

# Incidence of Co-infection of Malaria and Typhoid and their Diagnostic Dilemmas

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## Abstract

**Background:** This study was carried out to know the incidence of co-existence of typhoid and malaria in western part of Uttar Pradesh. Both these infections are common febrile illnesses prevalent in tropical countries including India.

**Materials and Methods:** A total of 300 blood samples were collected from the patients presenting with fever for more than one week. Diagnosis of typhoid was carried out using Widal test and blood culture and for diagnosis of malaria blood film examination was done.

**Results:** Out of total 300 patients, 31 (10.3%) were positive for malarial parasite and 82 (27.3%) were positive for typhoid by Widal test while 12 (4%) were positive for typhoid by blood culture. Rate of co-infection was found out to be 21 (6.7%) with Widal test and 3 (1%) with blood culture.

**Conclusion:** As there is paucity of data on co-infection of malaria and typhoid from this part of country, this study was carried out to know their prevalence. As both these illnesses present with same clinical features, the clinicians must look for co-existence of these infections. Hence, to facilitate the diagnosis and treatment more such studies must be carried out from different parts of the country.

**Keywords:** Blood film, Co-infection, Malaria, Typhoid, Widal

## Introduction

Both malaria and typhoid are diseases of epidemiological importance occurring globally. Malaria is a life-threatening mosquito-borne illness prevalent in tropics and subtropics and is caused by protozoan parasite belonging to Plasmodium genus. It is an important vector-borne disease with annual morbidity of one billion out of which 1-3 million people die annually.<sup>1</sup> The main clinical feature is fever with chills; however, sometimes nausea and headache can also occur. The diagnosis is confirmed by microscopic examination of a thick and thin blood film and Antigen based Rapid Diagnostic Tests. Majority of the patients usually recover from the acute episode of fever within a week. Due to inability to control vector borne diseases, malaria continues to pose a major public health threat in different parts of the country, with an estimated 1.6 million cases occurring annually leading to 400-1000 deaths,

particularly due to Plasmodium falciparum which may lead to severe illness and fatality, if not treated early.<sup>2</sup>

On the other hand, typhoid is a febrile, systemic illness of bacterial origin known to be caused by gram negative bacilli belonging to Salmonella genus. Typhoid is spread by having food or water contaminated with the feces of an infected person. Risk factors for the typhoid include poor sanitation and poor hygiene. That is the reason that typhoid is more rampant in areas with fast population growth like India, Africa, South and Central America and anyone who travels in the developing world is also at risk. In India alone, typhoid accounts for nearly two million cases with 20,000 deaths annually.<sup>3</sup>

The co-infection of malaria and typhoid is common, especially in the tropical region where malaria is endemic. Various factors which predispose to co-infection include poverty, poor sanitation, overcrowding, etc. The first

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instance of malaria and typhoid co-infection was reported in the nineteenth century by an army doctor among soldiers of United States Army and the condition was described as 'Typhomalarial fever'.<sup>4</sup> Since both these diseases share similar clinical manifestations, laboratory workup for both becomes mandatory.

## Materials and Methods

The study was conducted in a duration of one year at a Private Healthcare Center in Ghaziabad, Uttar Pradesh, India from year 2016 to year 2017. A total of 300 blood samples were received at the bacteriology laboratory from patients with febrile illness. Diagnosis of typhoid was made by Widal test and blood culture. For diagnosis of malaria peripheral blood smear examination was done.

- **Collection and Processing of Blood Specimens:** 10 ml of blood was collected aseptically by venipuncture from all patients.
- **Blood Culture:** 5 ml of blood was taken aseptically into 50 ml of brain heart infusion (BHI) broth (High media) followed by sub culture after 48 hours on Mac Conkey agar. Widal test: Serum was aseptically obtained from blood and used for Widal agglutination test. This test was carried out by tube agglutination method using commercial antigen suspension (Tulip diagnostics) for flagellar H and somatic O antigen. Serological diagnosis was made in accordance with manufacturer's guidelines. Antibody titers of 1:160 for TH and 1:80 for TO were taken as significant in this study.
- **Blood Film Examination:** Thick and thin blood films were made and stained with Giemsa stain and observed microscopically. A smear was considered negative for malaria if no parasites were seen after examining at least 200 microscopic fields.

## Results

A total of 300 patients were tested for malaria and typhoid out of which 206 (68.7%) were males and 94 (31.3%) were females. The age and gender distribution of patients is given in Table 1.

Table 1. Age and gender distribution of patients

Age groups (years)	Male	Female	Total
1-20	85	35	120
21-40	97	47	144
41-60	24	12	36

Of the total 300 patients, 31 (10.3%) were positive for malarial parasite by peripheral smear examination. The details of malarial species detected have been shown in Table 2. Diagnosis of typhoid was done using blood culture and Widal test. Widal test for typhoid was positive in 82/300 (27.3%) samples while 12/300 (4%) samples were positive for typhoid by blood culture.

Table 2. Incidence of types of malarial infection

Type of malarial infection	Incidence (n)	Incidence (%)
P. Vivax	19	61.2
P. falciparum	2	6.5
Mixed infection	10	32.3

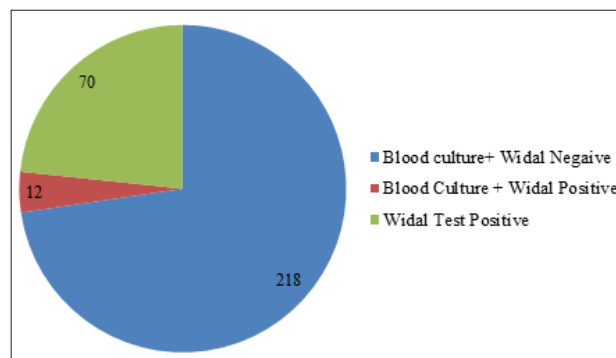


Figure 1. Typhoid positivity by multiple tests

Rate of co-infection of typhoid and malaria was determined using both Widal and blood culture for typhoid and peripheral blood smear examination for malarial parasite. The co-infection rate was 6.7% by Widal test and 1% by blood culture. The rate of malaria and typhoid co-infection by various combination tests has been shown in Table 3.

Table 3. Rate of malaria and typhoid co-infection

	Blood culture	Widal Positive
P. vivax (19)	3	19
P. falciparum (2)	0	02
Total Malaria positive (21)	3	21
% co-infection	1%	6.7%

Comparably, both malaria parasitemia and its co-infection with typhoid were more prevalent in females than in males. Typhoid fever was found to be more prevalent in males than in females as indicated in Table 4.

Table 4. Gender wise prevalence of malaria and typhoid

Gender	Malaria incidence (N=31)	Typhoid incidence (N=94)	
		Widal (N=82)	Blood culture (N=12)
Male	12	49	7
Female	19	33	5

## Discussion

Malaria and typhoid are two entities that have overlapping clinical features resulting in their diagnostic dilemma. Clinicians use the term "typhomalaria" to refer the acute fevers without localizing symptoms.<sup>5</sup> Since the two infections share similar social circumstances required for

their transmission, persons living in such an environment are prone to their concurrent occurrence. Furthermore, iron overload of the liver and complement deficiency in malaria predisposes a person to develop typhoid.<sup>6</sup> In our study 31/300 (10.3%) were positive for malarial parasite by peripheral blood smear examination while 82/300 (27.3%) were positive for typhoid by Widal test and 12/300 (4%) samples were positive for typhoid by blood culture.

In the present study the co-infection rate of malaria and typhoid was found out to be 1% (3/300) using blood culture and peripheral blood smear examination for typhoid and malaria, respectively. A study conducted by Sharma B et al.<sup>7</sup> reported 1.59% co-infection rate using Gold standard test for both the infections, which is quite similar to our study. In a similar study conducted in 2014, a co-infection rate of 1.6% for malaria and typhoid was observed.<sup>8</sup> Furthermore, a co-infection rate of 6.7% (20/300) was observed in our study using Widal test for typhoid and peripheral blood smear for malaria. A study from Ethiopia reported coinfection rate of 6.5% using Widal test and 0.5% with blood culture, which is in accordance to our study.<sup>9</sup>

However, in a recent report from Nigeria, a co-infection rate of 28% was reported using the same set of tests for typhoid and malaria which could be attributed to higher endemicity of malaria in this region.<sup>10</sup>

These findings suggest that the diagnosis of typhoid fever presents a greater diagnostic dilemma in comparison to malaria. A single Widal test has been pointed out to be of diagnostic value in the early stage of disease only and thus help in reducing morbidity and mortality from typhoid. However, if blood culture assay is employed along with Widal test, there would be a significant reduction in the rate of co-infection of malaria and typhoid as was evident in our study too.<sup>11,12</sup> Hence, in Widal test positive cases it is always advisable to do blood culture as this will reduce the over diagnosis of typhoid, which results into unnecessary treatment and overuse of the drugs. It appears from our findings that Widal test is not very specific and often results into false positive reactions which could arise from past infection or from previous exposure to cross-reactive antigens or vaccination. Thus, the interpretation of Widal test results, when diagnosing concurrent malaria and typhoid fever must be done with a lot of caution.

To conclude, a proper protocol is needed to diagnose co-infection of malaria and typhoid and the same rule applies to treatment. In many cases, doctors still often fail to diagnose the double infection during the first week of illness. And due to this reason, malaria and typhoid co-infection remain a threat to many developing countries.

Thus, in malarial patient with persistent fever in spite of therapy, one should consider drug resistant as well as concomitant gram-negative infection such as typhoid fever.

**Conflict of Interest:** None

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