

CHEST AND ABDOMEN CT FINDINGS IN DENGUE HAEMORRHAGIC FEVER

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ABSTRACT

BACKGROUND

Dengue fever is considered to be the most common acute vector-borne viral infection affecting man. The WHO estimates more than 50 million cases spread over more than 100 countries occur worldwide every year. Despite this abundance of case material, limited articles with regard to the CT findings in dengue fever are noted in the published literature.

The aim of the study is to characterise and evaluate the CT findings in Dengue fever in patients with severe disease.

MATERIALS AND METHODS

Abdomen and chest CT findings of 22 patients with severe DHF in a 3-month period from June to August 2017 were evaluated in a hospital setting in a semiurban location in Kerala, India. Those patients who underwent both abdomen as well as chest CT exams as part of their workup were categorised in WHO DHF grade I-IV.

RESULTS

The commonest chest CT findings were pleural effusion (n=19), atelectasis (n=16), ground-glass opacification (n=9), patchy consolidation (n=7) thickening of the peribronchovascular interstitium (n=3) and pericardial effusion (n=1). The commonest abdomen CT findings were ascites (n=16), gallbladder wall thickening (n=14), hepatomegaly (n=10), splenomegaly (n=8), pancreatitis/bulky oedematous pancreas (n=3), perinephric haematoma (n=1) and appendicitis (n=1).

CONCLUSION

The study documents the common findings on chest and abdomen CT. The most frequently detected findings on chest CT were pleural effusion, atelectasis and ground-glass opacification, while the most commonly occurring abdomen CT findings were ascites, gallbladder wall thickening, hepatomegaly and splenomegaly.

KEYWORDS

Dengue Fever, Dengue Virus, Computed Tomography.

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BACKGROUND

Dengue has become a widespread problem since mid 20th century and is common in more than 110 countries.¹ Each year over 50 million cases are reported and approximately 20,000 to 24,000 patients die from the disease and its complications.² As of August 2017, more than 36,635 cases of dengue fever were reported in India according to figures released by the National Vector-Borne Disease Control Programme. Of these, the highest number of cases, 16,530 were reported in Kerala with 28 deaths. The clinical presentation of dengue fever spans a spectrum from a mild self-limiting fever to dengue haemorrhagic fever and dengue shock syndrome. It is caused by four serotypes- DV 1-4.

DHF is classified into four grades of severity, where grades III and IV are considered to be DSS.¹ The presence

of thrombocytopenia with concurrent haemoconcentration differentiates grades I and II DHF from DF.

Grade I- Fever accompanied by nonspecific constitutional symptoms; the only haemorrhagic manifestation is a positive tourniquet test and/or easy bruising.

Grade II- Spontaneous bleeding in addition to the manifestations of grade I patients, usually in the forms of skin or other haemorrhages.

Grade III- Circulatory failure manifested by a rapid, weak pulse and narrowing of pulse pressure or hypotension with the presence of cold, clammy skin and restlessness.

Grade IV- Profound shock with undetectable blood pressure or pulse.

There is a paucity of clinical literature detailing CT features of DHF in an Indian context. The authors have attempted to demonstrate the spectrum of CT findings in both the chest and thorax in patients with DHF I-IV.

Aims and Objectives- To characterise the spectrum CT findings in dengue fever in patients with severe disease (DHF I-IV) in whom abdomen and chest CT examinations were ordered.

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MATERIALS AND METHODS

22 patients with DHF in a 3-month period from June to August 2017 were evaluated in a Hospital setting in a semi-urban location in Kerala, India. These patients underwent both abdomen as well as chest CT exams as part of their workup.

Patients were assessed for their symptomatology, clinical findings, laboratory parameters and dengue serology (DV NS-1, IgG, IgM). Helical noncontrast CT exams of both chest and abdomen were obtained by standard protocols. Preliminary chest x-rays were also evaluated prior to chest CT exams.

Statistical Analysis- The data obtained were coded, checked and entered into Microsoft Excel. The statistical analysis was done by SPSS Software Version 16. The level of significance was estimated with 95% confidence interval with 'p' value <0.05.

RESULTS

Statistical Analysis- The data obtained were coded, checked and entered into Microsoft Excel. The clinical, laboratory and CT scan findings were expressed in percentage. Demographic details of patients were expressed in rates and proportions.

Age/Sex Distribution of Study Population

22 subjects were assessed by combined chest and abdomen CT. The youngest patient was 5 years old and the eldest 68 years of age. Of these, 4 were in the 5-15 years age group, 5 in the 16-25 years age group, 2 in the 26-35 years age group, 3 in the 36-45 years age group, 1 in the 46-55 years age group and 7 were in the above 55 years group.

There were 13 males and 9 female subjects in the study.

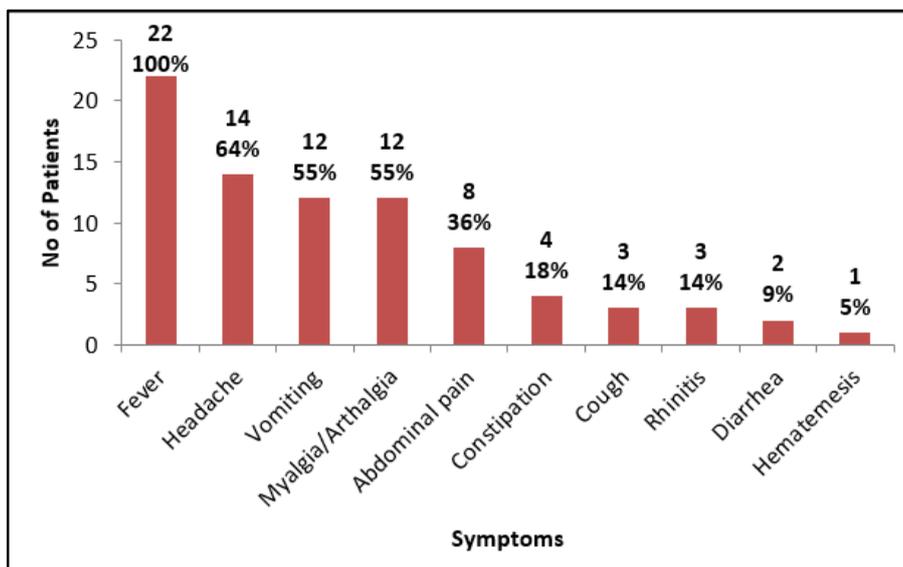


Chart 1. Symptomatology of the Study Population

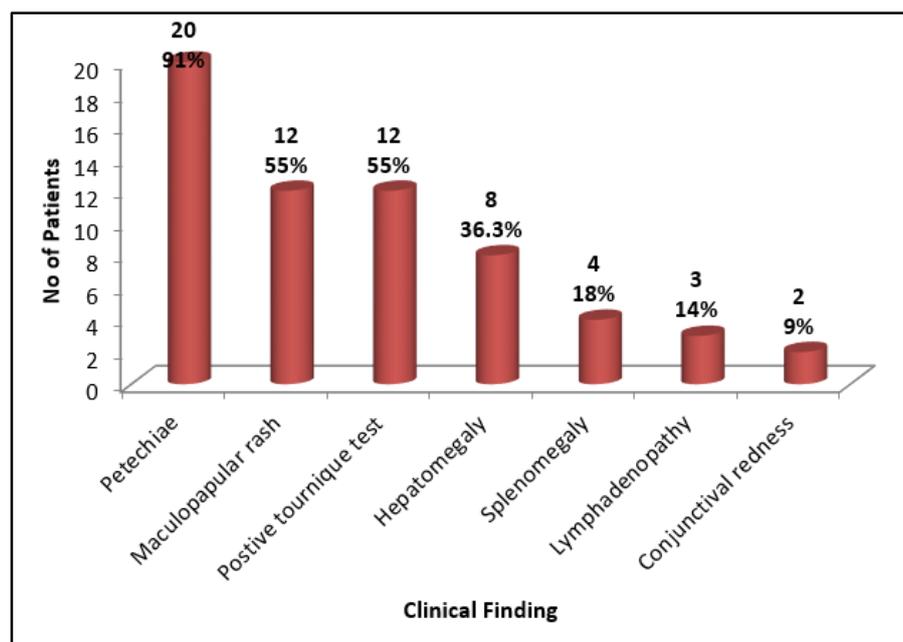


Chart 2. Clinical Findings

Particulars	No. of Patients Total 22 (%)
Thrombocytopenia (<1,50,000/mm ³)	22 (100%)
Leucopenia (<5,000/mm ³)	13 (59%)
Lymphocytosis (>4,000/mm ³)	11 (50%)
Elevated AST (>40 U/L)	11 (50%)
Elevated ALT (>40 U/L)	10 (45%)
Increase in haematocrit (>20%)	9 (41%)
Prolonged INR (>1.4)	7 (32%)
Elevated amylase (>125 U/L)	2 (9%)

Table 1. Laboratory Findings

(AST - Aspartate transaminase; ALT - Alanine transaminase; INR - International normalised ratio).

Particulars	No. of Patients Total 22 (%)
Dengue NS1	16 (73%)
Dengue IgG	14 (64%)
Dengue IgM	10 (45%)

Table 2. Dengue Serology

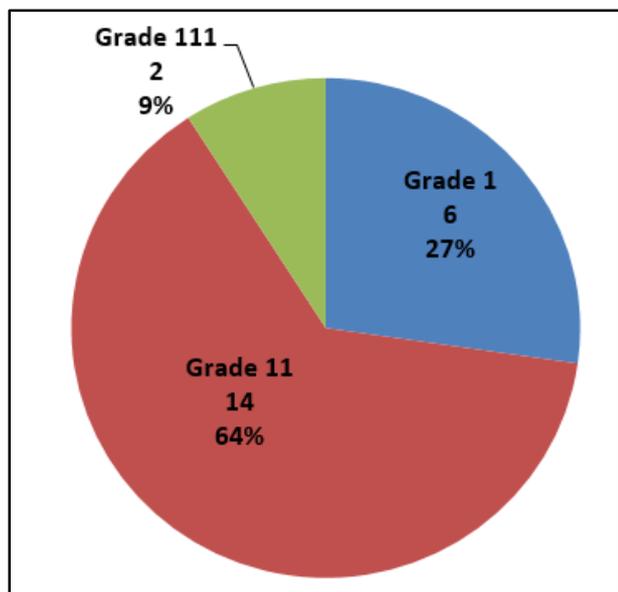


Chart 3. Grading of Patients According to WHO Classification

Chest CT Findings in Study Group

Non-contrast chest CT examinations were done in all 22 cases with positive findings seen in all patients with pleural effusion in 19 cases (86%), ground-glass opacification or patchy consolidation in 16 cases (73%) atelectasis in 15 cases (68%), thickening of the peribronchovascular interstitium in 3 cases (14%) and pericardial effusion in 1 case (5%).

Pleural effusion was the most common finding and was bilateral in 12 of 19 cases (63%) and noted unilaterally in the remaining 7 patients (37%). 2 cases (9%) of the 19 showed fissural effusions.

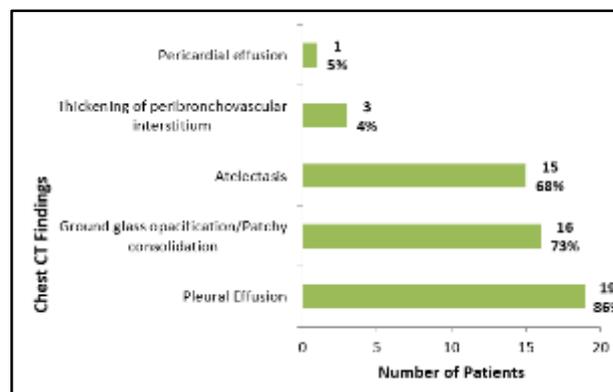


Chart 4. Chest CT Findings in Study Group

Abdomen CT Findings in Study Group

Abdomen CT examinations were also performed for all 22 cases and positive findings were found in 18 cases. These included ascites in 15 cases (68%), hepatomegaly with periportal stranding in 12 cases (55%), gallbladder wall thickening in 11 cases (50%), acute pancreatitis in 2 patients (9%) and perinephric haematoma in 1 patient (5%).

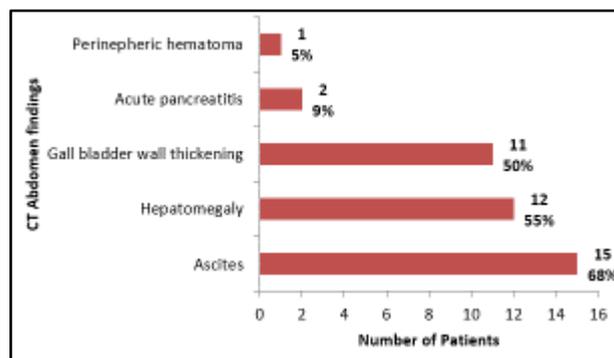


Chart 5. Abdomen CT Findings in Study Group

19 patients had pleural effusion (Figure 1). This was the only finding in 5 patients. 16 patients had pulmonary abnormalities. Lung parenchyma involvement ranged from subtle to moderate unilateral and bilateral ground-glass opacity (Figure 2) in 9 patients, followed by consolidation in 7 patients. Two patients with severe disease (grade III) showed peribronchovascular interstitial thickening (also noted in one patient with grade II disease).

Pleural effusion was the most frequent finding and lung involvement was often mild or moderate and bilateral.

The most frequently occurring abdomen CT findings were ascites (Figure 3) (16 patients), pericholecystic oedema (Figure 4) (14 patients), hepatomegaly (10 patients), splenomegaly (8 patients), pancreatitis (Figure 5)/bulky oedematous pancreas (3 patients), perinephric haematoma (Figure 6) and appendicitis (1 patient each) organomegaly and pancreatic oedema were typically mild-to-moderate, even in grade III disease.

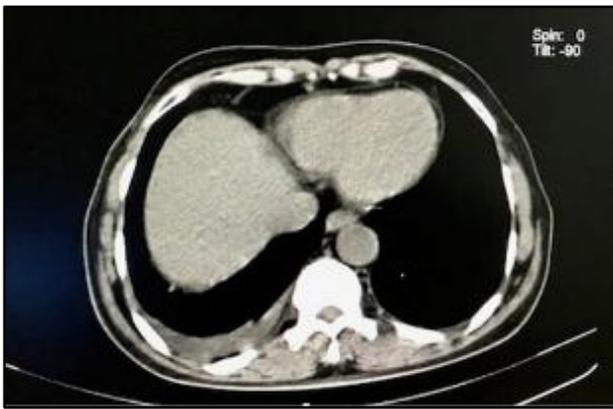


Figure 1. Pleural Effusion



Figure 2. Ground-Glass Opacification

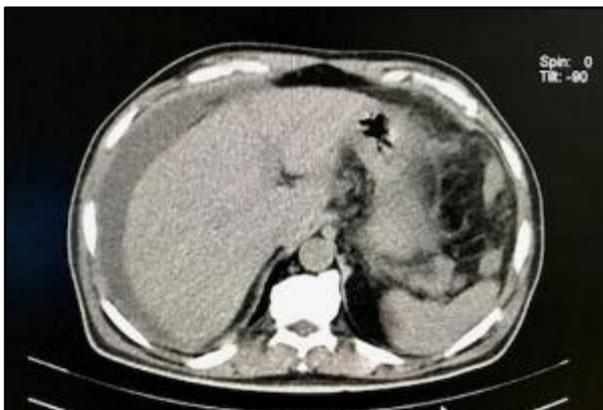


Figure 3. Ascites



Figure 4. Pericholecystic Oedema



Figure 5. Pancreatitis



Figure 6. Perinephric Haematoma

DISCUSSION

The mechanisms leading to the severe manifestations of dengue virus infections are still not completely understood, but are likely to be multifactorial with factors such as genetic background of the host playing a part.³ Following inoculation of dengue virus into the dermis, the virus spreads via the blood (primary viraemia) and infects tissue macrophages in several organs, especially the macrophages in the spleen. The viral load represents an important risk factor for development of severe disease. The infection of macrophages, hepatocytes and vascular endothelial cells influences the haemostatic and the immune responses to dengue virus. Infected cells result in cell necrosis with release of toxic products, which activate the coagulation and fibrinolytic systems. Haemopoiesis is suppressed, resulting in leucopenia and thrombocytopenia. A high viral load in blood and possibly viral tropism for endothelial cells, severe thrombocytopenia and platelet dysfunction results in increased capillary fragility, clinically manifested as petechiae, easy bruising and gastrointestinal mucosal bleeding, which is characteristic of DHF and in increased capillary permeability resulting in polyserositis.

The consequences of increased capillary permeability are ascites and pleural effusion. Capillary leak if unchecked, results in reduced intravascular volume, culminating ultimately in shock- Dengue Shock Syndrome (DSS).

No patients in the study were in DHF grade IV as these patients were too critically ill to be scanned by CT and were instead evaluated by bedside ultrasound.

Only noncontrast CT examinations were done in the current study, as patients suffering from DHF tend to have varying degrees of renal impairment from borderline to frank renal dysfunction.⁴

The most common chest CT finding in the current study was pleural effusion. This is in concordance with findings from a study of Chinese patients by Tianli Hu et al.⁵

Extensive lung parenchymal changes were not observed even in severe disease and these findings are in consonance with those reported Rodriguez RS et al⁶ who remarked that the presence of severe findings should lead physicians to consider other diagnostic possibilities. CT chest was more sensitive in the detection of chest pathology, when compared to chest x-rays.

DHF is known to present with features of acute abdomen.⁷⁻¹¹ In our study, it was noted that 36% of patients with DHF presented with abdominal pain. Clinical findings are often suggestive of cholecystitis, pancreatitis, appendicitis and peritonitis. Though ultrasound is the most commonly used and helpful imaging tool in the evaluation of patients with DHF, there is a definite role for CT in the further evaluation of patients presenting with clinical features of acute abdomen. This is especially pertinent in cases of pancreatitis, where findings in DHF are typically mild and maybe missed on ultrasound and in cases of acute appendicitis, where ultrasound detection maybe difficult, notably in obese individuals. Abdominal CT may help to clarify decision making in patients with DHF who present in this manner and may help prevent unnecessary laparotomy, which can lead to catastrophic consequences in the form of prolonged hospitalisations and need for repeated transfusion of blood products.¹²

The most common finding on abdomen CT is ascites. Ascitic volume has been described¹³ as minimal, mild, moderate, severe and massive, by looking for the presence of fluid in five areas of the abdomen, namely RUQ (perihepatic and Morrison's pouch), LUQ (perisplenic), right paracolic gutter, left paracolic gutter and pelvis- fluid in 1 location corresponds to minimal ascites, fluid in 2 locations - mild ascites, fluid in 3 locations - moderate ascites, fluid in 4 locations - marked ascites and fluid in 5 locations - massive ascites. The bulk of cases in DHF show mild and moderate ascites.

Abdominal wall and intra-abdominal haematomas have been described in previous studies.⁵ A small perinephric haematoma was seen in a solitary patient. CT is a more sensitive modality to evaluate the presence and extent of an intra-abdominal haematoma, especially when floating bowel

loops obscure visualisation of the retroperitoneum by ultrasound.

In conclusion, CT has a very definite role in the evaluation of chest and abdominal pathology in DHF and follow on studies will doubtless be contributing to the body of data that exists with reference to the CT radiology of dengue fever.

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