



Comparative Study of Various Bacterial Strains Causing Typhoid Disease

Shinde Pooja A., Thorat Sanket B., Bhor Pratiksha J., Shinde Jyoti A., Belkar Gayatri B., Indarkhe Yashwant B.

Samarth Institute of Pharmacy, Belhe, Maharashtra., India

Email: sanketthorat1221@gmail.com

ABSTRACT:

Typhoid fever is most prevalent in the Asian part of the world especially in the developing countries of Asia like Pakistan and India, caused by a gram-negative bacterium *Salmonella enterica* serovar Typhi. It is an orally transmitted communicable disease caused by consuming contaminated food and impure water. The incubation period of the disease is 7 to 14 days. Symptoms include high fever, rash, weakness, abdominal pain constipation, headache, and poor appetite. Antibiotic resistance is a major problem to treat it effectively. Firstline drugs are mostly not used to treat typhoid and the resistance is emerging in fluoroquinolones. The only choice of drug remaining is ceftriaxone and azithromycin. A counteractive action of typhoid fever is chiefly by individual and household cleanliness. The provision of clean water and safe disposal of faeces should be implemented to eradicate *S. Typhi*. Good surveillance, better diagnostics, more sensible use of antibiotics and efficient vaccine will be significant to reduce the burden of disease caused by *S. Typhi*.

Keywords: Widal Serology Test, Typhoid glomerulonephritis, Typhoid fever, Nephritis, Acute renal failure.

Introduction:

The plague of Athens, during the Peloponnesian War, was most likely an outbreak of typhoid fever. During the war, Athenians retreated into a walled-in city to escape attack from the Spartans. This massive influx of humans into a concentrated space overwhelmed the water supply and waste infrastructure, likely leading to unsanitary conditions as fresh water became harder to obtain and waste became more difficult to collect and remove beyond the city walls. In 2006, examining the remains for a mass burial site from Athens from around the time of the plague (~430 B.C.) revealed that fragments of DNA similar to modern day *S. Typhi* DNA were detected, whereas *Yersinia pestis* (plague), *Rickettsia prowazekii* (typhus), *Mycobacterium tuberculosis*, cowpox virus, and *Bartonella henselae* were not detected in any of the remains tested. ^[1]

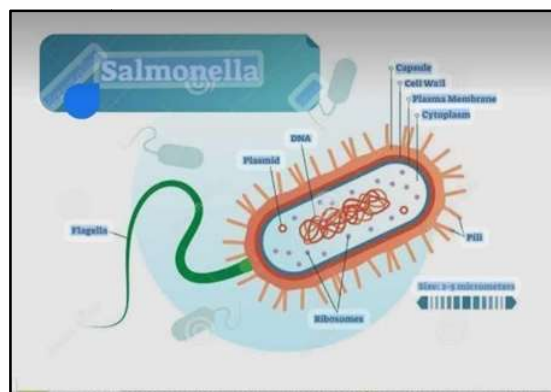


Fig 1: Salmonella

Objective:

1. To study the bacterial types involved in typhoid disease.
2. To study the severity of the various types of bacteria in given samples.

- To study the largest and lowest infected strain

Widal Serology Test:^[2-4]

- Widal Test is an agglutination test which detects the presence of serum agglutinins (H and O) in patients serum with typhoid and paratyphoid fever.
- When facilities for culturing are not available, the Widal test is the reliable and can be of value in the diagnosis of typhoid fevers in endemic areas.
- It was developed by Georges Ferdinand Widal in 1896.
- The patient's serum is tested for O and H antibodies (agglutinins) against the following antigen suspensions (usually stained suspensions).
- S. Typhi O antigen suspension, 9, 12.
- S. Typhi H antigen suspension, d
- S. Typhi A O antigen suspension, 1, 2, 12
- S. Paratyphi A H antigen suspension, a
- S. Paratyphi B O antigen suspension 1, 4, 5, 12
- S. Paratyphi B H antigen suspension, b, phase 1
- S. Paratyphi C O antigen suspension 6, 7
- S. Paratyphi C H antigen suspension, c, phase 1.

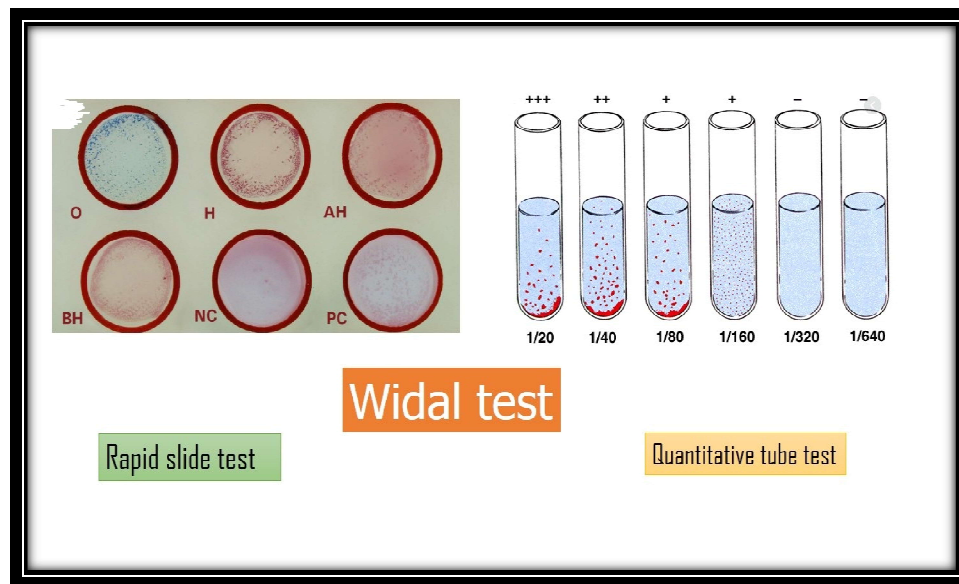


Fig 2:Widal Serology Test^[5]

Preparation of Widal Antigens:^[6-8]

H suspension of bacteria is prepared by adding 0.1 per cent formalin to a 24 hours broth culture or saline suspension of an agar culture.

For preparation of O suspensions of bacteria, the organisms is cultured on phenol agar (1:800) to inhibit flagella.

Standard smooth strains of the organism are used; *S* Typhi 901, O and H strains are employed for this purpose.

The growth is then emulsified in small volume of saline, mixed with 20 times its volume of alcohol, heated at 40° C to 50° C for 30 minutes and centrifuged.

The antigens are treated with chloroform (preservative) and appropriate dyes are added for easy identification of antigens.

Limitations of Widal Test:^[9-10]

The Widal test is time consuming (to find antibody titre) and often times when diagnosis is reached it is too late to start an antibiotic regimen.

The Widal test should be interpreted in the light of baseline titers in a healthy local population.

The Widal test may be falsely positive in patients who have had previous vaccination or infection with *S. Typhi*.

Specimen Collection:^[11]

Patients who met the criteria were asked to give informed consent and answer a brief questionnaire about clinical signs and symptoms, antimicrobial

treatment, and history of typhoid fever and vaccination. Participants gave 5 ml of blood (3 ml from children 3 to 5 yrs old) upon routine venipuncture for blood culture. Only patients with a laboratory-confirmed etiology of their fever were included in the analysis.

Laboratory analysis:^[12-17]

(i) Blood culture:-

At Cai Lay Hospital, 5 ml of patient blood was added to blood culture medium (biphasic tryptic soy agar and brain heart infusion broth with SPS [0.6 mg/ml]) supplied by the Pasteur Institute. The blood culture bottle was then incubated at 37°C for 24 h before being tilted so that the liquid flowed over the solid medium.

(ii) Confirmation and antimicrobial susceptibility testing of isolates at the Pasteur Institute:

The identification of suspect serotype Typhi isolates was confirmed at the Pasteur Institute by standard biochemical tests and *Salmonella* serotyping. Antimicrobial susceptibility testing was done by using the Kirby-Bauer disk diffusion method.

(iii) Laboratory confirmation of other pathogens:

Confirmation of other pathogens was done as follows: blood smear for malaria, acidfast bacilli (AFB) sputum smear for tuberculosis, blood or urine cultures for other bacterial pathogens, or serum immunoglobulin M (IgM) detection by antibody-capture enzyme immunoassay (MAC EIA) for dengue.

(iv) Widal test:

Widal testing was done by using the Sanofi qualitative agglutination test kits (BioRad) by two different methods. In both methods, serum was serially diluted, starting at 1/10, in physiological saline and then further diluted 1/10 in suspensions containing serotype Typhi O and H antigens, separately.

TREATMENT:^[18-24]

Oral Rehydration Therapy:-

The rediscovery of oral rehydration therapy in the 1960s provided a simple way to prevent many of the deaths of diarrheal diseases in general.



Fig 3:- oral rehydration therapy

Antibiotics:

Where resistance is uncommon, the treatment of choice is a fluoroquinolone such as ciprofloxacin.

Surgery:-

Surgery is usually indicated if intestinal perforation occurs. One study found a 30-day mortality rate of 9% (8/88), and surgical site infections at 67% (59/88), with the disease burden borne predominantly by low-resource countries.

Foods To Eat During Typhoid:

Requirement of the body and maintain a water and electrolyte balance. This is mainly to avoid irritation to the mucus membrane, to reduce gastric acidity, which would further inflame the gastrointestinal tract.



Fig 4: Diet During Typhoid

A progressive diet from a liquid diet to a normal diet depending on the level of tolerance would help the person's appetite.

Fluids in the form of tender coconut water, barley water, electrolyte fortified water, fresh fruit juice, vegetable soup, buttermilk and water should be consumed until body temperature comes back to normal.

Foods to Avoid During Typhoid:



Fig 5: Foods to Avoid During Typhoid

- Avoid high fiber foods: Intake of whole grain cereals and their products like oatmeal, whole wheat bread, and raw vegetables in the form of salads, are rich in fiber. It can add on the stress on your digestive system.
- Avoid vegetables like cabbage, capsicum, & turnip as these can cause bloating & gas.

Diet Tips:^[25-28]

- Consume 3-4 liters of fluids in the form of water, fruit juices, tender coconut water and soup.
- Eat small frequent meals rather than large meals to ease digestion and for maximum nutrient utilization by the body.
- Try not to include spices as much as possible till the fever recovers.

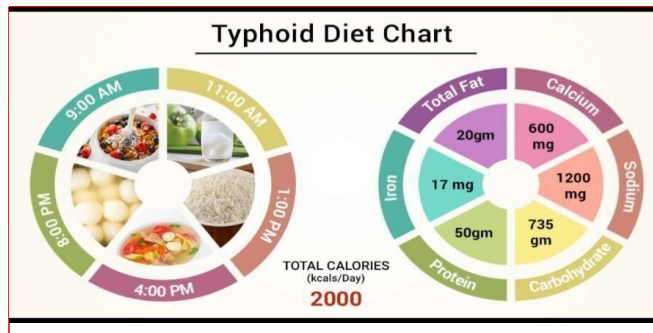


Fig:6 Typhoid Diet Chart.

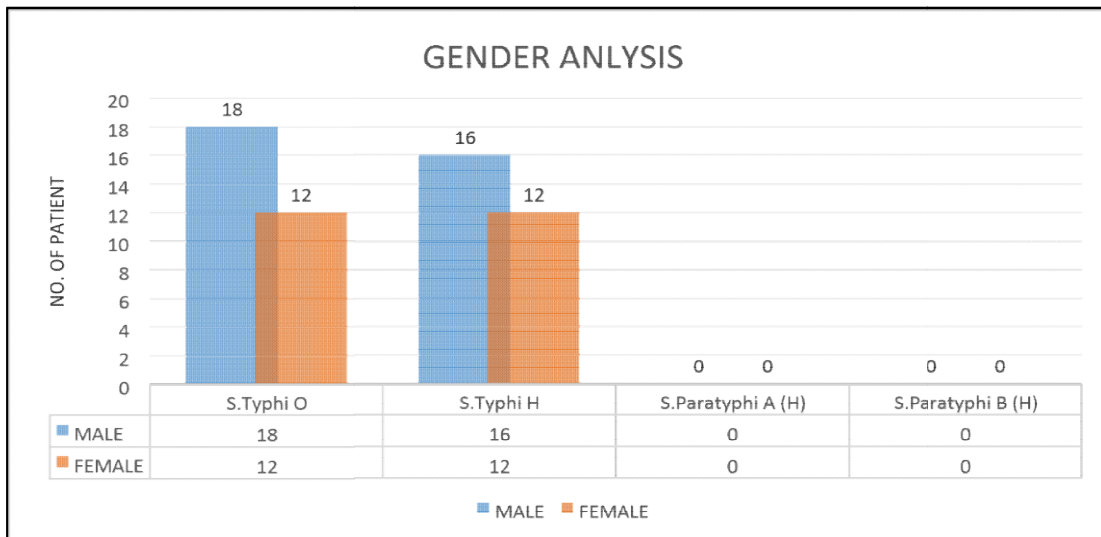
OBSERVATION TABLE

Sr.No	Patient	Sex	S.Typhi O	S.Typhi H	S.Paratyphi A (H)	S.Paratyphi B (H)	Remark
1.	A	Female	P	P	N	N	positive
2.	B	Female	P	P	N	N	Positive
3.	C	Male	P	N	N	N	Positive
4.	D	Female	P	P	N	N	Positive
5.	E	Male	P	P	N	N	Positive
6.	F	Female	P	P	N	N	Positive
7.	G	Female	P	P	N	N	Positive
8.	H	Female	P	P	N	N	Positive
9.	I	Male	P	P	N	N	Positive
10.	J	Male	P	P	N	N	Positive
11.	K	Male	P	P	N	N	Positive
12.	L	Female	P	P	N	N	Positive
13.	M	Male	P	P	N	N	Positive
14.	N	Male	P	P	N	N	Positive
15.	O	Male	P	P	N	N	Positive
16.	P	Female	P	P	N	N	Positive
17.	Q	Female	P	P	N	N	Positive
18.	R	Female	P	P	N	N	Positive
19.	S	Female	P	P	N	N	Positive
20.	T	Male	P	P	N	N	Positive
21.	U	Male	P	P	N	N	Positive
22.	V	Male	P	P	N	N	Positive

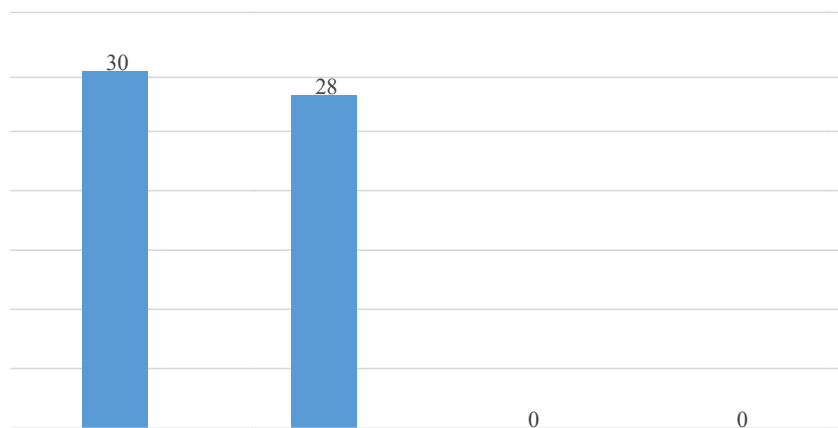
23.	W	Male	P	P	N	N	Positive
24.	X	Male	P	P	N	N	Positive
25.	Y	Male	P	P	N	N	Positive

RESULT ANALYSIS

GENDER	S.Typhi (O)	S.Typhi (H)	S.Paratyphi (H)	S.Paratyphi B (H)
MALE	18	16	00	00
FEMALE	12	12	00	00



Graph 1: Gender Analysis.



Graph 2: Infected Strain Analysis.

BACTERIAL STRAINS	S.Typhi O	S.Typhi H	S.Paratyphi A (H)	S.Paratyphi B (H)
NUMBER OF PATIENT	30	28	00	00

DISCUSSION

Typhoid fever is a life threatening systemic infection occurring more frequently and major public health problem. Typhoid fever is endemic and one of the commonest infectious diseases prevalent in India. Laboratory tests are essential for accurate diagnosis and early treatment with, suitable antimicrobials for speedy recovery, prevention of complication and deaths and also for the control of transmission. Widal test has been employed as a rapid serological test but it is a test with moderate sensitivity and specificity. Widal test is significant for the identification of typhoid disease various types of strains.

RESULT

Typhoid fever is a life threatening systemic infection occurring more frequently and major public health problem. Typhoid fever is endemic and one of the commonest infectious diseases prevalent in India. Laboratory tests are essential for accurate diagnosis and early treatment with, suitable antimicrobials for speedy recovery, prevention of complication and deaths and also for the control of transmission. Widal test has been employed as a rapid serological test but it is a test with moderate sensitivity and specificity. A serological test which is rapid, inexpensive, reliable, easy to perform with high sensitivity & specificity for diagnosis of typhoid and appropriate. In this study we found the Typhoid fever is probably caused by Salmonella Typhi O and Salmonella Typhi H strain for strain analysis.

SUMMARY

Typhoid, or Typhoid fever, Acute infectious disease resembling typhus (and distinguished from it only in the 19th century). *Salmonella typhi*, usually ingested in food or water, multiplies in the intestinal wall and then enters the bloodstream, causing septicemia. Symptoms begin with headache, aching, and restlessness. High fever gradually develops, with delirium. A rash appears on the trunk. The sites where the bacilli multiplied become inflamed and may ulcerate, leading to intestinal bleeding or peritonitis. Patients become exhausted and emaciated; up to 25% die if not treated. Antibiotic treatment is effective. Patients can carry typhoid for weeks to months or years. Carriers can contaminate the food they handle. Prevention depends mainly on water and sewage treatment and excluding carriers from food-handling jobs.

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