In this study 176 patients were included, which clinically diagnosed suffering from typhoid fever and laboratory findings also showing positive results. All male and female patients of all age groups, who were clinically suspected of having typhoid fever, either acute or chronic.

A total of 91 (51.7%) females and 85 (48.3%) males were included in the study. Out of the 176 patients, 47 (26.7%) patients had positive Typhidot IgG, 56 (31.8%) patients had positive Typhidot IgM, 21 (11.9%) patients had positive Typhidot IgG and IgM, and 52 (29.5%) patients had positive Widal test. Common abdominal findings on ultrasonography were 62 (35.2%) patients with bowel wall thickening, and 13 (7.4%) patients with having acalculous-cholecystitis.

Objective:
To determine the sonographic common abdominal findings among patients suffering from typhoid fever.

Methods:
This research was conducted at Al Qaim Ultrasound Centre and Islamia Hospital Chiniot in nine months duration. Honda Electronics (HS 2000, HS 2200, and Toshiba just vision) machines were used. Frequency range of 3.5-5.00 MHz was used. All the patients were enrolled voluntarily after explaining the procedure to the patient thoroughly. Statistical Package of Social Sciences (SPSS) version 21 was used to evaluate the data.

Results:
In this study 176 patients were included, which clinically diagnosed suffering from typhoid fever and laboratory findings also showing positive results. All male and female patients of all age groups, who were clinically suspected of having typhoid fever, either acute or chronic. All male and female healthy individuals and non-cooperative patients. Out of 176 patients, 91 were female and 85 males. Laboratory findings, 47 (26.7%), 56 (31.8%), 21 (11.9%), 52 (29.5%) patients having (Typhidot IgG), (Typhidot IgM), (Typhidot IgG, IgM), (Widal) positive results respectively. Common abdominal findings on ultrasonography were 62 (35.2%) patients with having hepatomegaly, and 88 (50%) patients with splenomegaly. Mesenteric lymph adenitis showed only in 21 (11.9%) patients. Results showed 27 (15.3%) patients with bowel wall thickening, and 13 (7.4%) patients with having acalculous-cholecystitis.

Conclusions:
Ultrasonography is a useful and helpful tool in diagnosing the typhoid fever, especially when serological tests are time consuming or showing negative results or cultures. Ultrasonography is also a quick, economical and non-invasive procedure.

Key words:
Ultrasonography, Typhoid fever, Hepatomegaly, Splenomegaly, Mesenteric lymph nodes, Bowl wall thickening

Introduction:
Typhoid fever is a potentially multi systemic and fatal illness, and this serious systemic infection caused by salmonella enterica serotype typhi and paratyphi which are both gram-negative bacteria. From thousands of years salmonella typhi has been a major human pathogen, thriving in condition of social chaos, crowding and poor sanitation. At the end of the Peloponnesian War, It may have the responsible for Great Plague of Athens. From the ancient Greek "typhos", this is an ethereal cloud of smoke that was believed to cause madness and disease, from where this name S (salmonella) is derived. The patient level of consciousness is truly clouded in the advanced stages of typhoid fever. In the developed countries the antibiotics have markedly reduced the frequency of typhoid.
Sonographic Common Abdominal Findings Among Patients

Typhoid fever is regularly found in Pakistan due to inadequate safe water drinking supply, poverty, unawareness, illiteracy, poor sanitation. In a survey from Karachi, Pakistan 170 cases reported of typhoid fever out of 100,000 on blood culture based and 710 cases reported of typhoid fever on serology based investigations out of 100,000. In another city of Pakistan, Quetta which is a district of Baluchistan Province, 14.63% prevalence rate of typhoid fever was found in general population. Salmonella infest or exploit the intestines of a numbers of vertebrate species as they consists bacilli and infect human, as a result of this infected individuals leading to gastroenteritis, enteric fever, septicemia with or without suppuration, and the carrier state. Salmonella typhi is the most important member of this genus and the causative agent of typhoid fever. Typhoid fever is commonly associated with systemic manifestations, such as progressive fever, leukopenia, bradycardia, rose spots and splenomegaly.

Several studies have reported ultrasonographic (US) findings in typhoid fever. US findings in three patients from the United States with typhoid fever, revealing enlarged mesenteric lymph nodes (MLNs) and mural thickening of the terminal ileum. These observations led to the conclusion the findings in typhoid fever are similar to those of non-typhoidal Salmonella. Daniel Elmer Salmon is an American veterinary pathologist, after him the genus "Salmonella was named. He was also the administrator of the USDA research. Salmonella are gram negative bacilli of 2-4/0.6 micrometer (um) size. They are motile and having flagella which is uniformly distributed over the body. They are non-capsulate, non-sporing and non-acid-fast. They are aerobes and facultative anaerobes. Characteristically salmonellae are ferment glucose but don't ferment lactose or sucrose and in addition they ferment mannose without producing gas, and H2S produced by most salmonellae. Salmonellae are identified and classified on the bases of antigen they posed; they possess the flagellar antigen H, Somatic antigen O, Surface antigen VI. The incidence rate of typhoid fever is continuously decreasing in United States as they improved their sanitary conditions and with successful antibiotic treatment. Only 314 cases of typhoid fever reported in United Stated in 2006 while in 1920 reported cases numbers were 35,994. In United States mostly cases of typhoid fever occurred in patients who had been out side of the country, and among these individuals mostly from Indian subcontinent.

USG is recognized as the most accepted imaging modality for the evaluation of typhoid fever, being quick, noninvasive, and nonionizing; eventually, it was considered safe for children. The present study was aimed to find the common abdominal findings on USG over the routine in the diagnosis of typhoid fever. USG findings might be helpful toward the early diagnosis of typhoid fever.

Methods:
In this Cross sectional descriptive study convenient sampling was performed to determine the sonographic common abdominal findings in all 176 male and female patients of all age groups, who were clinically suspected of having typhoid fever, either acute or chronic. Research was started after approval from institutional review board. The study was conducted at the Al Qaim Ultrasound Centre and Islamia Hospital Chiniot. Honda HS 2000, 2200, Toshiba just vision, a convex transducer frequency of 3.5 to 5 MHz was used in this study. All ultrasound examinations were started from right upper quadrant with the examination of liver. The patient was on supine position while examining the liver and transducer placed at right mid axillary line 9th or 10th intercostal space along the patient, where the size of the liver was noted. The gallbladder was next examined concentrating on its size and wall thickening while patient was on left lateral decubitus position. Then in left upper quadrant, spleen size...
was noted while patient was on right lateral decubitus position. Multiple transverse and longitudinal scans of abdomen and pelvis were then performed for the study of the small bowel to identify any area of wall thickening. Using a similar technique enlarged mesenteric lymph nodes were identified.

**Results:**
In this study 176 patients were included, which clinically diagnosed as suffering from Typhoid fever and laboratory findings also showing positive results. Table 1 shows Ultrasonographic findings of Hepatomegaly, Splenomegaly, Mesenteric Lymph Nodes, Bowl wall thickening, Acalculous Cholecystitis in patients suffering from Typhoid fever. Out of 176 patients, 62 (35.2%) were presented with Hepatomegaly and 114 (64.8%) were normal. Out of 176 patients, 88 (50%) were presented with Splenomegaly and 88 (50%) were normal. Out of 176 patients, 155 (88.1%) were presented with Mesenteric Lymph Nodes and 21 (11.9%) were normal. Out of 176 patients, 27 (15.3%) were presented with Bowl wall thickening and 149 (84.7%) were normal. Out of 176 patients, 13 (7.4%) were presented with Acalculous Cholecystitis and 163 (92.6%) were normal.

<table>
<thead>
<tr>
<th>Ultrasound findings of Abdomina</th>
<th>Hepatomegaly</th>
<th>Splenomegaly</th>
<th>Mesenteric Lymph Nodes</th>
<th>Bowl wall thickening</th>
<th>Acalculous Cholecystitis</th>
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</thead>
<tbody>
<tr>
<td>Yes</td>
<td>62</td>
<td>88</td>
<td>155</td>
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<td></td>
<td>(35.2%)</td>
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<tr>
<td>No</td>
<td>114</td>
<td>88</td>
<td>21</td>
<td>149</td>
<td>163</td>
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<td>(64.8%)</td>
<td>(50%)</td>
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<td>(84.7%)</td>
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<tr>
<td>Total</td>
<td>176</td>
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</table>

**Table 1: Ultrasonographic findings of hepatomegaly, splenomegaly, mesenteric lymph nodes, bowl wall thickening, acalculous cholecystitis in patients suffering from Typhoid Fever**

Table 2 of Lab Findings shows that out of 176 patients, 41 (23.3%) patients were with Typhidot (IgG positive), 59 (33.5%) patients were with Typhidot (IgM positive), 21 (11.9%) patients were with Typhidot (IgG & IgM positive) and 55 (31.3%) patients were with Widal Positive.

<table>
<thead>
<tr>
<th>Lab Findings</th>
<th>Frequency</th>
<th>Percent</th>
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<tr>
<td>Typhidot (IgG positive)</td>
<td>41</td>
<td>23.3</td>
</tr>
<tr>
<td>Typhidot (IgM positive)</td>
<td>59</td>
<td>33.5</td>
</tr>
<tr>
<td>Typhidot(IgG&amp;IgM positive)</td>
<td>21</td>
<td>11.9</td>
</tr>
<tr>
<td>Widal Positive</td>
<td>55</td>
<td>31.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>176</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

**Discussion:**
Thyphoid fever is septic emic disease caused by members of certain salmonella serovars. The commonest causative agent of enteric fever is Salmonella typhi. The clinical manifestations caused by this bacterium are also called as typhoid fever and those due to S.paratyphi A and B as paratyphoid fever. The primary mode of transmission of the typhoid bacillus is the oral or fecal rout through contaminated water and food. The incubation period usually 14 days but may range between 5 to 20 days. Previous studies shows common abdominal findings on Ultrasonography in diagnosing typhoid fever are hepatomegaly, splenomegaly, mesenteric lymph nodes, acalculous cholecystitis, and bowel wall thickening. A study published by Revdiwala D. et al., to determine the role of ultrasound in common fever pathologies. Their Ultrasonographic findings were hepatomegaly-splenomegaly, well distended gall bladder with thickened wall, oedematous wall thickening of terminal ileum, ileo-caecal junction and caecum, multiple rounded hypoechoic mesenteric lymph nodes. Lahiri K. et al. reported enteric fever and solitary hepatic abscess by Ultrasonography in a 13 year old child case in their article. They reported serial Ultrasonography would be essential for diagnosing and monitoring of of hepatic abscesses and cholecystitis.

Another clinical study published by Hanchate V. et al. to determine the role of Ultrasonography in diagnosis of enteric fever. They reported that, hepatosplenomegaly, enlarged mesenteric lymph nodes, bowel wall thickening, acalculous cholecystitis are diagnostic Ultrasonographic findings.
features for detecting enteric fever. In another article published by Dr Sushil J. to determine the diagnosing criteria of typhoid fever by Ultrasonography. They reported that, the Ultrasonographic findings like splenomegaly, mesenteric lymphadenopathy, terminal bowel wall thickening with clinical picture is highly suggestive to establish the diagnosis of the typhoid fever.

In our study splenomegaly was most visualized, splenomegaly was more common in young patients and in females. Patients with acute clinical features of typhoid fever having splenomegaly on ultrasound. In this study we seen patients with acute features of typhoid fever mostly splenomegaly and bowel wall thickening seen. In our study hepatomegaly was second most visualized in patients suffering from typhoid fever, hepatomegaly was more common in chronic typhoid fever patients and those with positive (Typhidot IgG) laboratory finding. Hepatomegaly was found very less common in young patients and those with acute clinical features of typhoid fever. Bowel wall thickening was more common in female patients than male patients. Mesenteric lymphadenopathy and acalculus cholecystitis were uncommon than other sonographic abdominal findings. Acalculus cholecystitis mostly visualized with hepatomegaly in this study. This study also has some limitations in patients follow up, patients not having proper history of other systemic or bacterial or any other disorders. Patients also don’t exactly know or not having proper treatment history. Ultrasound findings are very useful and diagnostic in those areas which are endemic for typhoid fever.

Conclusion:
Sonographic features specific for typhoid fever, are splenomegaly, enlarged MLNs, bowel wall thickening, acalculus cholecystitis, and hepatomegaly were evaluated. Thus, sonography is an additional diagnostic tool for typhoid fever with the above positive findings. Ultrasonography is a useful and helpful tool in diagnosing the typhoid fever, especially when serological tests are time consuming. Ultrasonography is also quick, safe economical and non-invasive investigation in the treatment of typhoid fever.

Images:

Figure 1 (A) Shows the enlarged mesenteric lymph nodes. (B) Hepatomegaly.

Figure 2. Abdominal ultrasonography findings for typhoid fever in adults. (A) Shows the abdominal ascites with normal liver size. (B) Mild abdominal ascites.

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