

## Research Article

# ULTRASONOGRAPHIC FINDINGS IN CHILDREN WITH DENGUE FEVER ADMITTED TO A TERTIARY CARE HOSPITAL IN RAWALPINDI DURING 2019 OUTBREAK

Rai Muhammad Asghar<sup>1</sup>, Rai Rijjal Ashraf<sup>1</sup>, Mudassar Sharif<sup>1</sup>, Muhammad Hussain<sup>1</sup>, Abid Hussain<sup>1</sup>

### Author's Affiliation:

1- Paediatric Department, Benazir Bhutto Hospital, Rawalpindi, Pakistan

### Correspondence:

Rai Muhammad Asghar, Email: researchcellpaeds@gmail.com

Received on: 28-Apr-2020

Accepted for Publication: 10-Jul-2020

## ABSTRACT

Dengue fever is one of the most important emerging vector-borne viral diseases. There are four serotypes of dengue viruses, each of which is capable of causing self-limited dengue fever or even life-threatening dengue hemorrhagic fever and dengue shock syndrome. The aim of this study was to evaluate the sonographic findings in serologically proven dengue fever patients. This cross sectional observational study included 438 serologically confirmed children with dengue fever admitted in Pediatric Department benazir Bhutto Hospital during 2019 outbreak. The participants were clinically and serologically evaluated against NS1 antigen, IgM and IgG antibody. These patients also underwent USG abdomen and chest within the first week of the illness. Among 438 dengue serology positive children, 254 were male children (58%), and 184 were female children (42%). The age of the children ranged from 03 months to 12 years, with a mean age of 8.03 years (SD  $\pm$ 3.13 years). 254 (58%) children were classified having uncomplicated dengue fever. Dengue hemorrhagic fever developed in 119 (27.1%) children while 65 (14.9%) children went in to dengue shock syndrome. Uncomplicated Dengue fever had no significant finding on ultrasonography. Free fluid in body cavities like ascites, pleural effusion was noted in almost 100% of cases having DHF or DSS followed by Thickening of gall bladder wall (19 % in DHF and 63% in DSS) hepatomegaly (30% in DHF and 95% in DSS) and Splenomegaly (9%in DHF and 20% in DSS). Findings in ultrasonography, suggested that there is more tendency of plasma leakage and hepato-splenomegaly in infants and 9-12 years age group. GB wall thickening was seen in most of the patients whose platelet count was <50,000 (50.7%). Ascites/pleural effusion (85%) and hepatomegaly (42.1%) were the other common findings seen in patients whose platelet count was <50,000. In patients whose platelet count was > 100,000, there were no significant ultrasonographic findings except for hepatomegaly.

## INTRODUCTION

A member of flavivirus family, Dengue virus (serotypes DENV-1 to DENV-4), is responsible for the highest disease burden of any arthropod-borne viral infection worldwide. The global incidence of dengue has grown dramatically in recent decades. About half of the world's population is now at risk. The global incidence of Dengue has grown dramatically in recent decades. Almost half of the world population is at risk. There are estimated 100-400 million Dengue infections each year<sup>1</sup> A high rate of Dengue infection is found in post monsoon months.<sup>2</sup> The case fatality in Dengue is 1.14%<sup>3</sup> Early and accurate diagnosis is critical to reduce mortality<sup>4</sup>.

Dengue can be diagnosed clinically against predefined list of sign and symptoms and by detection of dengue specific antibodies, non-structural 1 antigen or viral RNA by reverse transcriptase –polymerase chain reaction.<sup>5</sup> Viral detection and serological conversion have been the main targets of diagnostic assessment for many years. Ultrasound findings as increased gall bladder wall thickness, pleural effusion, ascites, hepatomegaly and splenomegaly in clinically suspected dengue fever cases especially in endemic areas are highly suggestive of dengue fever.<sup>7</sup> Third spacing of fluid in various areas of body can occur in critical (plasma leak) phase of Dengue,

manifesting in subtle effusions and gall bladder wall congestion that may not be evident on physical examination.<sup>8</sup> Gall bladder wall thickening is one of the most common findings in dengue fever.<sup>9</sup> The common ultrasound finding associated with severe dengue fever are gall bladder wall thickening,ascities,pleural effusion,pericardial effusion,pericholecystic fluid ,hepatomegaly,splenomegaly and mesenteric adenopathy.<sup>1</sup>Ultrasound findings of hepatomegaly,gall bladder wall edema ,right sided or bilateral pleural effusion and ascities in patients with signs and symptoms of dengue fever during an epidemic are virtually diagnostic of dengue fever.<sup>11</sup>Early demonstration of serosal collection helps to grade dengue fever to severe dengue fever and prioritize patients for critical care.<sup>12</sup>

The aim of present study was to evaluate the sonographic findings of dengue fever which may be useful as an early diagnostic tool and to predict the severity pattern of the disease.

## MATERIALS AND METHODS

This cross-sectional observational study was carried out in the department of pediatrics, Benazir Bhutto Hospital, Rawalpindi. 438 children age up to 12 years with serologically confirmed dengue fever, admitted during the outbreak of 2019, were included in this study. All these patients were clinically and serologically evaluated. These patients also underwent USG abdomen and chest within the first week of the illness. Based on the investigation results, patients were classified into 3 categories as per WHO guidelines: Dengue fever, Dengue Hemorrhagic fever and Dengue shock syndrome. All patients were treated as per DEAG guidelines. The results were tabulated and analyzed in SPSS24

## RESULTS

During the outbreak period of 6 months, 438 dengue serology positive children were admitted, among which 254 were male children (58%), and 184 were female children (42%). The age of the children ranged from 03 months to 12 years, with a mean age of 8.03 years (SD  $\pm$ 3.13 years).

DEMOGRAPHIC AND CLINICAL PRESENTATION OF DENGUE CASES		
Gender	Frequency (n= 438)	Percentage
Male	254	58
Female	184	42
Age (Mean 8.03 years SD $\pm$ 3.13 Years)		
Less than 1 year	15	3.4
1-4 years	78	17.8
5- 8 years	114	26.1
9-12 years	231	52.7

Each child was examined for ultrasound of abdomen, pelvis and chest for detection of plasma leakage and free fluid accumulation in cavities. All the children with final diagnosis of uncomplicated Dengue fever had no significant finding on ultrasonography. Free fluid in body cavities like ascites, pleural effusion was noted in almost 100% of cases having DHF or DSS followed by Thickening of gall bladder wall (19 % in DHF and 63% in DSS) hepatomegaly (30% in DHF and 95% in DSS), and Splenomegaly (9%in DHF and 20% in DSS).

ULTRASONOGRAPHIC FINDINGS		
USG FINDING	NO OF PATIENTS	PERCENTAGE
• Normal	254	57.99
• Gall bladder with thickening	63	14.38
• Ascites/Pleural/Pelvic fluid	175	39.95
• Hepatomegaly	95	21.69
• Splenomegaly	24	5.48
• Pericardial effusion	4	0.91

All children were classified according to DEAG-WHO criteria for severity of dengue fever. 254 (58%) children were classified having uncomplicated dengue fever. Dengue hemorrhagic fever developed in 119 (27.1%) children while 65 (14.9%) children went in to dengue shock syndrome. One child died of shock and severe Respiratory distress and multi organ failure.

USG	DHF (N=119)	DSS (N=65)	TOTAL (N=184)
Abdominal/pleural/ pelvic fluid	110 (92.5%)	65(100%)	175(95%)
Gall bladder wall edema	22(19%)	41(63%)	63(34.3%)
Hepatomegaly	35(29.5%)	60(92%)	95(51.7%)
Splenomegaly	11(9.2%)	13(20%)	24 (13%)
Pericardial Effusion	1(0.8%)	3(4.7%)	4 (4.5%)

Findings in ultrasonography, suggested that there is more tendency of plasma leakage and hepato-splenomegaly in infants and 9-12 years age group.

USG FINDING	Less than 1 year (n=15)	1-4 years (n=78)	4-8 years (n=114)	9-12 years (n=231)
Normal (254)	4	50	68	132
Gall bladder with thickening (63)	7	11	10	35
Abdominal/pleural/ pelvic fluid (175)	11	48	53	63
Hepatomegaly (95)	8	21	24	42
Splenomegaly (24)	4	4	6	11
Pericardial effusion (4)	2	1	1	0

GB wall thickening was seen in most of the patients whose platelet count was <50,000 (50.7%). Ascites/pleural effusion (85%) and hepatomegaly (42.1%) were the other common findings seen in patients whose platelet count was <50,000. In patients whose platelet count was > 100,000, there were no significant ultrasonographic findings except for splenomegaly.

USG FINDING	< 50,000 (N=67)	50,000 – 100,000 (N=341)	>100,000 (N=30)
Normal (254)	14	215	24
Gall bladder with thickening (63)	34	28	01
Ascites (175)	57	111	2
Hepatomegaly (95)	45	50	0
Splenomegaly (24)	14	07	03
Pericardial effusion (4)	3	1	0

## DISCUSSIONS

There are estimated 100-400 million Dengue infections each year(1). Pakista has experienced large epidemics of dengue fever.A comparison of data during these epidemics indicates a shift from mild to more severe disease which could be interpreted as an epidemiological transition pattern in the Couyntry.<sup>13</sup> Detailed knowledge of clinical symptoms and Laboratory feature is essential for appropriate triage.<sup>14</sup>

As Serological diagnosis is confirmatory of dengue and includes direct methods such as virus isolation and NS1antigen detection and indirect methods such as IgM and IgG antibody detection<sup>15</sup>. As serological diagnosis takes some time to reflect the results, sonography has an increasingly important role as sonography is a readily available and cost-effective method for the diagnosis, which helps improve the management of patients of dengue.

The aim of present study was to evaluate the role of sonographic findings as early diagnostic modality in children with dengue fever and to predict the severity of disease in terms of

complications. In present study, male predominance was seen with 58 % male cases to 42% females with male to female ratio of 1.4:1. A study by Manoj Kumar et al has found a similar male to female ratio of 1.54:1 in all sero positive cases.<sup>16</sup> while the study of Srinivasa et al.<sup>17</sup> the ratio of male to female was 1.13:1. The sex distribution is also consistent with a study by Thakur S et al shows dengue fever occurs more in male sex<sup>18</sup>.

The ultrasonographic findings showed pleural effusion and ascites in 137 (39.9%) cases, hepatomegaly in 95 (21.69%) cases, gall bladder thickening in 63 (14.4%) cases and splenomegaly in 24 (5.5%) cases. Four cases have evidence for pericardial effusion.

Overall 181 (42%) out of 438 cases had one or more of the positive finding in ultrasonography. This clearly shows that Ultrasound can be used as an early, non-invasive and economical diagnostic tool. In the study by Srinivasa et al.<sup>17</sup>, 72% of the cases had ultrasound findings in the form of either hepatomegaly or gall bladder wall thickening. The ultrasound findings showed gall bladder wall thickening in 30.5%, in a study by Quiroz-Moreno et al.<sup>19</sup> Gallbladder thickening was seen in 92.85% of the patients in severe Dengue fever And 45 %patients of non Severe Dengue fever, Parmar J et al.<sup>20</sup> In clinically Confirmed DHF cases finding of Gall bladder thickness >3mm to 5mm with 93.8% sensitivity can be used as a criterion for identifying DHF patients at high risk of developing hypovolemic shock.<sup>21</sup> A thickened Gall bladder wall is defined as >3mm(9) In our study, GB wall thickening was seen in most of the patients whose platelet count was <50,000 (50.7%). Ascites/pleural effusion (85%) and hepatomegaly (42.1%) were the other common findings seen in patients whose platelet count was <50,000. In patients whose platelet count was > 100,000, there were no significant ultrasonographic findings except for splenomegaly. In one study ascites 93.8% gall bladder wall thickening 64.8% right pleural effusion 78.7% left pleural effusion 64.1%, bilateral pleural effusion 64.15, hepatomegaly 28% splenomegaly 42.6% pericardial effusion 1.3% were found.<sup>22</sup>

In our study pleural effusion or ascites was apparent on clinical examination in some of the cases, but sonography helped in diagnosing all of them. This also aided in early initiation of management modules for the treatment of DHF and DSS. All the cases which went into hypotension and shock showed pleural effusion and or ascites and gall bladder wall thickening,. The early initiation of specific treatment and management in these cases greatly helped in mortality reduction at our hospital. Only one child out of 438 cases expired in our hospital due to dengue shock syndrome and its complications including multi organ failure. So this study clearly demonstrates the importance of ultrasonography in the accurate and complete clinical evaluation of dengue fever.

## CONCLUSION

USG should be considered as a first-line imaging modality in all children with suspected dengue fever to detect early signs suggestive of the disease progression along with obtaining serologic confirmation tests.

## REFERENCES

1. Dengue and Severe Dengue World Health Organization Fact Sheet. 2 march 2020. <https://apps.who.int>
2. Abdullah, Ali S, Salman M et al. Dengue out breaks in Khyber Pakhtunkhwa (KPK) Pakistan In 2017: An Integrated Disease Surveillance and Response System (IDSRS), based report. Pol J Microbiol. 2019; 68(1): 115-119.
3. Law G K-K, Ogston SA, Yong M-M, et al. Global Dengue Death Before and after the New World Health Organization 2009 Case Classification: A Systematic Review and Meta-Regression Analysis. Acta Trop 2018 Jun; 182: 237-245.
4. Hassan S, Jamdar SM, Alalowi M et al. Dengue Virus: A global human threat: Review of literature. J Int Soc Prev Community Dent. 2016 Jan-Feb; 6(1): 1-6.
5. Raafat N, Blacksell SD, Maude RJ. A review of dengue diagnostics and implications for surveillance and control. Trans R Soc Trop Med Hyg. 2019 Nov; 113(11): 653-660.
6. Muller DA, Depelsenaire ACI, Young PR. Clinical and Laboratory Diagnosis of Dengue Virus Infection. J Infect Dis. 2017 Mar 1; 2015(2): S89-S 95.
7. Parmar J, Mohan C, Kumar GP, Vora M. Ultra sound is not use full as a screening tool for dengue fever. Pol J radiol. 2017; 82: 693-700.
8. Shah S, Rolfe R, Henostroza G, Seas C. Ultrasound findings of Plasma Leakage in Dengue Fever. Am J trop Med Hyg. 2018 dec; 99(6): 1362-1363

9. Parmar JP, Mohan C, Vora M. Patterns of Gall Bladder Wall Thickening in Dengue Fever: A mirror of Severity of Disease. *Ultrasound Int Open*. 2017 Apr;3(2):E 76-E81.
10. Pothapregada S, Kullu P, Kamalakannan B, Thulas-ingam M. Is Ultrasound a useful Tool to predict Severe Dengue Infection? *Indian J Pediatr*. 2016 Jun;83(6):500-4.
11. Chandak S, Kumar A. Can Radiology Play a Role in Early Diagnosis of Dengue Fever. *N Am J Med Sci*. 2016 Feb;8(2):100-105.
12. Krishnaveni N, Sarda B, Vasudhara N, Padma K. Ultrasound as Screening Modality in Management of Fever Cases in Dengue Epidemic. *Afr J Radiol* 2017;24(2):135-41.
13. Haider Z, Ahmed FZ, Mahmood A et al. Dengue Fever in Pakistan :A Paradigm Shift, Changing Epidemiology and Clinical Pattern. *Perspect Public Health* 2015 Nov;135(6):294-8.
14. Tavakolipoor P, Schmidt, Chanosit J, Burchard D, Jordan S. Clinical features and laboratory findings of Dengue Fever in German travelers :A Single –Centre Retrospective Analysis. *Travel Med Infect Dis* 2016 Jan-Feb;14(1):39-44
15. Dhooria S. et al. “Clinical profile and outcome in children of dengue hemorrhagic fever in north India.” *Iran J Pediatr*. Sep 2008; vol 18 (No.3): 222-228.
16. Kumar M, Verma RK, Mishra B. Prevalence of Dengue Fever in Western Uttar Pradesh, India: A Gender-Based study. *Int J Appl Basic Med Res*. 2020 Jan-March;10(1):8-11.
17. Srinivasa S, Nawab T, Nair CC. Clinical profile and ultrasonographic findings in children with dengue fever. *Current Pediatrics*. 2014;18(2).
18. Thulkar S, Sharma S, Srivastava DN, Sharma SK, Berry M, Pandey RM et al. Sonographic findings in grade III dengue hemorrhagic fever in adults. *J Clin Ultrasound* 2000; 28: 34-37.
19. Quiroz-Moreno R, Mendez GF, Ovando- Rivera KM. Clinical Utility of ultrasound in the identification of dengue hemorrhagic fever. *Rev Med Inst Mex Seguro Soc* 2006 44(3): 243-348.
20. Parmar J, Varma M, Mohan C et al. “Honeycomb” pattern of gall bladder wall thickening –A forward step in early diagnosis of “Severe Dengue Fever”. *Indian J Radiol Imaging* 2019 Jan-Mar;29(1):14-18.
21. Setiawan MW, Samsi TK, Pool TN, Sugianto D, Wulur H. Gallbladder wall thickening in dengue hemorrhagic fever: an ultrasonographic Study. *J Clin Ultrasound* 1995; 23(6): 357-362.
22. Parmar J, Varma M, Mohan C et al. “Honeycomb” pattern of gall bladder wall thickening –A forward step in early diagnosis of “Severe Dengue Fever”. *Indian J Radiol Imaging* 2019 Jan-Mar;29(1):14-18.
23. Nagalu H, Papireddygar VK, Reddy PRV et al. Role of ultrasonography in diagnosis and evaluation of dengue fever. *Int. j. anat. radiol. surg*. 2017 Oct;6(4):Ro 52-Ro56.