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RESEARCH ARTICLE
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DIAGNOSTIC ACCURACY OF TYPHIDOT TEST FOR CLINICAL DIAGNOSIS OF TYPHOID FEVER KEEPING BONE MARROW CULTURE AS GOLD STANDARD

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Abstract

Background: Typhoid fever is a symptomatic bacterial illness, also called as enteric fever. The culture of organisms has long been the gold standard for diagnosis despite the fact that a variety of quick tests have been developed, results are accessible considerably fast than in culture and need little technical expertise or cost. These include several tests, such as the well-known Widal test and Typhidot.

Objective: To assess the diagnostic accuracy of typhidot test for clinical diagnosis of typhoid fever keeping bone marrow culture as gold standard

Methodology: The current study was cross-sectional study, carried out at the Department of Medicine, Bolan Medical College/ Bolan Medical Complex Hospital, Quetta. The duration of the study was six months from January 2023 to June 2023. 2cc blood sample was taken for the patients and was sent to laboratory for typhidot test investigation while bone marrow samples was taken in the procedure room of medical Department and was sent to laboratory for culture investigation. Data analysis was done by using SPSS version 17.

Results: In the current study, totally 178 patients were enrolled. The male patients were 103(58%) whereas female patients were 75(42%). The mean age (SD) in the current study was 30 (±11.26) years. Based on the diagnostic accuracy of typhidot test, sensitivity was 18.96%, specificity was 25%, PPV was 91.66%, NPV was 0.74% and the diagnostic accuracy was 19.10%.

Conclusion: Our study concludes that typhidot test had sensitivity 18.96%, specificity 25%, PPV 91.66%, NPV 0.74%, diagnostic accuracy 19.10% in typhoid fever diagnosis by keeping bone marrow culture as gold standard**.**

Keywords: diagnostic accuracy, typhidot test, clinical diagnosis of typhoid fever, bone marrow culture, gold standard

Introduction

Typhoid fever is a symptomatic bacterial illness, also called as enteric fever. Multiple Salmonella species are responsible for typhoid fever. Salmonella typhi, Salmonella paratyphi A, Salmonella paratyphi B, and Salmonella paratyphi C are the Salmonella species and strains that often cause human typhoid fever (1). Food or water contaminated with typhoid-infected human feces may carry the disease if consumed. The infection's most noticeable symptom is fever. Typhoid fever is a major source of morbidity in many parts of the globe, with 12 to 33 million cases and 216,000 to 600,000 fatalities reported each year (2).

Due to their low sanitation and hygiene, underdeveloped countries are most affected by this illness (2). A 2015 research that was published found that 42.86% of people had typhoid fever (3).The increased incidence among those between the ages of 46 and 60 may be due to the fact that these people are always in the market, where they purchase meals from food sellers and drink whatever water is available. Typhoid is caused by exposure to contaminated drinking water, near proximity to garbage dumps and human waste, poor preparation of food standards, and illiteracy (4, 5).

Blood culture is the most common way for a lab to diagnose typhoid fever, but bone marrow culture is the gold standard. Most of instances of typhoid fever occur in low-income nations, where bacterial cultures are not often performed (6). Bone marrow culture is still infrequent when it is done because it is an intrusive process and is technically challenging. Over a century has passed since the Widal test was first used in low-income nations. It finds S. Typhi O and H antigen-specific antibodies in patient serum. Yet, it has a lot of drawbacks, such as insufficient specificity (7). This study will provide us the latest and updated information regarding diagnostic accuracy of Typhidot test for clinical diagnosis of typhoid fever keeping bone marrow culture as gold standard**.** If Typhidot test has similar accuracy as bone marrow smear test then it will be recommended as a diagnostic tool for the diagnosis of typhoid instead of bone marrow culture because bone marrow culture is an invasive and costly investigation.

Material and methods

The current study was cross-sectional study, carried out at the Department of Medicine, Bolan Medical College/ Bolan Medical Complex Hospital, Quetta. The duration of the study was six months from January 2023 to June 2023. The sample size was 178 using the following parameters. Sensitivity of Typhidot Test = 26.7% (8)Specificity of Typhidot Test = 61.5%, (8) Prevalence of typhoid = 42.86%(5), Confidence Level = 95% and Desired precision = 10%, n = 178. Non probability consecutive sampling technique was used.

Inclusion criteria:

1. All the patients presenting with suspected typhoid fever
2. Both genders
3. All the patients in age range 18 to 65 years

Exclusion criteria:

1. History of significant organ/system disease that could interfere with study conduct or completion.
2. Presence of implants or prosthesis (on the bases history and radiological investigations).
3. Have previously received any typhoid vaccine
4. Female participants who are pregnant or lactating.

Data collection procedure:

After the approval of synopsis, permission was taken from the hospital ethical committee. All the patients presenting with suspected typhoid fever were included in the study. An informed written consent from them was taken.

All the routine examination and laboratory investigation was done for the diagnosis of typhoid fever. 2cc blood sample was taken for the patients and was sent to laboratory for typhidot test

investigation while bone marrow samples was taken in the procedure room of medical Department and was sent to laboratory for culture investigation. All the laboratory investigations were done under supervision of single expert microbiologist having minimum experience of five years. All of the information including name, age, gender, and duration of typhoid fever was recorded in a pre-designed Proforma.

Data Analysis:

Data analysis was done by using SPSS version 17. Variables such as age, typhoid fever duration were determined in the form of means and standard variables. The variables like gender, typhidot test and bone marrow culture were determined as frequency and standard deviation. The variables like "specificity, Sensitivity, positive predictive value (PPV) and negative predictive value (NPV)" were determined by using table below.

		Bone marrow culture results	
Typhidot test results		**+**	**-**
	+	**A**	**B**
	-	**C**	**D**

A = True positive, B = False positive, C = False negative, D = True negative

Sensitivity = A/(A+C)x100

Specificity = D/(B+D)x100

Positive predictive value = A/(A+B)x100

Negative predictive value = D/(C+D)x100

Accuracy = D + A / overall patients

Results

In the current study, totally 178 patients were enrolled. The male patients were 103(58%) whereas female patients were 75(42%). The mean age (SD) in the current study was 30 (±11.26) years. On the bases of age distribution, 121(68%) patients were 18-40 years old while 57(32%) patients were 41-65 years old. Based on duration of typhoid fever, 62(35%) patients had typhoid fever ≤3 days, 116(65%) patients had typhoid fever >3 days. Mean typhoid fever was 3 days with standard deviation ± 2.07.(Table 1)

Typhidot test findings among 178 patients were analyzed as typhidot test was positive in 36(20%) patients and was negative in 142(80%) patients. (Figure 1)Bone marrow culture findings among 178 patients were analyzed as bone marrow culture was positive in 174(98%) patients and was negative in 4(2%) patients. (Figure 2) Based on the diagnostic accuracy of typhidot test, sensitivity was 18.96%, specificity was 25%, PPV was 91.66%, NPV was 0.74% and the diagnostic accuracy was 19.10%. (Table 2)

Table 1: Clinical and demographic data of the enrolled patients

Parameter	**Sub category**	**Frequency**
Gender	Male	103(58%)
	Female	75(42%).
Age	18-40 years	121(68%)
	41-65 years	57(32%)
Typhoid fever duration	≤3 days	62(35%)
	>3 days	116(65%)

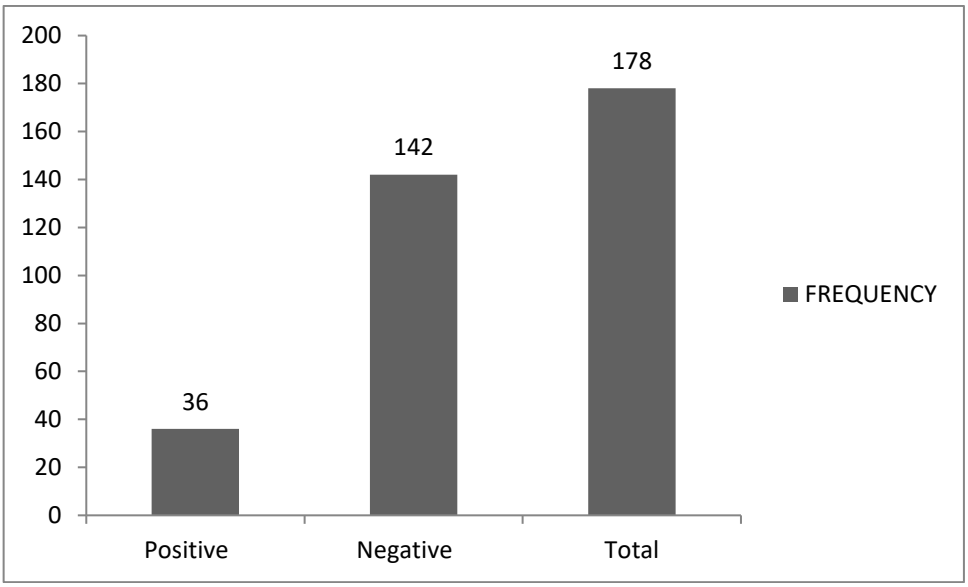

Figure 1: Positive and negative cases based on Typhidot test

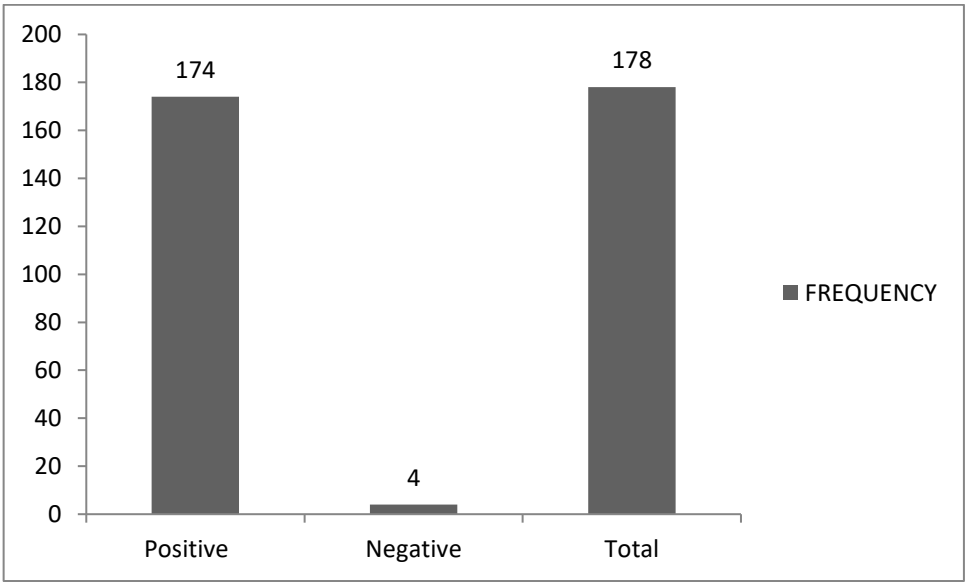

Figure 2: Positive and negative cases based on bone marrow culture

Table no 2: Diagnostic accuracy of typhidot test keeping bone marrow culture as gold standard

		BONE MARROW CULTURE		
		+	-	**Total**
TYPHIDOT TEST	+	A33 TP	B3 FN	36
	-	C 141 FP	D 1 TN	142
	Total	174	4	178

Sensitivity=18.96%
Specificity = 25%
Positive predictive value = 91.66%
Negative predictive value = 0.74%
Diagnostic Accuracy = 19.10%
Sensitivity=19.32%

Discussion

In Pakistan and other impoverished nations, typhoid fever is still a leading cause of mortality and morbidity. Globally, there are around 22 million instances of typhoid fever each year, with children being the main victims (9). According to estimates, typhoid illness kills 600,000 people annually, predominantly in Asia (10). Although being a widespread sickness, the true frequency cannot be adequately determined due to clinical characteristics that overlap with those of other febrile diseases and a lack of diagnostic resources in the majority of the most severely affected regions (11). The culture of organisms from blood or other bodily fluids has long been the gold standard for diagnosis (12) despite the fact that a variety of quick tests have been developed, results are accessible considerably fast than in culture and need little technical expertise or cost (13). These include several tests, such as the well-known Widal test and Typhidot. In the current study, totally 178 patients were enrolled. The male patients were 103(58%) whereas female patients were 75(42%). The mean age (SD) in the current study was 30 (±11.26) years. Typhidot test findings among 178 patients were analyzed as typhidot test was positive in 36(20%) patients and was negative in 142(80%) patients. Bone marrow culture findings among 178 patients were analyzed as bone marrow culture was positive in 174(98%) patients and was negative in 4(2%) patients. (Figure 2) Based on the diagnostic accuracy of typhidot test, sensitivity was 18.96%, specificity was 25%, PPV was 91.66%, NPV was 0.74% and the diagnostic accuracy was 19.10%. In contrary to our findings, a previous study carried out by Karamat Hussain et al. reported that there were 211 patients in all in their study; 49 individuals tested positive for typhoid fever (culture positive), and 162 patients tested negative for non-typhoidal illnesses. There were 47 instances of typhoid fever that tested positive for typhidot IgM, whereas there were 155 cases of non-typhoidal fever that tested positive for the IgM antibody. Typhidot has a sensitivity of 95.9% and a specificity of 26.5% for the diagnosis of typhoid fever (14). Similar findings were found in a prior national investigation; out of 147 patients, Typhidot sensitivity was 27% and its specificity was 61%. The blood cultures of just 15 individuals (10%) were positive for Salmonella typhi, while the false-positive rate for Typhidot was about 35% which is very high (15). In accordance with our study, another study carried out by Mohsan S et al. reported comparable results. They reported that Typhidot test results were positive in 67.4% patients, while blood cultures were positive in 77.5% patients. The diagnostic accuracy of the typhidot against culture was 60.7%, with diagnostic sensitivity of 68.1%, specificity (35%), PPV (78.3%), NPV of 24.1%, and NPV of 78.3% (16). Another study carried out by Bukhari N et al. reported contrasting results to our findings. They reported that Specificity was 84.6%, sensitivity was 81.7%, NPV was 91.4 %, and PPV was 69.8 % for the Typhidot-M test. Which is not in accordance with our findings (17).

Conclusion

Our study concludes that typhidot test had sensitivity 18.96%, specificity 25%, PPV 91.66%, NPV 0.74%, diagnostic accuracy 19.10% in typhoid fever diagnosis by keeping bone marrow culture as gold standard**.**

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