

A Comparative Study of Widal Test and Typhidot Test in the Diagnosis of Typhoid Fever in A Tertiary Care Hospital in Western U.P.Charu Chandwani¹, Natasha Tyagi², Amit Joon³, Ritika Kansal^{4*}, Devesh Kumar Bhagwani⁵¹Assistant Professor, Paediatrics, G S Medical College and Hospital²Assistant Professor, Microbiology, G S Medical College and Hospital³Associate Professor, Community Medicine, G S Medical College and Hospital⁴Associate Professor, Pathology, G S Medical College and Hospital⁵Associate Consultant, Gastroenterology, Akaash Healthcare, Dwarka

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Conflict of interest: Nil

Abstract

Background: Enteric fever (Typhoid fever) is a common systemic infectious disease worldwide, especially in developing countries like India and continues to be one of the leading causes of morbidity and mortality. It is caused by the bacterium *Salmonella typhi* or *Salmonella paratyphi* serotypes A, B and C. The clinical diagnosis of Enteric fever traditionally depends on Blood culture and Widal tests. However limitations such as longer time for Blood culture results and difficulties in the interpretation of Widal tests make them unpractical for screening patients in endemic regions and lead to misdiagnosis and missed diagnosis.

Aims and Objectives: In this study we compare the sensitivity and specificity of Widal test and Typhidot test, in the diagnosis of Typhoid fever.

Material and Methods: The comparison for the presence of the *Salmonella* antibodies done by the Typhidot and Widal tube agglutination test in central lab of gs medical college over a period of jan23 to jun23.

Results: Out of 350 blood specimen, 42.8% cases were positive by Typhidot test and 31.42% cases were positive by Widal test.

Conclusion: Typhidot is a rapid and more sensitive test for early diagnosis of typhoid fever. It offers the advantage of early and rapid diagnosis and helps in early institution of therapy. Widal test showed the sensitivity and specificity of 53.3% & 73.1% respectively. Typhidot test showed sensitivity of 80% and specificity of 63.3%.

Keywords: Enteric fever, Widal test, Typhidot test, Blood culture, *Salmonella typhi*.

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Introduction

Enteric fever (Typhoid fever) is a systemic disease mostly occurs in developing countries and continues to be a major public health problem [1, 2]. It is caused by dissemination of *Salmonella typhi* or *Salmonella paratyphi* serotypes A, B and C. Enteric fever is a major cause of morbidity and mortality worldwide, causing an estimated 27 million cases with 200000-600000 deaths annually [3]. The subcontinent India bears the brunt of the disease both in terms of absolute number of cases and drug resistant strains [3, 11]. The annual incidence is highest (>100 cases/100000 population) in south-central and southeast Asia; medium (10-100 cases/100000 population) in the rest of Asia, Africa, Latin America and Oceania (excluding Australia and New Zealand); and low in other parts of the world. In disease endemic area like India, the annual incidence of Enteric fever is about 1% [3]. Because the clinical presentation of Enteric fever is relatively non-specific, laboratory tests are important for

accurate diagnosis and early treatment with suitable antibiotics for speedy recovery, prevention of emergence of complications, morbidity and deaths and also for the control of transmission [4]. The definitive diagnosis of Enteric fever requires the isolation of *Salmonella typhi* or *paratyphi* from blood, bone marrow, other sterile sites, rose spots, stool or intestinal secretions which consumes a lot of time and energy [5]. Widal test has been used as a rapid serological test but it has moderate sensitivity and specificity and positive predictive value. However, it becomes positive only in the second week of illness [6], and paired sera are required for confirmation of the diagnosis [7]. Complexity and higher costs of other molecular test hinders its routine use [12-15]. Therefore to overcome the limitations of conventional methods a serological test (Typhidot test) which is a rapid inexpensive, early to perform, reliable with high sensitivity and specificity for diagnosis of Enteric fever and

appropriate for outpatient settings has been introduced. Hence present study was done to compare the sensitivity and specificity of Widal test and Typhidot test in our region.

Therefore there is a need of a serological test which is rapid, inexpensive, reliable, easy to perform with high sensitivity & specificity for diagnosis of typhoid.

2. Materials and Method

A comparative study of Typhidot&Widal test in the diagnosis of typhoid fever was conducted from Jan23 to jun23.

2.1. Inclusion criteria

350 blood samples of pediatric age group and sexes coming to the central laboratory of gs medical college and hospital, pilkhuwa.

2.2. Exclusion criteria

Samples which came positive for malarial antigen and dengue IgM and IgG antibodies were excluded from the study to rule out cross reactivity with Salmonella antibodies.

2.3. Procedure

All the blood samples received in the laboratory were centrifuged at 2500 rpm for 5 minutes and the serum so separated was collected in a separate serum vial. All those samples which met the inclusion and exclusion criteria were subjected to:

Widal tube agglutination test by using Widal agglutination kit by Arkay. Set of 16 dry clean 10 x 75 mm test tubes were taken for the test. Dilution of the serum samples were made as follows

Like this 4 rows of test tubes are made. One of O, next H antigen, Next AH antigen and last BH antigen. All tubes are mixed well and incubated at 37 degree C for 16–20 hours and read for agglutination.

On site Typhidot IgG/IgM Rapid test by CTK was used based on lateral flow immunoassay was used to detect Salmonella antibodies. 1 drop (30- 45 µl) of serum was put in the center of the sample well. After this, 1 drop (30 – 45 µl) of sample diluent was added into the sample well and allowed to stand for 15 min. After 15 minutes result was interpreted. Positive samples give a band on control line, IgM or IgG antibodies.

3. Results

A total of 350 serum samples were included in this study. Out of these, 77.5% were males, 22.5% were females positive for both Typhidot and Widal. [Table 1]. While, 150 (42.8%) were positive by Typhidot test and 110 (31.42%) were positive by Widal test. Whereas 80(22.85%) patients positive for both Typhidot and Widal. [Table 2] Widal test has a sensitivity of 53.3%, specificity of 73.1%. Typhidot test has a sensitivity of 80%, specificity of 63.3%[Table 5].

Table 1: Prevalence of male and female according to test

Test	Typhidot	%	Widal	%	Both	%
Male	114	76	86	78.1	62	77.5
Female	36	24	24	21.8	18	22.5
Total	150		110		80	

Table 2: Comparison between Blood culture, Widal test and Typhidot test.

Results	Typhidot	Widal	Blood Culture
Positive	150	110	50
Negative	200	240	300
Total	350	350	350

Table 3: Comparison between blood culture and Widal test.

Blood Culture				
		Positive	Negative	Total
Widal Test	Positive	32	78	110
	Negative	28	212	240
	Total	60	290	350

Table 4: Comparison between blood culture and Typhidot test.

Blood Culture				
		Positive	Negative	Total
Thphidot Test	Positive	40	110	150
	Negative	10	190	200
	Total	50	300	350

Table 5: Observation of outcome of Typhidot test and widal test

Test	Sensitivity %	Specificity %	PPV %
Typhidot	80	63.3	26.6
Widal	53.3	73.1	29

4. Discussions

Enteric fever results in significant amount of morbidity, mortality and loss or absence from work hours in developing countries. Low standard of living, poor sanitation and hygiene, overcrowding and injudicious use of antibiotics lead to endemicity of Enteric fever and emergence of multi-resistant strains of Salmonella typhi in developing countries [1, 2].

For diagnosis of Enteric fever Blood culture remains the gold standard but its utility in early and rapid diagnosis is limited in early phase of the disease thereby making the isolation of Salmonella typhi and paratyphitroublesome. Widal test has been used for diagnosis of Enteric fever since many decades but its low sensitivity, specificity, positive predictive value and sharing of O and H antigens by other Salmonella serotypes and other Enterobacteriaceae makes the role of this test more controversial [8, 9].

Discovery of Typhidot test resulted from the limitations of Widal. This test detects specific IgM and IgG antibodies independently against Salmonella typhi. Based on immunochromatography, it is simple, user-friendly, rapid and economical test with high specificity of 75%, sensitivity of 95%, and high negative and positive predictive values [10]. It detects IgM antibodies suggesting acute early phase of infection, while both igG and IgM antibodies suggests acute typhoid in the middle phase of infection. IgG antibodies of typhoid remain for more than 2 years after infection; hence we cannot differentiate between acute and convalescent cases.

In the present study we compare the commercial rapid diagnostic kits for their sensitivity and specificity. Our study shows a lower percentage of widal test positivity in comparison to other studies. The results of previous studies which were done by various researchers, shown in Table 6.

Table 6: Comparative analysis of Typhidot with widal test in different regions of India

S.N	Author	Typhidot	Widal
1	Present study	49.31%	38.60%
2	Bhutta ZA et al. (1999)7	70%	54%
3	Retnosari Set al. (2001)16	72%	11%
4	Sherwal BL et al. (2004)1	79%	-
5	Jesudason MV et al. (2006)10	9%	-
6	Yaramis A et al. (2001)17	-	20%
7	Gopalakrishnan V et al. (2002)18	-	34.70%

Conclusion

Typhidot test is simple, easy to perform, more reliable, rapid screening test having high sensitivity and specificity as compared to Widal test in diagnosing Enteric fever. Typhidot test becomes positive within 2-3 days of infection and gives result within 15 minutes which allows medical professional to take immediate action and early institution of therapy.

Hence, we conclude that the typhidot appears to be a practical alternative to Widal test in the diagnosis of typhoid fever even in the resource poor laboratories as it neither requires much laboratory equipment's nor laboratory expertise to conduct the test.

References

1. Sherwal, BL, Dhamija RK, Radhawa VS, Jais M, Kaintura A, Kumar M.A comparative study of typhidot and Widal test in patients of typhoid

fever. JIND Acad Cord Med., 2004; 5(3): 224-6.

- Agrawal PK, Gogia A, Gupta RK, Typhoid fever. J Ind Academy Clin Med., 2004; 5(1): 60-4.
- Kothari A, Pruthi A, Chugh TD. The burden of enteric fever. J Infect Dev Ctries., 2008; 2(4): 253-9.
- Dutta S, Sur D, Manna B, Sen B, Deb AK, Deen JL, et al. Evaluation of new generation serologic tests for the diagnosis of typhoid fever: data from a community-bases surveillance in Calcutta, India. DiagnMicrobiol Infect Dist., 2006; 56(4): 359-65.
- Postoor R, Hatta, M, Abdoel TH, Smits HL. Simple, rapid and affordable point of care test for the serodiagnosis of typhoid fever. Diagn Microbiol Infect Dis., 2008; 61: 129-34.
- Haque A, Ahmed J, Qureshi JA. Early detection of typhoid by polymerase chain reaction, Ann Saudi Med., 1999; 19(4): 337-40.
- Bhutta ZA, Mansurali N. Rapid serological diagnosis of paediatric typhoid fever: A

- prospective comparative evaluation of two dot enzyme immunoassays and the Widal test. *Am J Trop Med Hyg.*, 1999; 61(4): 654-7
8. Schroeder SA. Interpretation of serological tests for typhoid fever. *JAMA*, 1968; 206(4): 839-40.
 9. Parry CM, Hien TT, Dougan G, White NJ, Farrar JJ. Typhoid fever. *N Engl J Med.*, 2002; 347(22): 1770-82.
 10. Jesudason MV, Sivakumar S. Prospective evaluation of a rapid diagnostic test typhidot@ for typhoid fever. *Indian J Med Res.*, 2006; 123: 513-6.
 11. Brown JC, Shanahan PM, Jesudason MV, et al. Mutations responsible for reduced susceptibility to 4-quinolones in clinical isolates of multi resistant *Salmonella typhi* in India. *J Antimicrobolchemother.*, 1996; 37: 891-900.
 12. House, D., J. Wain, V. A. Ho, T. S. Diep, N. T. Chinh, P. V. Bay, H. Vinh, M. Duc, C. M. Parry, G. Dougan, N. J. White, T. T. Hien, J. J. Farrar. Serology of typhoid fever in an area of endemicity and its relevance to diagnosis. *J. Clin. Microbiol.*, 2001; 39: 1002-1007.
 13. Oracz G., W. Feleszko, D. Golicka, J. Maksym-iuk, A. Klonowska, H. Szajewska. Rapid diagnosis of acute *Salmonella* gastrointestinal infection. *Clin. Infect. Dis.*, 2003; 36: 112-115.
 14. Gilman, R. H., M. Termini, M. M. Levine, P. Hernandez-Mendoza, R. B. Hornick. Relative efficacy of blood, urine, rectal swab, bone-marrow, and rose-spot cultures for recovery of *Salmonella typhi* in typhoid fever. *Lancet*, 1975; i: 1211-1213.
 15. Membrebe FA, Chua JA. The clinical utility of Typhidot in the diagnosis of Tyhiod fever. *Phil J Microbial Infect Dis.*, 1999; 28(1): 1-4.
 16. Retnosari S, Tumbelaka AR, Akib AP, Hadinegoro SRS. Clinical and laboratory features of typhoid fever in childhood, focus on relationship between prior antibiotic administration with blood culture, Widal and typhidot results. *PaediatrIndones.* 2001;41:149-54.
 17. Yaramis A, Yildirim I, Katar S, Ozbek MN, Yalcin T, Tas MA. Clinical and laboratory presentation of typhoid fever. *Int Paediatr.* 2001;16(4):227-31.
 18. Gopalakrishnan V, Sekhar WY, Soo EH, Vinsent RA, Devi S. Typhoid fever in Kuala Lumpur and a comparative evaluation of two commercial diagnostic kits frothed detection of antibodies to *Salmonellatyphi*. *Singapore Med J.* 2002;43(7):354-8.