# CT findings of severe dengue fever in the chest and abdomen

Tianli Hu, Jinxin Liu*, Wanhua Guan, Lieguang Zhang, Songfeng Jiang, Bihua Chen, Qingxin Gan, Deyang Huang

*Department of Radiology, The Eighth People's Hospital of Guangzhou, Guangzhou 510060, PR China*

## Abstract

*Objective*: To study and analyze the chest CT and abdominal CT findings of severe dengue fever.
*Methods*: Imaging data of chest CT and abdominal CT in 38 patients with severe dengue fever were retrospectively analyzed.
*Results*: For chest CT of these patients, 34 cases were positive, with the main performances were pleural effusion (n = 21), patchy clouding opacity (n = 20), atelectasis (n = 18), nodule (n = 6), and pericardial effusion (n = 3). For abdominal CT, 12 cases were positive, including hematoma (n = 4), ascites (n = 4), multiple low density space-occupying lesions in hepar (n = 3), and nephropathy (n = 3).
*Conclusion*: The main CT features of severe dengue fever in chest and abdomen were pleural effusion, patchy exudation and multiple abdominal lesions. These CT findings facilitate more accurate diagnosis of dengue fever.
© 2015 Beijing You'an Hospital affiliated to Capital Medical University. Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

*Keywords:* Dengue fever; Dengue virus; X-ray computed tomography

## 1. Introduction

Dengue fever (DF) is a set of acute vector-borne infectious diseases caused by mosquito infected with dengue virus (dengue virus, DV), which is widely prevalent in tropical and subtropical regions. DV has four serotypes (DV1-4), namely DVI, II, III, and IV [1]. Once infected with DV, body can be presented in two different states, namely primary infection and secondary infection status [4], and dengue fever, dengue hemorrhagic fever (DHF) or dengue shock syndrome (DSS) may occur [2,3]. Dengue fever is a self-limiting disease, with the main symptoms of fever, muscle pain, headache and rash. By now, there are no sufficient reports on imaging manifestations of dengue fever, especially for severe type. Aimed at further understanding of the disease, severe dengue patients in our hospital with CT image data (34 cases of chest CT and 21 cases of abdominal CT) were collected and analyzed.

## 2. Materials and methods

### 2.1. General information

38 patients with severe dengue from June to October 2014 in our hospital were collected for CT scans (34 for chest CT, and 21 for abdominal CT). The main symptoms are as follows: 38 patients with fever, 14 cases with muscle pain, 9 cases with headache, 12 cases with dizziness and fatigue, 21 cases with anorexia, 6 cases with rash, 3 cases with vaginal bleeding, 4 cases with hematoma, 7 cases with consciousness disorder, and 8 cases with vomiting and black.

### 2.2. Laboratory tests

PCR for dengue virus nucleic acid testing showed positive in 38 cases, including 33 cases of DV I and 5 cases of DV II. It was showed dengue antibody IgM/IgG test positive in 36 patients, white blood cell count decreased in 21 cases with a minimum of $1.32 \times 10^9$/L, low platelet count in 38 cases with a minimum of $5.0 \times 10^9$/L.

Case selection criteria [5]:

a Clinically diagnosed cases: fever, headache, muscle pain, joint and bone pain, rash, bleeding tendencies, living in the affected areas, and there are white blood cells and/or thrombocytopenia, a single serum DENV-specific IgM antibodies.

b Confirmed cases: detecting DENV nucleic acid, DENV NS1 antigen from the serum of acute patients or isolating virus.

c Severe dengue diagnostic criteria: any one of severe bleeding (including subcutaneous hematoma, haematemesis, bloody diarrhea, vaginal bleeding, hematuria, intracranial hemorrhage, etc), shock or organ dysfunction (alanine aminotransferase (ALT) and/or aspartate aminotransferase (AST) > 1000 IU/L, ARDS, acute myocarditis, acute renal failure, encephalitis, meningoencephalitis).

### 2.3. Imaging method

Regular helical scan and HRCT scan were performed by employing the Philips Mx 8000 MSCT, with screw Rotary slice thickness of 6.5 mm and interlayer spacing of 6.5 mm. Continuous partial HRCT scan was performed with thickness of 1 mm and interlayer spacing of 1 mm. Patients were supine, with arms raised, with head advanced, performing inspiratory breath-hold volume scanning. CT images were analyzed by two professional radiology physicians.

## 3. Results

Regular chest CT examination was performed for 34 cases, and all were positive performances, with pleural effusion in 21 cases (61.76%, 21/34), patchy exudation in 20 cases (58.82%, 20/34) (Figs. 1 and 2), atelectasis in 18 cases (52.94%, 18/34), small nodules in 6 cases (17.65%, 6/34), and pericardial effusion in 3 cases (8.82%, 3/34).

Abdominal CT examination (in the upper abdomen CT scan examination-based) were performed for 21 cases, and abnormalities were found in 12 cases, including hematoma (underlying rectus abdominis, subcutaneous and perinephric) in 4 cases (19.05%, 4/21) (eg Figs. 3–5), ascites in 4 cases (19.05%, 4/21) (5, 6), intrahepatic multiple low density lesions
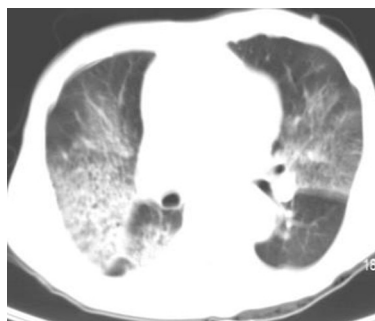


Fig. 2. Patchy exudation.



Fig. 3. Hematoma underlying rectus abdominis, subcutaneous hematoma and perinephric hematoma.



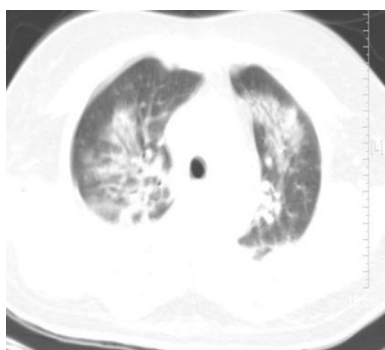Fig. 4. Hematoma underlying rectus abdominis, subcutaneous hematoma and perinephric hematoma.
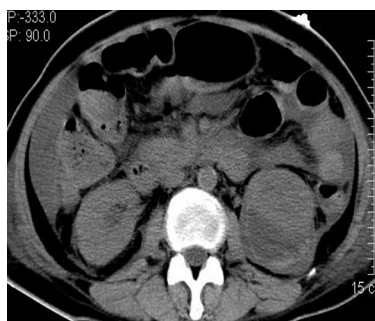


Fig. 5. Hematoma underlying rectus abdominis, subcutaneous hematoma, perinephric hematoma and ascites.



Fig. 1. Patchy exudation.

Fig. 6. Multiple intrahepatic low density lesions and ascites.

Table 1
Clinical symptoms of 102 patients with severe dengue fever.

| Clinical symptoms | Cases |
| --- | --- |
| Fever | 102 |
| Acratia, inappetence | 72 |
| Courbature | 51 |
| Dizzy, headache | 45 |
| Rash | 31 |
| Haematemesis, melena | 15 |
| Colporrhagia | 11 |
| Gingival bleeding | 2 |
| Consciousness obstacle | 10 |

Table 2
Laboratory examinations of 102 patients with severe dengue fever.

| Laboratory index | Cases |
| --- | --- |
| PCR positive | 102 |
| IgM/IgG positive | 92 |
| Reduced platelet | 73 |
| Reduced hemameba | 69 |

Table 3
Chest CT findings of 35 patients with severe dengue fever.

| Imaging features | Cases | Percentage |
| --- | --- | --- |
| Patchy exudation | 23 | 65.71 |
| Pleural effusion | 20 | 57.14 |
| Atelectasis | 15 | 42.86 |
| Interstitial lung disease | 13 | 37.14 |
| Nodule | 3 | 8.57 |
| Hydropericardium | 3 | 8.57 |
| Hematoma | 4 | 11.43 |
| Negative | 3 | 8.57 |

Table 4
Chest X-ray findings of 76 patients with severe dengue fever.

| Imaging features | Cases | Percentage |
| --- | --- | --- |
| Patchy exudation | 14 | 18.42 |
| Pleural effusion | 12 | 15.79 |
| Atelectasis | 7 | 9.21 |
| Interstitial lung disease | 3 | 3.95 |
| Nodule | 2 | 2.63 |
| Negative | 49 | 64.47 |

in 3 cases (14.29%, 3/21) (Fig. 6), and kidney disease in 3 cases (14.29%, 3/21).

The clinical symptoms, laboratory examination, chest CT findings and chest X-ray findings were all listed in Table 1—4, respectively.

## 4. Discussion and conclusion

Outbreaks of dengue infection in Guangdong Province are mainly from August to October each year [6]. From June to October 2014, it has been reported with a total of more than thirty thousand cases, while our hospital has admitted 2050 cases of dengue fever, with 102 cases of severe dengue.

Recent news on dengue fever have reported that the pleural effusion is a more common manifestation [7], which were also observed through chest CT findings of 34 cases with severe dengue fever in this study. Pleural effusion is mainly caused by hydrostatic pressure imbalance [8]; while compression of adjacent lung tissue by exudative pleural effusion may cause atelectasis.

38 patients with severe dengue who underwent routine CT examination were found with thrombocytopenia with a minimum of $5.0 \times 10^9$/L. The dengue virus antigen could combine with platelets comprising virus receptors, and then the virus antibody could combine with the virus antigen on platelets, which resulted in platelet aggregation and destruction in peripheral blood, causing thrombocytopenia, enabling bleeding, such as petechiae and ecchymosis purpura, even hematoma, haematemesis, melena, colporrhagia, hematuria, and intracranial hemorrhage [9]. Furthermore, dengue virus may cause multiple organ damages and increased vascular permeability, as well as hematoma, ascites, perirenal effusion and so on. In this study, hematoma was found in 4 patients, including 2 cases of rectus abdominis hematoma, 1 case of hematoma, and 1 case of hematoma in the left kidney. Although the incidence of hematoma is low, it should also be paid more attention.

In the 21 cases underwent abdominal CT scan, several abdominal diseases were found in 7 cases, including multiple intrahepatic space-occupying lesions. Since patients could not undergo contrast-enhanced abdominal CT examination due to their severe conditions, we failed to capture more useful imaging findings, such as dynamic image features. Reviewing the significantly increased blood leukocytes and other clinical data, liver infections were taken into consideration, and more possibly, liver abscess. Intrahepatic infections may have some relationship with dengue virus invasion, which invaded human body, causing viremia, and reducing immune function by suppressing white blood cells in the bone marrow. Thereby, it caused reduce of the white blood cell count and low immunity, inducing liver or kidney infections.

## 5. Conclusion

It was shown that pleural effusion, patchy exudation, and multiple abdominal lesions (including hematoma, ascites and intrahepatic multiple low-density lesions) were the primary abdominal CT findings in patients with severe dengue.

Although severe dengue has a lack of specific imaging findings, however, once the above imaging features occurred combined with immediately PCR, DF can be confirmed. CT can be used as one of the adjuvant screening methods.

## References

[1] Zhang ZS, Yan YS. Advances in laboratory diagnosis and vaccine on Dengue. Chin J Zoonoses 2006;22(5):460–3.

[2] World Health Organization. Dengue hemorrhagic fever: diagnosis, treatment, prevention and control. 2nd ed. Geneva: WHO; 1997.

[3] Hemungkorn M, Thisyakorn U, Thisyakorn C. Dengue infection: a growing global health threat. Biosci Trends 2007;1(2):90–6.

[4] Xiang H, Nie SF. Advances in laboratory diagnostic technology on Dengue. Chin J Clin Laboratory Sci 2006;24(2):156–7.

[5] Dengue guidelines. National Health and Family Planning Commission of China, NHFPC, 2nd ed., 2014-10-11.

[6] Guo RN, He JF, Liang WJ, Zhong HJ, Yang F. Analysis on the epidemiologic features of dengue fever in Guangdong province, 2005–2010. J Pract Med 2011;27(19):3477–80.

[7] Cam BV, Tuan DT, Fonsmark L, Poulsen A, Tien NM, Tuan HM, et al. Randomized comparison of oxygen mask treatment vs. nasal continuous positive airway pressure in dengue shock syndrome with acute respiratory failure. J Trop Pediatr 2002;48(6):335–9.

[8] Wang CC, Wu CC, Liu JW, Lin AS, Liu SF, Chung YH, et al. Chest radiographic presentation in patients with dengue hemorrhagic fever. Am J Trop Med Hyg 2007;77(2):291–6.

[9] Ma YJ, Song XY, Zhao SY. An experimental study on cause of reduction of platelets in dengue fever patients. China Trop Med 2008;8(11):1931–2.