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Role of the Widal test in diagnosing typhoid fever compared with culture at Teaching Al-Hussein Hospital in Nasiriyah

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Abstract
One of the infectious diseases that affect people is typhoid. Typhoid fever outbreaks, which are mostly caused by *Salmonella typhoid* and *Salmonella paratyphoid* A, continue to be a major global health concern. We attempted to demonstrate in our study the value of the Widal test in the typhoid illness diagnosis. Slide agglutination widal test was employed to look at antibiotic susceptibility, culture, and the prevalence of typhoid illness. the study looked on the prevalence of typhoid fever and was carried out at the teaching Al-Hussein hospital between September 2018 and April 2019.the hospital admitted 155 patients who were thought to have typhoid fever. of whom 155 patients received a diagnosis of typhoid fever; the majority of these cases fell between the(>1–16) age range. there were seventy-six (49.03%) females and seventy-nine (50.96%) males. March and April saw the greatest number of patients, with lower numbers in subsequent months.

The Widal test and blood culture were positive in 75 cases (48.38%) of typhoid fever, while the blood culture was positive in 55 cases (35.4%), and 20 cases (17.3%) were negative for the blood culture, but positive for the serological test. Therefore, Widal's test is important in diagnosing typhoid.

Keywords: Widel test, Culture, Typhoid Fever and Hospital

Introduction
Gram-negative, facultative anaerobic, rod-shaped, and motile, Salmonella sp is a pathogenic bacterium [1]. The most prevalent food-borne pathogen is this one [2]. Salmonella.sp is responsible for 3 million fatalities, 1.3 billion instances of gastroenteritis, and 16 million cases of typhoid fever each year worldwide [3]. In poor nations, enteric fever remains a serious health concern. Serotypes Typhi and Paratyphi A of Salmonella enterica are frequently responsible for typhoid and paratyphoid fevers in Iraq, while serotype Paratyphi B is associated with typhoid fevers and serotype Paratyphi B is uncommon [4-5].

Both locals and visitors to endemic areas are susceptible to enteric fever. Rainy seasons increase the risk of enteric fever because of floods and fecal material pollution of water [6]. Isolation of Salmonella.sp from blood, stool, urine, bone marrow, bile, or other bodily fluids is necessary for a

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definitive diagnosis of enteric fever [5-7]. that approach isn't always available and is somewhat expensive. In these situations, the Widal agglutination test is a different laboratory test that is frequently employed for the serological diagnosis of enteric fever. The Widal test was created in 1896 by Georges Fernand Isidore Widal to help in typhoid fever diagnosis. It uses a suspension of deceased Salmonella enterica as antigen to identify typhoid fever in patients' serum who are suspected of having enteric fever [8,9].

The test is predicated on proving the existence of agglutination (antibody) against the H (flagellar) and O (somatic) antigens of *Salmonella enterica* serotype typhi, paratyphi A, and paratyphi B, in the serum of an infected patient, during the acute and convalescent phases of infection [10]. Typically, during the first week of infection, up to 70% of adults have an early rise in antibody titer [11]. When cross-reacting antigens are present, such as in the case of endocarditis, malaria, brucellosis, dengue fever, healthy carrier status, chronic liver disease, or other enterobacteriaceae infections, anti-body titers may be elevated in healthy individuals [12].

Commercial kits containing Salmonella paratyphi A, B, and C antigens are available. The tube agglutination technique, which involves testing consecutive two-fold dilutions of the subject's serum from 1:20 to 1:1280, is the suggested way for performing the widal test [13]. Due to its ease of use, quick slide testing is currently the method most frequently employed in nearby labs and hospitals. The Widal test is still the only useful test accessible in the majority of underdeveloped nations and has been widely utilized in the sero diagnostic of typhoid illness [13].

An essential diagnostic technique is the isolation of *Salmonella typhi* from bodily fluids such as blood, feces, urine, bone marrow, or other fluids. Furthermore, the preference for the Widal test has been linked to the lack of microbiological facilities and the lengthy wait times for culture results[14]. Cross-reactivity, which can lead to false positive results from other bacteria in the same genus, is one of the main drawbacks of the Widal test. For this reason, clinical correlation is required for positive results before medication is prescribed. While not as affordable as widal, Typhid is another quick test for typhoid fever diagnosis. For typhoid fever, the Widal test is the preferred method, particularly in rural areas. Our study aims to conduct the Widal test for those infected with typhoid fever and compare it with bacterial culture and know the data of infected patients.

Methods and materials

1 - Collection of samples

Samples were obtained from the teaching Al-Hussein hospital's main laboratory. There were 155 samples total, split between feces, urine, and blood. they were then transferred to laboratory procedures such as culture and serological examination.

2 - Antigenic detection

The baseline antibody titers were measured against the "O" and "H" antigens of the *Salmonella enteric* serotype Typhoid and the "H" antigens of the serotypes Paratypholid A and B. Standard Widal Confirmatory Quantity was used to measure the antibody titers. the teaching Al-Hussein hospital conducted this cross-sectional comparative study (from September 2018 to April 2019). blood samples were taken for the Widal test and culture from patients who were clinically suspected of having typhoid fever.

Every patient had a first blood sample taken for the culture Widal test, and a second sample was taken 7–10 days after the initial blood sample was taken in order to monitor the rising Widal test

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titer. Using Murex reagents (Murex Biotech Limited, UK), the quick slide titration method was used to perform the widal agglutination test [16].

3- Bacteriological investigations

Patients provided various specimens, including blood, stool, and urine. Bacteriological exams, including Gram stain and bacterial cultures, were used to make the diagnosis, which was then confirmed by biochemical tests specific to each isolate [25].

4- Antibiotic susceptibility test

Five distinct antibiotic drugs were evaluated for susceptibility in the isolates: ampicillin (10ug), amoxicillin (25ug), cefotaxime (30ug), chloramphenicol (30ug), and tetracycline (10ug), (bioanalysis , turkey) [27] .

5 - Risk factors

A number of host characteristics, including age groups, sex, and month incidence, were investigated using a questionnaire in this study.

Results

A total of 155 specimens were taken from patients who were hospitalized to the teaching Al-Hussein hospital with probable typhoid fever. Typhoid fever was identified in 155 individuals; 75 isolates (48.38%) were found in patient blood; 55 isolates (35.38%) were found through stool culture; and 25 isolates (16.12%) were found through urine culture. Table 1 lists the sources and Numbers of isolates of *Salmonella typhi* .

Table 1 : *Salmonella typhi* Isolate Sources and Numbers

Source and NO. of samples	NO. of isolates	%
Blood	75	48.38
Stool	55	35.48
Urine	25	16.12
Total	155	100

The frequency distribution of typhoid fever cases according to patient age groups is displayed in Table 2, which spans from less than one year to sixteen years old. The age group of patients who are (>12-14 years old) exhibits the highest frequency of typhoid fever cases (22.58%).

Table2: Age distribution of typhoid fever patients infected

age ranges (years)	Number	%
≤ 1-2	15	9.67
> 2 -4	15	9.67
> 4-8	20	12.90
>8-10	25	16.12
>10-12	30	19.35
>12-14	35	22.58
>14-16	15	9.67

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Total	155	100

Cases of typhoid fever by patient sex distribution. According to the study, there was a larger incidence of typhoid fever in men than in women; 79 cases, or 50.96% of the total, were men (table 3). Table 4 displays the distribution of cases of typhoid fever during the sample collection period, with March and April having the highest number of cases relative to the other months.

Table 3: Case distribution of typhoid fever based on patient sex.

Patient sex	Number of cases	%.
Females	76	49.03
Males	79	50.96

Table 4: Distribution of typhoid fever cases over the study period

the year's months	Number	%
September	15	9.6
October	15	9.6
November	20	12.9
December	16	10.3
January	15	9.6
February	17	10.9
March	30	19.3
April	27	17.4
Total	155	100

In our investigation, the following three tests' results on the specimen culture rate of 155 isolates of *Salmonella typhi* were used: widal (66 cases are positive ,22 cases are negative) ; Stool (15cases are positive,19 cases are negative) ; while Urine (14 cases are positive,19 cases are negative) see (Table 5) .

Table 5:Results of specimens culture of *Salmonella typhi*.

Test	Positive	Negative
Widal	66	22
Stool	15	19
Urine	14	19

The investigation involved 155 isolates of *Salmonella typhi*, and the antibiotic sensitivity and resistance rate of these isolates to five different antibiotics—Ampicillin (10µg), Amoxicillin (25µg), Cefotaxime (30µg), Chloramphenicol (30µg), and Tetracycline (10µg)—are displayed in Table 6.

Table 6: Test for antibiotic susceptibility of isolates of *Salmonella typhi*.

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antimicrobial agent	Sensit.	Resist.
Ampi.	100	55
Amoxi.	95	60
Cefot.	89	66
Chloram.	82	73
Tetra.	80	75

Discussion

Typhoid fever cases with positive results from the Widal test and blood culture were 75 (48.38%), whereas positive results from the blood culture were 55 (35.4%).whereas 20 patients (17.3%) had positive serologic test results but negative blood culture results.given that the Widal test results are typically available prior to blood culture, they may aid in the diagnosis of this illness [17, 18]. typhoid does not rule out the illness if a blood culture or Widal test are negative [19, 20]. If both of these tests came out negative, the illness is ruled out. The second week is when the antibodies, or agglutinins, typically develop [20].

During the first week of fever, blood cultures produce higher positive results [19]. The low rate of salmonella isolation from blood may have been caused by pre-hospital antibiotic use as well as delayed hospital admission [21].

In this study, the age group (>12–14 years old) accounted for 22.58% of cases with typhoid fever. This could be because people in this working age group are more likely to become infected early in life [21]. The age range that was impacted by this illness appears to be the same as previously reported [22.23]. This indicates that children under the age of 14 had the highest rate of infection, while patients beyond the age of 14 had lower rates of infection.The fact might be connected to children's immunity [19].

Males are impacted more often than females; this finding differs from earlier research findings [24, 23]. This could be because the majority of the men were outside, and from this vantage point, they might be seen as handling or consuming food, or as interacting with other patients [25]. Patients' monthly incidence of typhoid fever peaks in March (19.3%), April (17.4%), and other months less frequently.This outcome is the same as that of another report [23]. that explains why the majority of infected cases happen in the summer. This is because people drink more water during these months, increasing their chance of contracting typhoid fever.

Salmonella typhi isolates' antibiotic sensitivity to five different antibiotic agents is shown in Table 6.Strong resistance to β lactam antibiotics is present in the isolates, with the exception of Amoxiclave (which contains Ampicillin, Amoxicillin, Cefotaxime, Tetracycline, and Chloramphenicol).the outcomes align with the findings of prior research [24, 23].therapy for *Salmonella typhi* Due to innate and acquired resistance to a range of antimicrobial agents, infection by antibiotic agents is frequently challenging [26]. Abuse of antibiotics causes bacteria to

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adapt and develop resistance, particularly in developing nations like ours [26, 23]. We deduced from this study that typhoid fever is typical among.

The widal test results is more equivalent and more rapid than culture of stool and urine because the laters is not specific (antagonism of relationship and medium components). Ultimately, we are advised to consider the following points: The current research indicates that public health initiatives aimed at preventing typhoid fever should prioritize education in addition to providing clean water supplies, ensuring safe and hygienic excreta disposal, and promoting better food trade practices or strict guidelines for handling, processing, and storing food.

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