*. Only 121 cases were identified in Malaysia during a 4 years study period [14]. Our results indicated that, as expected, in non-outbreak human diarrheal cases the *Salmonella* strains are frequently present in the stool specimens (69% in children and 31% in adults (Table 1)). A study from Germany found that infants had remarkably higher incidence of *Salmonella* than adults [15]. Among reported cases in California USA, children had the highest rate compared to adults [4].

Agent	Salmonella Serogroups (%)					
	A	B	C	D	SPP	Total
Amp	-	46	23	9	12	25
C	0	11	18	0	7	8
CRO	0	4	0	0	0	2
CIP	0	6	19	2	0	5
SXT	0	29	16	6	4	15

Amp: Ampicillin; C: Chloramphenicol; CRO: Ceftriaxone; CIP: Ciprofloxacin; SXT: Co-Trimaxazole

Table 3: Resistance pattern of the Salmonella serogroups to different antimicrobial agents.

Most of our isolates were serogroup B, followed by serogroup D and *Salmonella* spp. A small proportion were serogroups C and A. A study from Thailand showed a similar pattern of distribution in which the majority of isolates were serogroup B (56.1%) [10]. The most frequent *Salmonella* serogroup in Spain was serogroup D [11]. In Taiwan, serogroup D formed the third largest group (after serogroups B and C) among all *Salmonella* isolates [8]. The figures also considerably vary in the few studies carried out in the Gulf region. In Kuwait, the most prevalent was serogroup B, followed by serogroup C and D [12]. In Saudi Arabia, the most isolates were serogroup D, followed by serogroup B and C [1]. The vast majority (>90%) of *Salmonellae* isolated from man in developed countries belonged to serogroups B and D [16].

Like our study, a survey of 661 *Salmonella* isolated from Kuwait showed that resistant strains were more prevalent among children than adults [12]. A study carried out in Mérida, Venezuela, reported that 81% of the non-typhoidal *Salmonella* isolates were resistant to at least one of the antimicrobial tested [17]. A study from Thailand reported that most isolates were multidrug resistant [10]. Non-typhoidal *Salmonella* isolated in our study were sensitive to most antibiotics

tested (71%). The notable exceptions were Ampicillin (25% resistant), Co-Trimaxazole (15% resistant), and Chloramphenicol (8% resistant). In Saudi Arabia, 50% of their *Salmonella* isolates were resistant to Ampicillin (except serogroup D 20%), 15% to Chloramphenicol (except serogroup C 50%), and 5% to Co-Trimaxazole [5]. A study carried out in Buenos Aires, Argentina, reported that all strains were resistant to Ampicillin, and 5.3% to Chloramphenicol [18]. In Tunis, it was found that majority of *Salmonella* were isolated from blood and feces of newborns and nursing and *Salmonella typhimurium* represented 75% of the isolates, and all these isolates were resistant to Ampicillin and Chloramphenicol [19]. In Pontevedra, Spain, 39% of the strains were resistant to Ampicillin [11]. In Kuwait, about 39% of the isolate were resistant to Ampicillin, 17% to Co-Trimaxazole, 13% to Chloramphenicol [12]. In Yucatan, Mexico, resistance for the treatment of *Salmonellosis* was observed for Chloramphenicol (21%), Co-Trimaxazole (19.3%) and Ampicillin (17.6%) [20]. While in Korea, all isolates were sensitive to Co-Trimaxazole [21]. The low resistance of our isolates to Ampicillin, Co-Trimaxazole and Chloramphenicol may need a separate study, however, better antibiotic prescribing practices at Al Ain Hospital may have some contribution.

In Belgium, all *Salmonella* strains were susceptible to Ceftriaxone and Ciprofloxacin [22]. In Spain, none of the strains was resistant to the 3rd-generation Cephalosporins and Fluoroquinolones [11]. In Kuwait, all the strains were susceptible to Ciprofloxacin [12]. A recent study from Seoul, Korea showed no resistance to Ciprofloxacin and Ceftriaxone [21]. In Yucatan, Mexico, none of the isolates was resistant to Ciprofloxacin, and only 0.8% resistant to Ceftriaxone [20]. In contrast, 5% of our *Salmonella* isolates were resistant to Ciprofloxacin and 2% were resistant to Ceftriaxone (only on Serogroup B).

Conclusion

Salmonella serogroups B, D and *Salmonella* spp. predominate as causative agent of gastroenteritis. Our findings prove those of earlier studies indicating that most non-typhoidal *Salmonella* strains were susceptible to a wide range of antimicrobial agents [8]. Nevertheless, antimicrobial resistance to clinically essential "first line" drugs is increasing among our isolates. This tendency is alarming and related to agricultural uses of antimicrobial agents [9].

Although most isolates remained susceptible, the first identification of ciprofloxacin and Ceftriaxone resistance in our isolates is a cause of concern. Active monitoring of non-typhoidal *Salmonella* for antibiotic resistance is crucial because of the public health implications derived from the increasing incidence of such organisms. There is also likelihood that incidence of invasive disease with non-typhoidal *Salmonella* can also increase in the future.

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