

Isolation Of Salmonella Typhi In Typhoid Fever Patients In Kirkuk, Iraq

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Abstract

Typhoid fever is still a deadly disease in developing regions, including Iraq. The disease is an important cause of morbidity and mortality in the pediatric and adult population. Therefore, this study was conducted on the bacteria involved in patients with typhoid fever symptoms by isolating *Salmonella typhi* and some enteric bacteria from stool culture and establishing early diagnosis using laboratory serological parameters. Stool and blood samples were collected from 300 patients in different age who visited hospitals in Kirkuk city in northern Iraq during the period from December 2019 to March 2021. Data analysis showed that out of a total of 275 patient cases, the percentage of infected females was higher (51%) compared to the percentage of infected males (49%). The results indicated that (7%) of patients showed a positive stool result compared to (93%) a negative stool result, Widal test also showed a positive result in most of the samples tested (67%). In conclusion, it is necessary to adopt more accurate tests, such as blood tests, and more advanced laboratory techniques to detect and identify *Salmonella typhi*.

Keywords: Typhoid fever, *Salmonella typhi*, enteric bacteria, laboratory parameters.

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I. Introduction

Enteric fever is a disease that is prevalent in underdeveloped nations and is linked to inadequate public health measures and low socio-economic indicators. Failure to promptly identify and treat this condition might have catastrophic consequences, as it can lead to difficulties in several organ systems [1,2]. Significant gastrointestinal consequences of enteric fever encompass hepatitis, intestinal ulcers, hemorrhage, and bowel perforation. *Salmonella typhi*, often known as *S. typhi*, is responsible for causing typhoid fever, a very fatal and debilitating disease that affects people all over the world [3,4].

Salmonella typhi is a significant intracellular pathogen, and out of the more than 2,300 closely-related *Salmonella* serovar bacteria that have been identified, *S. typhi* is the only one that exclusively causes disease in humans [5,6]. It specifically leads to typhoid or enteric fever. *S. typhi* is a type of bacteria that is found in the intestines. It belongs to the *Salmonella* genus in the Enterobacteriaceae family [7]. It is a pathogen that affects multiple organs, including the lymphatic tissues of the small intestine, liver, spleen, and bloodstream of infected humans [8]. This bacterium possesses a combination of characteristics that enable it to function as a very effective pathogen. This species possesses an endotoxin that is distinctive to Gram-negative organisms, along with the Vi antigen that enhances its pathogenicity [9]. The *S. typhi* virulence factors are concentrated in specific regions of the chromosome called *Salmonella* pathogenicity islands (SPI). These regions contain genes responsible for adhesion, invasion, and toxin production [10,11]. The bacterium produces and excretes a protein called invasion, which enables non-phagocytic cells to be invaded and allows the bacterium to live inside these cells [12]. The oxidative burst of leukocytes can be suppressed, rendering the innate immune response ineffective [13]. The hematologic changes observed were elevated red blood cell count and hemoglobin concentration, accompanied by a temporary decrease in white blood cell count characterized by neutropenia and lymphopenia [14]. The conventional method of serotyping or antigenic classification of *Salmonella* is based on the response of antibodies with three types of surface antigens: somatic O antigens, flagellar H antigens, and Vi capsular antigens. The O antigen is responsible for determining the specific group to which *Salmonella* isolate belongs, while the H antigen is responsible for determining the specific serovar. The capsular antigen is exclusive to S [15,16]. Typhi and S. Paratyphi C. *Salmonella* is capable of creating biofilms on both living and non-living surfaces [17]. The aim of this study is to isolate and identify *Salmonella typhi* and some enteric bacteria in patients with symptoms of typhoid fever and to verify the diagnosis using laboratory serological criteria.

II. Method And Patients

This prospective study was conducted on a total of 275 cases of patients aged 2 to 72 years with a clinical approved of typhoid fever by physicians in hospitals in Kirkuk, northern Iraq, during the period from December 2019 until March 2021. Informed consent was taken from adults as well as from parents of children participating in the study. Stool and Blood samples were collected from patients with a clinical suspicion of typhoid fever and checked for presence of S.typhi infection in stool culture, hematological test and serological test. The blood sample was drained on the first day of management at the same time with stool culture sample collection. The blood sample analyzed for serological test including Widal test and immunochromatographic test.

III. Results And Discussion

Stool samples from 275 febrile patients clinically suspected typhoid fever were examined to confirm the presence of Salmonella typhi bacteria and some intestinal bacteria. The results indicated that (7%) patients showed positive stool versus (93%) negative stool culture as shown in the figure (1).

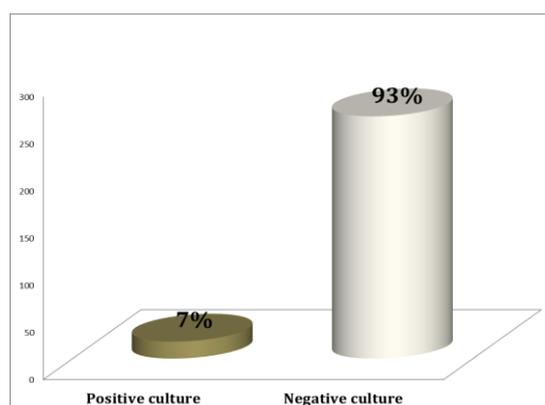


Figure 1: Positive and negative Salmonella typhi growth results in stool samples.

Culture remains to be the gold standard in the diagnosis of typhoid fever. Wakwoya *et al.*(2018) and Balakrishna *et al.*(2013) disagree with the previous studies shown that the stool culture is not the best test to isolate *Salmonella typhi* bacteria in comparison with blood culture[18,19]. In a previous study a stool was cultured from 300 individuals, the sensitivity of *Salmonella typhi* detection from stool samples is low, Nichols, *et al.*(2016) in a study mention that *Salmonella typhi* was not isolated from stool samples at either site, but non-typhoidal *Salmonella* (NTS) prevalence in stool samples was (24.1) (95%) per 1000 population and 10.3 (95%) per 1000 population[20].

Mawazo,*et al.*(2019) carried out a study conducted involved a total of 158 typhoid- suspected cases were enrolled, of the 158 patients participated in the study, 17 (11%) patients were stool culture positive[21].

The study also showed a difference in the percentage of typhoid fever distribution between males and females, as the results showed that the percentage in females was (51%) while in males was (49%), as shown in Figure (2).

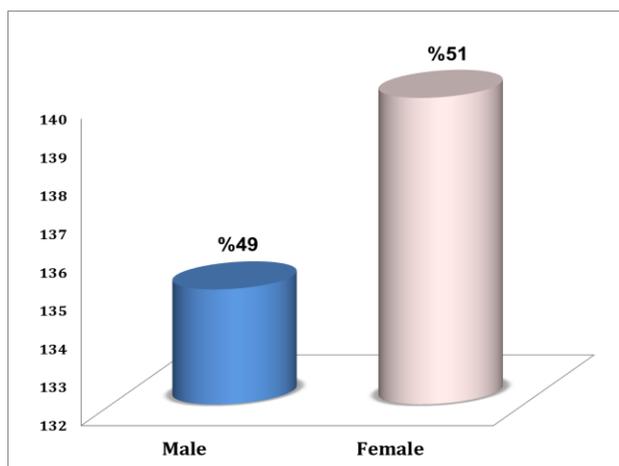


Figure 1: Distribution of patients with typhoid fever symptoms according to gender.

This is in line with previous studies in Kirkuk that reported that females are more susceptible to typhoid fever than males, as well as the same results reported in Tikrit by Awaid and Abdel Hamid., 2016[22]. Asl et al., 2013 showed that females are more affected than males in Iran[23].The results of the current study regarding the higher incidence of typhoid in females compared to males may be related to the fact that the female does not care about her health, but only cares about her family, and the main reason for her delay in visiting the doctor or health center is for reasons that may be economic.

Widal test and ICA test are tests to diagnosis typhoid fever disease but they different in the cost , time and accuracy in action. On the bases a differentiation between them according to number of infected person, the Figure 3 shown that Widal test are positive in most tested samples with a percentage (67%). However there are some studies considered that Widal test is a false positive study [24]. Also shown that Widal test had low specificity, but the study of House (2005) disagree with the last study [25].

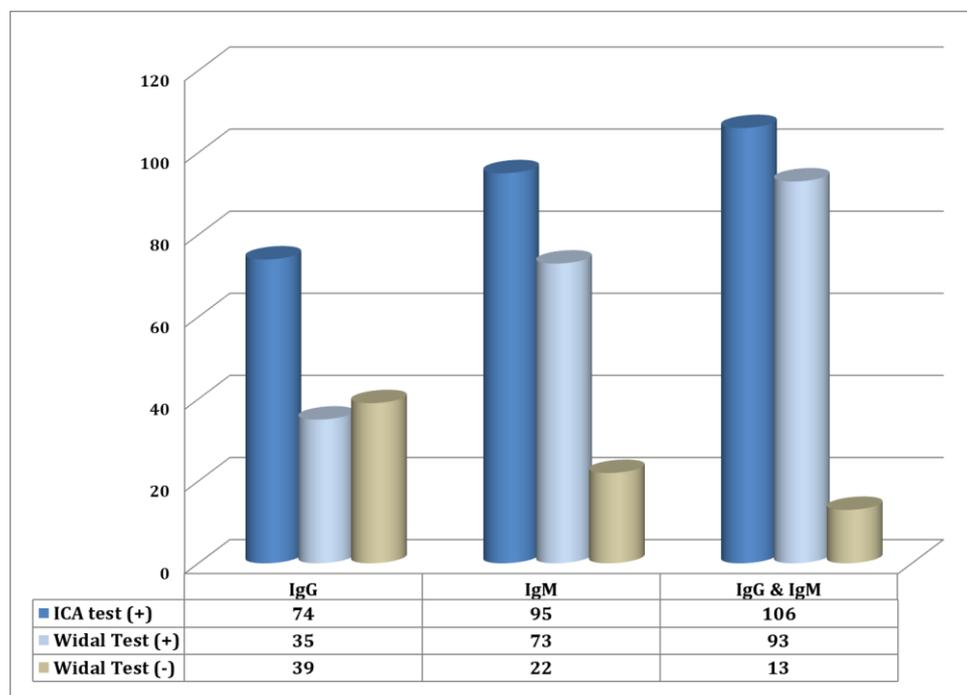


Figure 3: Results of positive Widal test to positive Immunochromatography ICA test for suspected Salmonella typhi positive patients.

This study compared among IgG that it is ratio are (24%) , positive widal test that are (47%) and negative widal test that are (52%), IgG refers to chronic disease . The acute cases IgM that recorded (31%) for the suspected people that were positive to Widal test as a ratio (76%) while negative cases were (23%). The highest range of the infection are positive IgG & IgM as a percentage(36%) compared with positive widal test that are also the highest rate as (88%).Hasan, 2013 [26] agree with that recorded the positive (56%)and negative case are only(6%).The last detected IgM antibody is suggestive of recent infection and IgG indicated a current or previous infection .

IV. Conclusion

Routine tests remain insufficient to detect and identify Salmonella typhi, and more accurate tests must be adopted, such as blood culture or blood film and more advanced biotechnological techniques.

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