

Article Research: Differentiation Between Typhoid and Typhus Fever Infection and Coinfection with Limited Resources in Iraq

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ABSTRACT

Enteric fever is caused by the Gram-negative bacilli *Salmonella typhi* and paratyphi, which have similar signs and symptoms to typhus and rickettsial illness. Both typhoid fever and rickettsia typhus, whether endemic or epidemic, have similar presentations, making it difficult to distinguish between the two diseases. As a result, coinfection of typhoid and typhus fever can be ignored if not recognized clinically. Serum was collected from 182 patients from the Suweib and fourth shurta areas who had a temperature of more than 38°C and two or more signs and symptoms of typhoid and typhus, such as headache lasting more than a week, rash, myalgia, arthralgia, and bleeding. Started with widal test slide method All result results confirmed by tube method Same samples investigated for typhus infection by weil-felix tests. Data entered to analyzed by SPSS program. the results were appeared of the 182 patients tested, 58 (18%) yielded results suggested that rickettsial infections or typhoid were the most likely because of their illnesses. patients' age ranged from 8 to 75 years with mean age 29.10 years. The majority were female and mainly student (41.4%) and housewife (25.9%) by age and sex for the 58 patients for whom data were recorded. Age groups did not differ significantly ($p > 0.5$). The frequency of disease was 69% in female patients and 31% in male patients ($p < 0.005$). Finally, can Concluded Both widal and weil-felix test should done specially if no responses to typhoid treatment and depend on trial therapy by adding doxycycline in case that more sensitive and accurate tests are not available.

Keywords- widal, weil-feilx test, typhoid fever, typhus.

I. INTRODUCTION

Salmonella bacteria is the cause of typhoid, while typhus occurs due to rickettsia, which often leads to similar illness pattern, lead to misdiagnosis and treatment [1]. Gram negative bacilli *salmonella typhi* and paratyphi causes enteric fever by faecal- oral from carriers common in endemic area with low socioeconomic indices where sanitary conditions are suboptimal [2,3]. 16 million cases of typhoid fever, 600,000 deaths occur world-wide each year [4]. In Iraq Typhoid fever is endemic because of hot weather and the frequent interruptions of electricity and water supply during the summer months have resulted in increased incidence that numerous interventions were implemented to prevent and control outbreaks. In 2007, 2008, 2009 and 2010, a total of 36,208, 58,247, 49,113 and 49,139 suspected cases of typhoid fever were

reported, respectively [5]. Typhus fever is a group of diseases caused by rickettsia, the most important of which are epidemic typhus caused by rickettsia prowazekii and spread by body lice, murine typhus due to *R. typhi* and scrub typhus by *R. tsutsugamushi* transmitted by fleas and chiggers respectively [2]. Epidemic typhus and typhoid fever usually have similar signs and symptoms infection with one disease or co-infection may be misdiagnosed [1]. Rickettsia is gram negative, small size microorganism between bacteria and viruses. Intracellular, bacterial group rickettsiae, in coccobacilli form multiply in nucleated cells, red colour by Gimenez or Giemsa stain [5, 6]. This microorganism's transmitted by arthropods ticks, lice, and mites which considered the natural hosts with the mammals [8].it adhere and invade endothelium of skin. Central nervous system, adrenal and other organs as intracelluer pathogen [7]. In Iraq the main presentation of typhus is abdominal pain, high fever, arthralgia, myolgia, nausea, headache, rash, chills and confusion. which is similar with presentation of typhoid fever also word typhi increase the confusion between both diseases so many in society thought them as same disease for decades that affect millions of people who can't differentiate between two names. So effective laboratory testing needs to make the perfect diagnosis.[9]

II. MATERIAL AND METHODS

Serum of 182 patients from the Suweib and fourth shurta districts were collected during the period from May 2018 until April 2020. These patients were selected based on the common signs and symptoms of typhoid and typhus. So, they had fever more than 38°C with two or more signs and symptoms like headache for more than week, rash, myalgia, arthralgia and bleeding with exclusion the patients with obvious respiratory tract infection, gastroenteritis, and other significant febrile illness. All laboratory tests were done in the national centre of haematology/ Mustansiriya University and primarily in almuasalat health center. Started with widal test slide method, adding 0.08,0.04,0.02,0.01 and 0.005ml of serum on a white tile than add one drop of antigen (O and H antigen) for typhoid fever, mix it and rotate tile for one minute. The reaction appears as 1:20, 1:40, 1:80, 1:160, 1:320 respectively [11,12]. All result results confirmed by tube method, taking eight tubes, the first contain 1,9ml of 0.85% saline. the remaining tubes

contain 1ml of saline, 0.1 of undiluted serum mixed well in first tube than take 1ml from it to mix with second tube and so on 1 ml from second to third till the seven one while the eight tube contain 1ml saline as control. Then add one drop of the reagent to all tubes, incubate in 50°C water bath for 4 hours, if agglutination appear mean positive results [13]. Same samples investigated for typhus infection by weil-felix tests. These tests depend on common somatic Proteus antigens that share with rickettsia, So Proteus OX19 and OX2 react usually with serum of patients infected by typhus group Rickettsiae and spotted fever infection respectively. The reagents contain killed, standardized, stained Proteus antigen suspensions [14]. Using slide methods and tube methods the same as in typhoid fever. the interpretation of the results if agglutination occur in rapid slide method after one minuet indicates the presence of antibody in serum fellow by quantitative tube method by presence of granular agglutination, patients rarely failed to develop antibody [15].

III. DATA AND ANALYSIS

Data entered to analyse by SPSS program. Descriptive analysis was used to summarize the data in the form of frequencies and percentages of variables. Pearson chi-square test was used to evaluate the

statistically significant difference in the level of prevalence of typhoid fever, typhus, between male and female study patients and according to the reported clinical features, P-value below 5% was considered as indicator of statistical significance.

Ethical consideration

Permission was obtained all Health Office in Baghdad health directorate. Participants' information sheet which contains the objective of the study, inclusion/exclusion criteria, the required data and methods of data.

IV. RESULTS AND DISCUSSION

Of the 182 patients tested, 58 (18%) yielded results suggested that Rickettsial infections or typhoid were the most likely because of their illnesses Table 1. Patients from all 2 study sites in 3 departments of Baghdad had evidence of Rickettsiae infections and or the typhoid as the cause of illness. Frequencies of confirmed patients in the 2 departments did not differ significantly ($p > 0.52$). student (41.4%) and housewife (25.9%) by age and sex for the 58 patients for whom data were recorded. Age groups did not differ significantly ($p > 0.5$). The frequency of disease was 69% in female patients and 31% in male patients ($p < 0.005$).

Table1: shows the frequencies of typhoid fever, typhus and positive result for both diseases in same serum samples. (P-value 0.001)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	positive widal and wiel	16	27.6	27.6	27.6
	Positive widal	30	51.7	51.7	79.3
	positive wiel	12	20.7	20.7	100.0

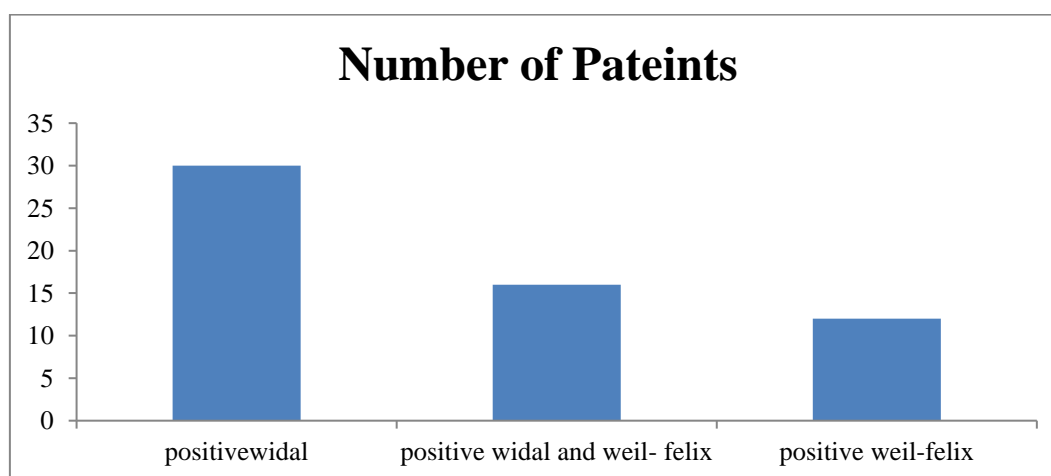


Figure 1: Out of 182 sera screened by the DCAT and tube titration method, 124 were negative for all tests. 58 of them were positive.16 for both test widal and weil-felix (27.6%) 30 for widal (51.7) and 12 for weil-felix(20.7).

Table 2: Patients' age ranged from 8 to 75 years with mean age 29.10 years. The majority were female and mainly

Variables		Number (%)
Sex	Male	18(31)
	Female	40(69)
Age	8-14	11(19)
	15-30	27(46.6)
	31-67	20(34.5)
Occupation	Student	24(41.4)
	Employee	12(20.7)
	Worker	2(304)
	Soldier	4(6.9)
	Housewife	15(25.9)
	Retired	1(1.7)

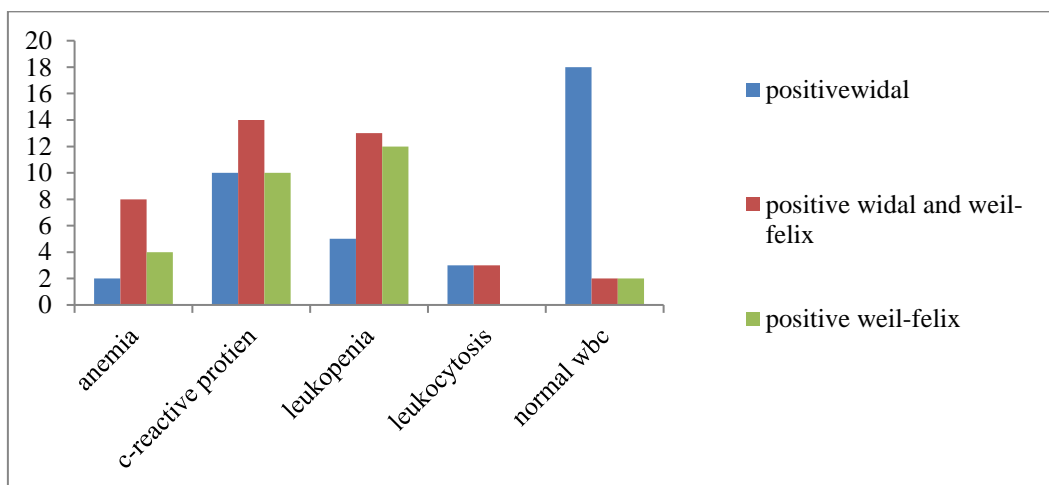


Figure 2: Laboratory parameters of typhus and typhoid cases (n = 58). The most common haematological changes observed in the study were; increase in CRP (19,7%), leukopenia (17,4%), anaemia (8,12%) & leucocytosis (5,8%). Whereas, normal wbc (12,76)

During the past century before 1990, the numbers of typhoid fever patients were limited because of good standard of living, but during the 90th Period especially after the Second Gulf War Typhoid fever outbreak disease spread more than threefold between 1996-2000 because of poor sanitation and water supplies, , Poor nutrition and Deterioration of preventive health programmers as a result of economic sanction against the country [16] There were 29,000 cases in 2003 and 5460 in the first quarter of 2004 [17], also the process of

disposing weapons of mass destruction, including biological weapons by United Nations inspection teams, may have played a major role in this outbreak of typhoid fever, especially after the Kurdistan Research Centres(Kurdish- British medical and scientific support group) confirmed the presence of typhoid bacteria, even using them in the first Gulf War [18]where Typhoid fever in aerosolized form can be a potential biological weapon, and sources reported that Iraq experimented with typhoid fever as a possible biological weapons agent. [19] All

these reasons have made Typhoid disease endemic in Iraq [20]. The presentation of both typhoid fever and rickettsial typhus, endemic or epidemic sometimes nearly similar that difficult to differentiate between both diseases so in case of co-infection of typhoid and typhus fever can be overlooked if not suspected clinically. High continued fever with variable associated symptoms, such as malaise, headache, and myalgia, are usually present in both typhoid and typhus fever and the word typhi make confusion in identification between both diseases why many have thought them the same disease for decades, that affect millions of people every year who can't differentiate between the similarity of name. So, effective laboratory testing needs to make the perfect diagnosis [21,22].

I try in this research show the simplest ways in the laboratory diagnosis to distinguish between the two diseases in case of weak initial diagnostic possibilities. Depend on Widal, The Weil–Felix test and other haematological data. Of the 180 patients with the same common symptoms, depending on preliminary laboratory tests, only 58 had positive results. In table 1 there was more than a half of patient revealed positive Widal test for typhoid .20% for rickettsia and 27% positive for both diseases which represent the co-infection (p-value 0.054) this go with Robin. G.M study of co-infection both diseases in Singapore with respect to typhoid Coinfection with typhus fevers, less than a handful of cases have been reported. Typhus fevers like epidemic and murine typhus may sometimes be misdiagnosed as typhoid fever in tropical regions. Moreover, because of the clinical and laboratory similarities, a Coinfection of typhoid with typhus fever can be overlooked. This case, therefore, emphasizes the importance of screening patients with typhoid fever for rickettsial diseases, especially when patients do not respond to standard typhoid treatment [23,24]. The result showed a significant reduction in the values for WBC, and HAE and increase CRP concentration in co-infection more than typhoid and typhus positive patients. While leukopenia and anaemia more in typhoid positive than typhus. This is what makes relying on these tests to differentiate between the two diseases less useful. It may be useful when associated with a clinical diagnosis in the absence of recent laboratory equipment's. And rely on widal and weilfelix. This study implies that anaemia, bone marrow suppression is likely resulting factors of typhoid fever more than typhus due to the changes in the haematological parameters. Therefore, these parameters have to be further studied to allow for efficient management of this illness. So, in case of poor response to treatment with intravenous ceftriaxone for positive widal and till the blood culture revealed grow Salmonella typhi (which was sensitive to ceftriaxone), patient continued to have fever spikes of 100°F. Weil Felix test must do suggestive of typhus infection. Oral doxycycline (100mg twice daily) was added along with ceftriaxone that co-infection suspected. Therefore, we see in this research the necessity of

adopting more sensitive diagnostic tests, such as immunofluorescent antibody technique and PCR when treating cases with similar symptoms and less or no response to initial treatment.

V. CONCLUSION

Cases with high fever, malaise, headache, and myalgia. Both widal and weilfelix test should done specially if no responses to typhoid treatment and depend on trial therapy by adding doxycycline in case that more sensitive and accurate tests are not available.

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