



## Original Article

# ABDOMINAL ULTRASONOGRAM IN TYPHOID FEVER: A USEFUL DIAGNOSTIC TOOL

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### Abstract:

**Objectives:** To See the use of abdominal ultrasonographic in the diagnosis of Typhoid fever.

**Materials and Methods:** This cross sectional study on enteric fever was carried out during the period of July 2008 to June 2009 on 30 patients between 2 months 12 years of age of either sex admitted with the clinical diagnosis of enteric fever having positive hemoculture for *Salmonella typhi* or *paratyphi* and or significant Widal test. Abdominal USG was done at Centre for Nuclear Medicine and Ultrasound, Bangladesh atomic energy commission, Sir Salimullah Medical College & Mitford Hospital.

**Result:** On ultrasonogram, hepatomegaly observed in 93.3% cases, splenomegaly in 53.3% cases, thickened bowel wall in 46.7% cases, enlarged mesenteric lymph node in 63.3% cases and 30% cases showed gall bladder changes. Ultrasonogram was done on first week of fever in 33.3% cases, on second week in 43.3% cases and third week in 23.3% cases. Out of them ultrasonogram done on first day of admission in 6.6% cases, on second day in 80% cases and third day in 13.3% cases.

In first week the bowel wall thickening found in 10% cases, lymph node enlargement in 23.3% cases and gall bladder changes in 3.3% cases, in second week the bowel wall thickening found in 23.3% cases, lymph node enlargement in 26.6% cases and gall bladder changes in 20% cases, in third week the bowel wall thickening found

in 13.3% cases, lymph node enlargement in 13.3% cases and gall bladder changes in 6.6% cases.

Sonologic findings of bowel wall thickening, lymph node enlargement and gall bladder changes found in 23.33% cases in 1<sup>st</sup> week, 33.33% cases in 2<sup>nd</sup> week and 13.33% cases in 3<sup>rd</sup> week.

**Conclusion:** In endemic areas like Bangladesh ultrasound findings of hepatomegaly, splenomegaly, mesenteric lymphadenopathy, bowel wall thickening, gall bladder changes are useful diagnostic features of typhoid fever.

**Keywords:** Typhoid fever, ultrasonogram, bowel wall thickening, mesenteric lymphadenopathy

### Introduction:

Typhoid fever is an important cause of childhood febrile illness with considerable morbidity and mortality. The global incidence in 2000 was an estimated 21,650,974 cases with 216,510 deaths<sup>1</sup>. A survey by ICDDR, B showed that the overall incidence of typhoid fever in Bangladesh was 3.9 cases per 1000 population per year<sup>2</sup>. Along with clinical findings different investigation tools are used to diagnose the typhoid fever, but investigation tools that are used have some limitations. Blood culture is the gold standard for the diagnosis of typhoid fever but is only positive in 50-80% cases during 1<sup>st</sup> week and less often later the illness<sup>3</sup> furthermore random use of antibiotic in febrile illness before diagnosis is a problem for culture of *Salmonella* from blood and stool<sup>4</sup>. Widal test is widely available serological test that usually becomes positive in second week of illness and rising titre is required for diagnosis but repeat widal test is always not possible. Moreover widal test is not as useful as culture because both false positive and false negative results occur. In this situation ultrasonography of whole abdomen may

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be an important tool for the diagnosis of typhoid fever. Ultrasonography findings of whole abdomen like splenomegaly, hepatomegaly, mesenteric lymphadenopathy, bowel wall thickening and changes in gall bladder wall may provide clue in the diagnosis of typhoid fever<sup>4</sup>. Hence abdominal USG is a non-invasive, easily available, well-accepted investigation, where results are found within a short time,

The objective of the present study was to see the use of abdominal ultrasonogram in the diagnosis of typhoid fever.

### Materials and Methods:

This cross sectional study on typhoid fever was carried out in the Department of Pediatrics of Sir Salimullah Medical College & Mitford Hospital during the period of July 2008 to June 2009 on 30 patients between 2 months 12 years of age of either sex admitted with the history of fever for more than 5 days, associated with three or more of the following clinical features:

- a. Toxic appearance,
- b. Coated tongue,
- c. Hepatomegaly,
- d. Splenomegaly, and
- e. Absence of features of other febrile illness<sup>5</sup>.

Only cases with above criteria plus one or both of the following were included:

- a. Significant Widal test (either one or both of TO & TH titer 1:160 or more)
- b. Isolation of *Salmonella typhi* or *paratyphi* from blood culture.

Widal test was taken as significant, when titre-

For *S. typhi*  $\geq$ 1:160 against O or H or both

For *S. paratyphi A*  $\geq$ 1:40 against O or H or both.

For *S. paratyphi B*  $>$ 1:80 against O or  $\geq$ 1:40 against H antigen

For *S. paratyphi C*  $\geq$ 1:40 against O or H or both<sup>6</sup>.

Purposive sampling method was followed. Based on history and physical examination a provisional diagnosis was made. Patient who had life threatening complications like gastrointestinal haemorrhage, intestinal perforation and shock were excluded from the study. Then investigations like complete blood count, widal test & blood culture was sent. Abdominal

USG was done at The Centre for Nuclear Medicine and Ultrasound, Bangladesh Atomic Energy Commission, Sir Salimullah Medical college & Mitford Hospital. Abdominal USG examination was performed within one to three days of hospitalization. A convex transducer with frequency of 3.5MHz and a linear transducer of 7.5 MHz on the USG machine (SIUI; CTS 415, China.) was used.

Liver and spleen were examined for size and echotexture. The gall bladder was examined for its size, luminal content, wall thickness and pericholecystic fluid collection. Small bowel and the entire colon including ileocecal region were studied with multiple transverse and longitudinal scan of the abdomen and pelvis to identify any bowel wall thickening. Positioning the calipers in between inner and outer layers did measurement of the bowel wall thickness. The thickness was considered abnormal when it measured more than 3 mm<sup>7,8</sup>. Using similar technique, enlarged lymph nodes were visualized and their size and shape noted. Lymph nodes were considered enlarged when their maximum diameter exceed 5 mm<sup>9,10</sup>.

All clinical findings as well as investigation findings were recorded in a pre designed questionnaire. Some patients came with prior investigations before admission in the hospital were also included.

Statistical analysis was done using the Statistical Package for Social Sciences version 16 (SPSS-16) program for personal computer.

### Results:

Of the 30 patients majority (80%) were seen in the age group of  $>$ 60 months followed by 25-60 months (16.7%) among them 20 (66.6%) cases were male and 10 (33.3%) were female.

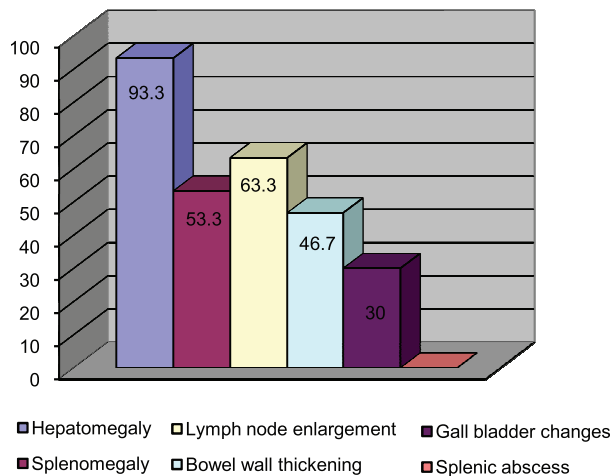
Majority (43.3%) of patients were brought to hospital during the 1<sup>st</sup> week of illness followed by 40% in the 2<sup>nd</sup> week. Remainder presented at 3<sup>rd</sup> week. Fever was the universal complain followed by abdominal pain. Constipation was present in a higher proportion of patients than diarrhoea. Less commonly others like vomiting was noted in 6.7% cases.

Fever and coated tongue was the universal physical findings present in 100% patients. Hepatomegaly (93.3%) was the most common findings than splenomegaly (53.3%). Abdominal tenderness and abdominal distension was present in 66.6% and 20% cases respectively. Toxic appearance noted in 16.6%

cases. Other physical finding noted was caecal gurgling (3.3%).

Antibiotics were taken by 26 (86.7%) cases prior to admission; only 4 (13.3%) cases did not take antibiotics and 29 (96.7%) cases took antipyretics prior to admission. Widal test was significant in all cases but blood culture was positive in only in 10% cases.

On USG of abdomen the liver was enlarged in 28 (93.3%) cases with normal echotexture in 26 cases and with increased periportal echos in 2 cases. Sixteen (53.3%) cases showed diffuse enlargement of the spleen with normal echotexture. Splenic abscess was not found in any case. Enlarged lymph node was found in 19 (63.3%) cases, bowel wall thickening in 14(46.7%) cases and gall bladder changes in 9(30%) cases. (Fig: 1)



**Fig.-1: Sonologic findings of whole abdomen in typhoid fever (n=30)**

Ultrasonogram was done on first week of fever in 10 (33.3%) cases, on second week in 13(43.3%) cases and third week in 7(23.3%) cases. (Table-I)

In first week hepatomegaly found in 10(33.3%) cases, splenomegaly in 4(13.3%) cases, bowel wall thickening found in 3(10%) cases, lymph node enlargement in 7(23.3%) cases and gall bladder changes in 1(3.3%) cases, in second week hepatomegaly found in 11(36.6%)cases, splenomegaly in 8(26.6%) cases, the bowel wall thickening found in 7(23.3%) cases, lymph node enlargement in 8(26.6%) cases and gall bladder changes in 6(20%) cases, in third week hepatomegaly found in 7(23.3%)cases, splenomegaly in 4(13.3%) cases, the bowel wall thickening found in 4(13.3%) cases, lymph node enlargement in 4(13.3%) cases and gall bladder changes in 2 (6.6%) cases. ( Table-I)

Enlarged mesenteric lymph node was noted in 19(63.3%) cases. (Table-II)

Bowel wall thickening was noted in 14(46.7%) cases. Among them 5(16.7%) cases showed increased wall thickness in the terminal ileum, 4(13.3%) cases showed caecum and ascending colon thickening and 5(16.7%) cases showed increased wall thickness in the ileum, caecum and ascending colon. The maximum thickness noted was 6.8 mm. The five layers intestinal wall structure was maintained in all cases. No perforation and abscess formation was noted in any cases. (Table: III)

Gall bladder changes observed in 9 (30%) cases. Among them thick walled gall bladder found in 5(16.7%) cases, thickened wall and biliary sludge was noted in 3 (10%) cases, only biliary sludge in 1(3.3%) case and distended gall bladder in 1 (3.3%) case. (Table: IV)

Sonologic findings of bowel wall thickening, lymph node enlargement and gall bladder changes found in 23.33% cases in 1<sup>st</sup> week, 33.33% cases in 2<sup>nd</sup> week and 13.33% cases in 3<sup>rd</sup> week.

Enlarged lymph nodes, thickened bowel wall and gall bladder changes with hepatomegaly and or splenomegaly found in 21(70%) cases and only hepatomegaly and or splenomegaly found in 9(30%) cases. (Fig: 2)

**Table I**  
*Sonologic findings at different weeks (n=30)*

USG performed between days of fever	Hepatomegaly n (%)	Splenomegaly	Bowel wall thickening	LN enlargement	Gall bladder changes
5-7	10(33.3%)	4 (13.3%)	3 (10%)	7 (23.3%)	1(3.3%)
8-14	11(36.6%)	8(26.6%)	7(23.3%)	8(26.6%)	6(20%)
15-21	7(23.3%)	4(13.3%)	4(13.3%)	4(13.3%)	2(6.6%)

**Table II**

*Pattern of Lymph node enlargement on abdominal USG (n=30)*

Lymph node	Frequency	Percent
Mesenteric	19	63.3
Para aortic	0	00
Coeliac	0	00
Hepatic	0	00
None	11	36.7
Total	30	100

**Table III**

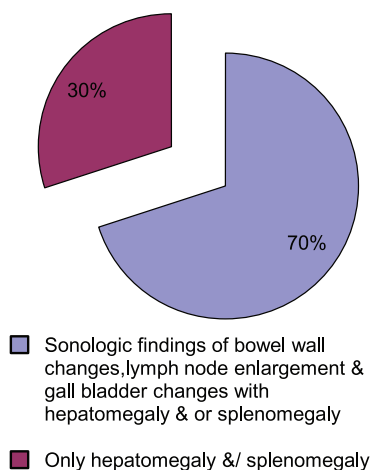
*Pattern of bowel wall thickening on USG (n=30)*

Bowel wall involved	Frequency	Percent
Terminal ileum	5	16.7
Caecum and Ascending colon	4	13.3
Ileum, Caecum & Ascending colon	5	16.7
None	16	53.3
Total	30	100

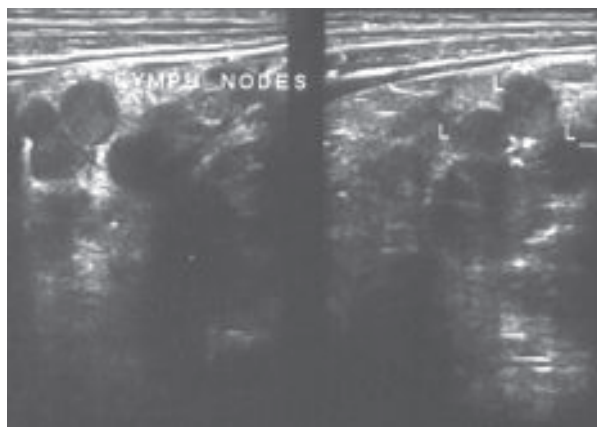
**Table IV**

*Pattern of gall bladder changes on USG (n=30)*

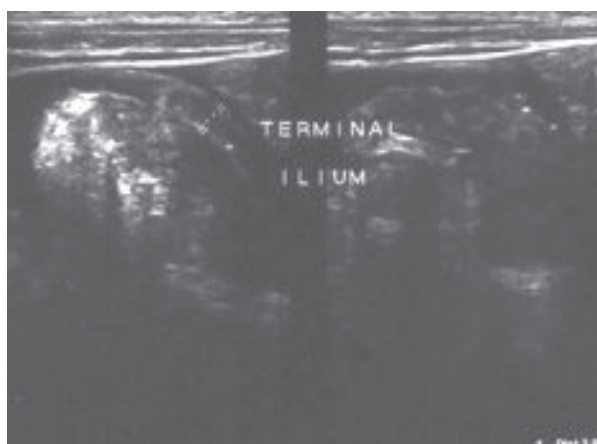
Gall bladder changes	Frequency	Percent
Distended gall bladder	1	3.3
Thickened wall	5	16.7
Biliary sludge	1	3.3
Thickened wall and Biliary sludge	3	10.0
None	20	66.7
Total	30	100



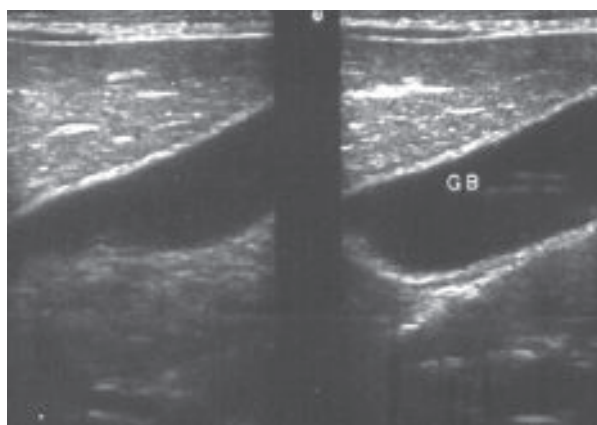
**Fig.-2:** Comparison between sonologic findings of typhoid fever with hepatomegaly and or splenomegaly and only hepatomegaly and or splenomegaly



**Fig.-1:** US scan showing multiple enlarged lymph nodes in a case of typhoid fever



**Fig.-2:** US scan showing thickened terminal ileum



**Fig.-3:** Thick walled gall bladder and biliary sludge on US scan

**Discussion:**

The clinical features of Typhoid fever are very much suggestive of diagnosis but not pathognomonic. Definitive diagnosis is made by blood culture. Present



study was carried out to see the usefulness of ultrasound of the abdomen as a diagnostic test in typhoid fever.

In our study findings of abdominal ultrasonogram in Typhoid fever shows hepatomegaly in 93.3%, splenomegaly in 53.3%, lymph node enlargement in 63.3%, bowel wall thickening in 46.7%, and gall bladder changes in 30% cases, which is similar to the findings of Mateen et al <sup>6</sup>, where splenomegaly found in 100% cases, bowel wall thickening in 85% cases, mesenteric lymphadenopathy in 77% cases, gall bladder changes in 62% cases and hepatomegaly in 31% cases.

In this study enlargement of mesenteric lymph node was observed in 63.3% cases and the bowel wall thickening was noted in 46.7% cases. Among them 16.7% cases were found with increased thickness of terminal ileum, 13.3% cases were with caecum and ascending colon and 16.7% cases with increased thickness of terminal ileum, caecum and ascending colon. Increase in the thickness of bowel wall and enlargement mesenteric lymph node in Typhoid fever was first reported by Puyleart <sup>7</sup>. In 1997 Tarantino L. reported similar findings in 95 patients of confirmed Typhoid fever, who have observed enlarged lymph nodes in 55.8% cases and bowel wall thickening in 36.8% cases <sup>8</sup>, which is similar to the present study. M.A Mateen et al reported bowel wall thickening in 85% cases (n=26), where 12 cases showed terminal ileum and caecal wall thickening, 7 cases showed only ileal thickening and 3 cases showed thickening of whole colon and mesenteric lymphadenopathy was found in 77% cases <sup>4</sup>. Findings of bowel thickening and lymphadenopathy were also reported in *Yersenia enterocolitica* and *Campylobacter jejuni* enterocolitis by Puyleart <sup>9</sup>, in tubercular enteritis by Lee <sup>10</sup> and inflammatory bowel disease, Ulcerative colitis and Crohn's disease by Lim <sup>11</sup>.

Gall bladder changes were observed in 30% cases in our study. Among them 16.7% cases were with thickened gall bladder wall, 10% cases with thickened wall with biliary sludge, 3.3% cases with distended gall bladder and 3.3% cases with only biliary sludge. Shetty and Broome found different types of gall bladder changes in 62 patients with culture positive Typhoid fever. In that study the common sonographic changes were globular distension of gall bladder (53%), positive sonographic Murphy's sign (40%), pericholecystic edema or fluid (40%), gall bladder wall thickening and

biliary sludge (34%) (1998). M.A Mateen et al., found distended and thickened walled gall bladder in 62% cases, biliary sludge in 23% cases, positive sonographic Murphy's sign in 27% cases and pericholecystic edema in 23% cases <sup>4</sup>.

In tubercular enterocolitis the 5 layers bowel wall is lost and narrowing of bowel wall and stricture is common. Whereas in Typhoid fever structure is maintained. This distinguishes it from tuberculous enteritis. Inflammatory bowel diseases Ulcerative colitis and Crohn's disease are differentiated from Typhoid enterocolitis based on the extent and location of the thickened bowel wall. In Crohn's disease skip lesions are found.

The sensitivity and specificity of bowel wall thickening and enlarged lymph node for diagnosis of Typhoid fever in patients admitted with fever as described by Tarantino was 68.4% and 81.4% respectively and accuracy of 77.4% <sup>8</sup>. Many diseases can mimic the typical clinical findings of Typhoid fever and on the other hand, can be difficult to exclude these diseases in Typhoid fever with atypical clinical features <sup>8</sup>. In these cases abdominal ultrasonography provides a rapid and effective tool in differentiating from conditions like appendicitis, abscess and diverticulitis <sup>8,9</sup>.

#### Limitations of the study:

The study had few limitations e.g. all cases were not bacteriologically proven enteric fever. Follow up ultrasonogram could not be done to find out treatment response.

#### Recommendation:

The clinical and the ultrasound findings of enlarged mesenteric lymph nodes, bowel wall thickening, dilated thick walled gall bladder and biliary sludge are very useful for diagnose the enteric fever even when widal test is inconclusive and blood cultures are sterile or not available.

Further multi centre large-scale case-control studies with culture proven enteric fever are recommended.

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