

Research Article

Reevaluation of baseline Widal titres in children: a cross-sectional survey of 250 children (1-15 years) in and around Davangere, Karnataka, India

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ABSTRACT

Background: Typhoid fever is a serious health problem in developing countries including India. Isolation of *S. typhi* by culture is the gold standard for diagnosis, but the positive cases are very less, time consuming and expensive, so the best alternative is Widal test. Widal test can be used as a diagnostic tool if we know the baseline titres in a particular community. Objective: To re-evaluate the baseline Widal titres in apparently healthy children in and around Davangere, and to find the significance of 1:160 titres in Widal test.

Methods: Cross sectional study was done on 250 children. Tube agglutination test was done on 112 healthy and 138 children with minor nontyphoidal illness. Titres were studied in relation to age, sex, nutritional status and healthy children to minor nontyphoidal illness.

Results: Out of 112 healthy children, 52.7% had titres less than 1:20, 25% had 1:20, 18.8% had 1:40 and 3.6% had a titre level of 1:80 for 'O' antigen of *S. typhi*. 63% children had a titre of less than 1:20, 21.4% had 1:20, 8% for 1:40 and 7.1% had a titre of 1:80 for 'H' antigen of *S. typhi*. For 'H' antigen of *S. paratyphi A* the titres for less than 1:20 were 83%, 8% cases had a titre of 1:20 and 4.5% cases had titre levels of 1:40 and 1:80. No children had a titre value of $\geq 1:160$ for both *S. typhi* and *paratyphi A* in the healthy children group.

Conclusions: The baseline titres of healthy children in all the age groups and both sex is $\leq 1:80$ for 'O' and 'H' antigen of *S. typhi* and 'H' antigen of *S. paratyphi A*.

Keywords: Widal titres, Healthy children, *S. typhi*, *S. paratyphi A*

INTRODUCTION

Typhoid is an acute illness caused by infection of *Salmonella typhi*, a major endemic health problem among children in India.¹ Typhoid fever is a food and water borne disease causing a serious public health problem in developing countries including India. It is estimated that around 22 million cases and 220,000 deaths occur every year in developing countries according to a recent WHO estimate.² Serological diagnosis relies classically in demonstrating the rising titre of antibody in paired samples is not always demonstrated even after 2 weeks. For curative purpose, a decision must be made on the

basis of results obtained with a single acute phase sample i.e., by Widal test chosen in a particular community which depends on the background level of typhoid fever, and the level of typhoid vaccination. So Widal test can be used as a diagnostic tool in typhoid fever endemic area, if we know the baseline titres. Widal test is most simple and over utilized diagnostic tool available in local laboratories, it is relied, because of its convenience.

METHODS

The study was conducted at the Department of Pediatrics, J J M M C, Davanagere, Karnataka, India. The children

included in the study were from 1-15years age group attending the 3 hospitals attached to JJMMC Davangere.

Serum samples were drawn from all 250 children who included 112 healthy and 138 children with minor nontyphoidal illness. Widal tube test was done on all the serum samples by agglutination method using commercially available antigen (TULIP Diagnostics Pvt. Ltd). Serum dilutions from 1:20 to 1:320 were prepared. 0.9% saline is used as a control.

Present study was done to re-evaluate the value of Widal titres for the diagnosis of Typhoid fever in and around Davangere.

RESULTS

The titres were assessed for 'O' & 'H' of *S. typhi* and 'H' antigen of *S. paratyphi*. It is seen from the table N.. that

out of 138 children with minor nontyphoidal illness, 11.6% had 'O' agglutinin titre level of 1:160 when compared to healthy children who did not have any titre levels $\geq 1:160$ ($p < 0.001$). For 'H' agglutinin, 12.3% of the minor non typhoidal illness children had a titre of 1:160 while in the controls none had titre of $\geq 1:160$ ($p = 0.001$). Likewise the titres for 'H' antigen of *S. paratyphi*, 5.8% children with minor nontyphoidal illness children had titres of 1:160 while in the controls it was 0% for $\geq 1:160$ ($p < 0.001$). As shown in Table 1.

The results were also analysed for titres with relation to nutritional status (WHO GRADING OF PEM). Of the 250 children 181 were in $<15^{\text{th}}$ centile, 56 in $<50^{\text{th}}$ centile. The other 13 children belonged to <85 and $<97^{\text{th}}$ centiles for which we would not like to comment. The titres levels were not significant $p = 0.52$, 0.08 and 0.11 for 'O' and 'H' of *S. typhi* and 'H' antigen of *S. paratyphi* as seen in Table 2.

Table 1: Widal titres in relation to healthy and nontyphoidal illness children.

Children	No	TO					TH					AH				
		<20 (%)	20 (%)	40 (%)	80 (%)	160 (%)	<20 (%)	20 (%)	40 (%)	80 (%)	160 (%)	<20 (%)	20 (%)	40 (%)	80 (%)	160 (%)
Minor nontyphoidal illness	138	54 (39.1)	37 (26.8)	17 (12.3)	14 (10.1)	16 (11.6)	53 (38.4)	30 (21.7)	18 (13)	20 (14.5)	17 (12.3)	84 (60.9)	21 (15.2)	11 (8)	14 (10.1)	8 (5.8)
Healthy children	112	59 (52.7)	28 (25)	21 (18.8)	4 (3.6)	0	71 (63.4)	24 (21.4)	9 (8)	8 (7.1)	0	93 (83)	9 (8)	5 (4.5)	5 (4.5)	0
Total	250	113 (45.2)	65 (26)	38 (15.2)	18 (7.2)	16 (6.4)	124 (49.6)	54 (21.6)	27 (10.8)	28 (11.2)	17 (6.8)	177 (70.8)	30 (12)	16 (6.4)	19 (7.6)	8 (3.2)
Minor ill v/s healthy		$X^2 = 20.97$ $P < 0.001$, HS					$X^2 = 26$ $P < 1.001$, HS					$X^2 = 17.25$ $P < 0.05$, 5 ($P = 0.001$)				

Table 2: Widal titres in relation to nutritional status (NS).

NS	No	TO					TH					AH				
		<20 (%)	20 (%)	40 (%)	80 (%)	160 (%)	<20 (%)	20 (%)	40 (%)	80 (%)	160 (%)	<20 (%)	20 (%)	40 (%)	80 (%)	160 (%)
<15 th centile	181	82 (45.3)	51 (28.2)	23 (12.7)	13 (7.2)	12 (6.6)	90 (49.7)	42 (23.2)	20 (11)	20 (11)	9 (5)	135 (74.6)	18 (9.9)	11 (6.1)	11 (6.1)	6 (3.3)
<50 th centile	56	25 (44.6)	11 (19.6)	13 (23.2)	5 (8.9)	2 (3.6)	29 (51.8)	10 (17.9)	5 (8.9)	8 (14.3)	4 (7.1)	36 (64.3)	10 (17.9)	3 (5.4)	6 (10.7)	1 (1.8)
<85 th centile	11	5 (45.5)	3 (27.3)	1 (9.1)	0	2 (18.2)	5 (45.5)	1 (9.1)	2 (18.2)	0	3 (27.3)	6 (54.5)	1 (9.1)	1 (9.1)	2 (18.2)	1 (9.1)
<97 th centile	02	1 (50)	0	1 (50)	0	0	0	1 (50)	0	0	1 (50)	0	1 (50)	1 (50)	0	0
Total	250	113 (45.2)	65 (26)	38 (15.2)	18 (7.2)	16 (6.4)	124 (49.6)	54 (21.6)	27 (10.8)	28 (11.2)	17 (6.8)	177 (70.8)	30 (12)	16 (6.4)	19 (7.6)	8 (3.2)
		$X^2 = 11.11$, $P = 0.52$, NS					$X^2 = 19.27$, $P = 0.08$, NS					$X^2 = 18.09$, $P = 0.11$, NS				

DISCUSSION

Typhoid still remains an endemic problem in India with the emergence of MDR in various parts.³ Isolation of

Salmonella is the gold standard, but due to the fact that culture facility is not readily available or limited in many areas, Widal test can still be relied upon in our setting. It is less expensive, less time consuming and with less yield

of culture positive cases, Widal test remains the only practical test in developing countries like India.

Classically, a fourfold rise of antibody in paired sera is considered diagnostic of typhoid fever. In a setting like ours, paired sera are often difficult to obtain and specific chemotherapy has to be initiated on the basis of a single Widal test.

Another drawback relates to the difficulty in interpreting the Widal tests in the background of normal titre of the population in the area and where the normal titres are not known. So every country, regions should have the baseline titre of healthy population and it should be revised or revalidated periodically for meaningful interpretation of titre.

Table 3: Widal titres for o and h antigen of *S. typhi* and h antigen of *S. paratyphi* by different workers and region.

Workers	Place, year (no. of subjects)	TO					TH					AH				
		<20 (%)	20 (%)	40 (%)	80 (%)	160 (%)	<20 (%)	20 (%)	40 (%)	80 (%)	160 (%)	<20 (%)	20 (%)	40 (%)	80 (%)	160 (%)
Pang T	Malaysia 1983 (300)	6	29	26	34	5	61	18	14	5	2	78	8	7	5	2
Kulkarni ML et al	Davangere, 1994 (50)	52	34	10	4	-	90	10	-	-	-	-	-	-	-	-
Punia JN et al	Chandigarh 2003 (255)	-	34.1	-	-	-	-	40.39	-	-	1.57	-	17	-	0.78	-
Ibadin MO et al	Benincity Nigeria 2002 (175)	-	29	33	14.9	1.1	-	29.1	33	14.9	1.4	-	-	-	-	-
Pokhrel BM et al	Nepal 2007	-	-	36	12	15	59	-	-	29	12	12	-	-	-	-
Aftab R et al	Pakistan 2009 (733)	-	-	89	48	8	-	-	91	55	4	-	-	97	59	1
Patil AM et al	Davangere 2007 (250)	64.4	22.4	9.6	3.6	-	67.2	21.2	8	3.6	-	98.4	1.2	0.4	-	-
Noorbaksh et al	Iran (40)	-	-	≤ 40 (100)	-	-	-	-	≤ 40 (100)	-	-	-	-	-	-	-
Salmani MP et al	Bijapur, 2009	60		16.5	7	-	81	-	5	1.5	-	94	3	2	1	-
Present study	250	45	26	15	7.2	6.4	49.6	21.6	10.8	11.2	6.8	70.8	12	6.4	7.6	3.2

Titres in relation to age group

In this study, for 'O' titres 92.8% children had a titre of <1:80 in all the age groups. Only 7.2% had a titre of 1:160. There was no significant influence of age on 'O' titres ($p=0.09$) of *S. typhi*. Similarly there was no significant difference of A titres of *S. paratyphi* among different age groups ($p=0.16$). In contrast for H antigen the titres were high in the older age group (>6y) which was statistically significant ($p<0.05$). This could be explained by subclinical exposure to the disease in older age group.⁴ The results are in agreement with the results obtained by others workers, like Kulkarni ML et al and Patil AM et al.^{4,5} Similar to present study the above studies also showed the titres of $\geq 1:160$ in older age group for H antigen.

Titres in relation to gender

In the present study the level of Widal titres was nearly same in both the sexes except for 1:160 titres which was more in boys for 'O' and 'H' titres. (For 'O' titres in Males=8.3%; Females=3.8% and 'H' titres M=9%;

F=3.8%). But this difference was not statistically significant ($p=0.39$ and 0.1 respectively for 'O' & 'H'). This indicates that gender has no influence on the Widal titres in children. These results are in agreement with the study conducted by Patil AM, et al at Davangere in 2006.⁴

Titres in relation to healthy children and minor nontyphoidal illness

When healthy children Widal titres were compared with the titres of children with minor nontyphoidal illness, there was significant difference in titres with higher titres noted in children with minor nontyphoidal illness ($p<0.001$; $p<0.05$ and $p<0.001$) for 'O' 'H' and AH respectively. All the healthy children had titres $\leq 1:80$ for 'O' 'H' and AH, when compared to nontyphoidal illness were 1:160 titres were seen in 11.6%; 12.3% and 5.8% for 'O' 'H' and AH titres respectively. This suggests that the basal titre in healthy children is $\leq 1:80$. In agreement to the present study various other studies as in Table shows that titres $\geq 1:160$ was taken as significant in their region to diagnose typhoid fever.

Similar results have been also reported by other workers but in their study 1% of normal population too had a titre of 1:160 for both O and H antigen.⁴⁻¹⁰ Even the study done in 2003 in Nigeria showed that 97% had anti O titre of $\leq 1:80$ and 95% had anti H titre of $\leq 1:80$, goes in accordance with the present study.¹¹

This study adds to our knowledge those titers of $\geq 1:160$ to be considered as significant to diagnose typhoidal illness. But this has to be established by estimating Widal titers in culture proven typhoid illness. Also the titres have to be re-established by studying in a larger population in our region. The established basal titres should be reevaluated periodically.

Even today, Widal test remains one of the best, easily accessible, cheap and simple method for diagnosis of typhoid fever and thus helps in reducing morbidity and mortality from typhoid.

CONCLUSION

From present study, we concluded that;

1. The basal titres of healthy children in all age groups and both sex is $\leq 1:80$ for 'O' and 'H' antigen of *S. typhi*.
2. The basal titres of healthy children in all age groups and both sex is $\leq 1:80$ for 'A' of *S. paratyphi*.
3. Age did not influence the Widal titres.
4. Sex of the child did not have any effect on Widal titres.
5. No effect of nutritional status on Widal titres.
6. The titre levels above the baseline $\geq 1:160$ titres can be taken as diagnostic titre for the diagnosis of typhoid fever in this part of the country.
7. Also the titres have to be re-established by studying in a larger population in our region.
8. The established basal titres should be reevaluated periodically.

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