

Laboratory Diagnosis of Typhoid Fever Using Blood Culture, Widal and Rapid Diagnostic Tests - A Comparative Study

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Abstract: ***Background:** Typhoid fever remains a major public health challenge in developing nations, where diagnostic limitations significantly delay treatment. Early and accurate diagnosis is crucial to prevent morbidity and complications. **Aim:** To compare diagnostic efficacy of blood culture, Widal agglutination test, and Typhidot rapid enzyme immunoassay among clinically suspected cases of enteric fever. **Methods:** A cross-sectional study was conducted among 140 clinically suspected typhoid fever patients. Blood culture, Widal tube agglutination test, and Typhidot dot-enzyme immunoassay were performed. Diagnostic sensitivity and specificity were calculated using blood culture and a Composite Reference Standard (CRS). **Results:** Among week-1 cases (n = 81), blood culture showed 64.19% positivity, Widal 23.45%, and Typhidot 74.07%. In week-2 cases (n = 59), blood culture positivity dropped sharply (10.16%), while Widal and Typhidot showed 71.18% positivity. Typhidot showed overall highest sensitivity. **Conclusion:** Blood culture continues to be the diagnostic gold standard during early infection phase. However, the Typhidot assay demonstrated consistently high sensitivity and is recommended as a rapid point-of-care tool, especially in resource-limited setups.*

Keywords: Typhoid fever diagnosis, Blood culture testing, Widal agglutination test, Typhidot rapid assay, Resource-limited healthcare settings

1. Introduction

Typhoid fever is a systemic febrile illness caused predominantly by *Salmonella enterica* serovar Typhi, transmitted through fecal-oral contamination. Clinical manifestations - step-ladder fever, abdominal discomfort, hepatosplenomegaly, and malaise - often mimic other febrile diseases, complicating clinical diagnosis.

Blood culture remains the gold standard for diagnosis, but its sensitivity declines after the first week of infection or following antibiotic exposure. Serological tests such as the Widal test continue to be widely used due to affordability but demonstrate highly variable reliability. Rapid diagnostic assays, including Typhidot, have emerged to improve early diagnosis.

2. Materials and Methods

A cross-sectional observational study was conducted among clinically suspected enteric fever cases at a tertiary-care teaching hospital in Odisha, India. A total of 140 patients were enrolled.

Diagnostic Procedures:

- Blood Culture: 5–10 mL peripheral blood inoculated into Brain-Heart Infusion broth at 37°C with subculture every 48 hours.
- Widal Tube Agglutination Test: Titres $\geq 1:100$ (O) and $\geq 1:160$ (H) were considered positive.
- Typhidot Rapid Assay: Dot enzyme immunoassay detecting IgM/IgG antibodies.

3. Results

Table 1: Diagnostic Yield in Week-1 Typhoid Suspects (n = 81)

Diagnostic Test	Number Positive (n)	Percentage Positive (%)
Blood Culture	52	64.19%
Widal Test	19	23.45%
Typhidot Test	60	74.07%

Table 2: Sensitivity & Specificity vs Blood Culture – Week-1 (Gold Standard)

Test	Sensitivity (%)	Specificity (%)
Widal Test	30.7%	10.34%
Typhidot Test	100%	58.06%

Table 3: Diagnostic Yield in Week-2 Typhoid Suspects (n = 59)

Diagnostic Test	Percentage Positive (%)
Blood Culture	10.16%
Widal Test	71.18%
Typhidot Test	71.18%

Table 4: Sensitivity & Specificity using Composite Reference Standard (CRS) – Week-2

Test	Sensitivity (%)	Specificity (%)
Widal Test	85.71%	67.92%
Typhidot Test	100%	58.53%

4. Discussion

Blood culture continues to be the most accurate confirmatory diagnostic method in the early disease stage, particularly within the first week of illness. However, its utility is limited by infrastructure needs, processing time, and prior antibiotic exposure. Widal test demonstrated poor sensitivity during early disease and showed improved

performance only beyond the first week. Typhidot displayed high sensitivity consistently, reinforcing its role as a rapid and reliable screening tool.

These results support a diagnostic strategy integrating blood culture with Typhidot for early detection and Typhidot with Widal for patients presenting later.

5.Conclusion

Typhidot rapid test is a valuable diagnostic method for both early and late stages of typhoid fever and is particularly useful where culture facilities are unavailable. Blood culture should still be performed where feasible, especially in early cases.

Conflict of Interest

None declared.

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