

## Use of Chest X-Ray Examination as a Diagnostic Aid for Detection of Dengue Haemorrhagic Fever

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**ABSTRACT** The advantage of a chest X-ray in the RLD position in 15 children with DHF hospitalized at the paediatric ward of the Ternate General Hospital within the period of May-June-July 1990 and June-July 1991 were evaluated. Besides clinical and laboratory assessment to establish the diagnosis of DHF according to the WHO guidelines (1975), child and a haemagglutination-inhibition test was also done to confirm the diagnosis. Chest X-rays in the RLD position found a pleural effusion in 11 out of 15 patients with DHF especially in those with dengue shock syndrome. A positive serological test was always associated with the presence of PE (100%), while this could be shown in only 2 patients with negative test results. It may be concluded that the WHO criteria for the clinical diagnosis of DHF may be confirmed not only by the serological test but also by the presence of PE on chest film in the RLD position and therefore this examination may play an important role in establishing a diagnosis of DHF in a regency hospital. [*Paediatr Indones* 1995; 35:216-221]

### Introduction

Dengue hemorrhagic fever (DHF) is an acute infectious disease caused by the dengue virus, which is transmitted by the bites of the *Aedes* mosquitoes.<sup>1</sup> DHF is still a serious public health problem, because of its high mortality rate, its more widespread distribution and also because it involves mostly children.<sup>2</sup>

Increased vascular permeability which is a pathophysiological process in DHF, leads to plasma leakage into various serous cavities. This has been proven by the presence of fluid in the pleural, peritoneal, and pericardial cavities at autopsy. The amount of fluid found in the pleural cavity ranges from 25 ml to 900 ml.<sup>3,4</sup>

The presence of pleural effusion (PE) may be detected by chest X-ray examination in the supine and upright posteroanterior (PA) positions.<sup>4</sup> Tarau et al.<sup>5</sup>

found that the right lateral decubitus (RLD) position was significantly more sensitive than the PA position in detecting pleural effusion ( $p < 0.005$ ).

This study is aimed at evaluating the advantage of chest X-ray examination in the RLD position in detecting pleural effusion as an aid for establishing the diagnosis of DHF.

## Methods

A prospective study was carried out on all suspected DHF patients hospitalized in the pediatric ward of the Ternate General Hospital during the period of May, June, July, 1990 and June, July 1991. Patients data including name, age, sex, fever, hemorrhagic manifestations, hepatomegaly, shock symptoms, abdominal pain, signs of encephalopathy, platelet count, and increase of Ht values were recorded.

The clinical diagnosis of DHF was established based on the following guidelines by WHO (1975)<sup>3,6</sup>: (1) sudden continuous high fever lasting for 2-7 days, (2) presence of hemorrhagic manifestations such as positive tourniquet test or other forms of bleeding including petechiae, purpura, ecchymoses, gum bleeding, hematemesis and melena, (3) hepatomegaly, (4) shock or near shock (5) thrombocytopenia i.e., (platelet count 100,000/ $\mu$ l or less), and (6) hemoconcentration (hematocrit increased by 20% or more in the acute stage compared to the hematocrit during convalescence). The presence of the first two or three clinical criteria combined with thrombocytopenia and hemoconcentration is sufficient to establish the diagnosis of DHF. Additional criteria are

abdominal pain and signs of encephalopathy.<sup>3,6</sup>

The severity of DHF was classified according to the WHO grading (1975):

- Grade I: Fever accompanied by non-specific constitutional symptoms, and the only hemorrhagic manifestation is a positive tourniquet test.
- Grade II: Additional manifestations to those of grade I including spontaneous skin bleeding and or bleeding at any other sites.
- Grade III: Circulatory failure manifested by rapid and weak pulse, narrowing of pulse pressure or hypotension, cold and clammy skin, and restlessness.
- Grade IV: Profound shock with undetectable blood pressure and pulse.

DHF with shock (dengue shock syndrome) comprises grade III and IV, whereas those without shock belong to grades I and II.

Chest X-ray examination in the RLD position was performed on all patients immediately on admission and repeated prior to discharge from the hospital. Pleural effusion, as seen on X-ray film, is defined as pleural thickening (radioopaque silhouette) located between the chest wall and lung. The more the fluid, the thicker is the radio-opaque silhouette on the chest film.<sup>5,7</sup> The chest X-rays were evaluated by one of the authors.

Blood samples for the hemagglutination-inhibition tests (HI) were put on filter paper discs. The first blood sample was taken on admission during the acute stage and the second one during convalescence, before the patient was discharged. These blood samples were examined at the "Balai Laboratorium Kese-

hatan Manado".<sup>1</sup>

The serological test results were evaluated as follows:<sup>3</sup>

Antibody titer	Interpretation
Acute	Convalescence
< 1 : 20	> 4 x < 1: 2560 Primary infection
< 1 : 20	> 4 x > 2560 Second. infection
< 1 : 20	> 4 x Second. infection
> 1 : 1280	with or without greater antibody titer rise - infection Recent second.

Patients without radiological findings or serological test results were excluded from this study.

All of the data were statistically analyzed using the Chi-square test for comparison of distributions and the student's t-test for assessing the difference between the means. The level of significance was set at 0.05 for all tests.

### Results

During the period of May-June-July 1990 and June-July 1991, a total of 32 children with suspected DHF were hospitalized in the pediatric ward of Ternate General Hospital. Only fifteen cases (47%) were included in this study, comprising 8 boys and 7 girls. The age range was 2 to 13 years with a mean age of  $8.3 \pm 0.9$  years.

The presence of pleural effusion on chest X-ray were found in 11 patients with DHF (73%). (Table 1).

Table 1. Presence of pleural effusion and mean age of patients with DHF.

Pleural effusion	n	mean age (years)
Positive	11	$8.4 \pm 2.9$
Negative	4	$8.0 \pm 1.1$

Table 1 shows that the mean age of DHF patients with pleural effusion did not differ significantly from those without pleural effusion.

Table 2. Distribution of pleural effusion according to sex in patients with DHF

Pleural effusion	Boys	Girls	Total
	N	N	N
Positive	6	5	11
Negative	2	2	4
Total	8	7	15

$X^2 = 0.5676$   $p > 0.05$

There was no significant difference of sex distribution in patients with or without pleural effusion (Table 2).

Table 3 shows that pleural effusion was more frequent in dengue shock syndrome (67%) compared to those without shock (33%).

Sixty percent of patients with DHF had positive serological findings, as shown in Table 4.

Table 6 shows that all DHF patients with positive serological test also had pleural effusion (100%), whereas those with negative results only 33% showed evidence of pleural effusion in the right lateral decubitus position of the chest film. This difference is statistically signi-

ficant ( $p < 0.001$ ). In other words, a positive serological test indicates the presence of a pleural effusion while a negative result does not rule it out, which was evident from our two cases (33%). Therefore, pleural effusion can be used as a diagnostic aid in establishing the diagnosis of DHF.

Table 3. The frequency rate of pleural effusion according to the degree of DHF

Degree of DHF	n	Pleural effusion	
		n	n
DSS (-)	5	2	3
DSS (+)	10	9	1
Total	15	11	4

Table 4. Distribution of serological findings in patients with DHF

Serological findings	n
Boys	6
Positive	
- primary infection	1
- secondary infection	3
- recent secondary infection	5
Total	15

### Discussion

Our study reveals that the incidence of DHF was essentially similar in boys and in girls. A slight male preponderance was reported by Sunoto et al.<sup>8</sup> and Tarau et al.<sup>5</sup> who found a ratio of 1.34 : 1 and 1.4 : 1, respectively.

Table 5. Relationship between pleural effusion and serological test results

Pleural effusion	Serological results		
	Positive	Negative	Total
	n	n	n
Positive	9	2	11
Negative	0	4	4
Total	9	6	15

In a previous study, Tamaela and Karjomanggolo demonstrated the presence of pulmonary edema (100%) and pleural effusion (50%) on chest X-ray examination of patients with DHF in supine and upright antero-posterior position.<sup>4</sup> Sumarmo<sup>3</sup> also noted pleural effusion in 77% of cases with shock and 20% without shock while Tarau et al.<sup>5</sup> found pleural effusion in 56% of dengue shock syndrome cases and in 43% of DHF cases without shock. In this study pleural effusion was found in 67% of dengue shock syndrome cases and in 33% of DHF cases without shock.

It seems that pleural effusion (PE) may already be detected on chest X-ray film in patients without shock and the more severe the degree of DHF, the higher is the percentage of PE which may be demonstrated on chest X-ray. According to Meschan<sup>9</sup> as little as 100 ml of fluid should already be detected on chest X-ray film in the right lateral decubitus position, whereas 300 ml or more fluid is necessary to be evident on chest film in the supine and or upright posteroanterior position. This opinion was shared by Azis and Makaliwy<sup>7</sup> and Tarau et al.<sup>5,6</sup> as

a result of separate studies in Ujung Pandang.

In this study, the author demonstrated the presence of PE by means of chest X-ray examination in the right lateral decubitus position (Tables 2, 3, and 4) in 73% of cases with DHF which were confirmed by serological examination. It turns out that there was a significant relationship between the serological test results and the occurrence of PE, viz. patients with positive serological test also showed evidence PE on the chest film. Based on this relationship, we suggest that the WHO criteria for clinical diagnosis of DHF (1975) may be confirmed not only by serological examination but also by the presence of PE on chest X-ray in the RLD position.

Some previous studies<sup>4,5,7</sup> found that the presence of PE on chest X-ray film could be helpful in establishing an early diagnosis of DHF, especially in the clinical and laboratory findings were still doubtful. Aziz and Makaliwy<sup>7</sup> claimed that to establish the diagnosis of DHF, a chest X-ray in the RLD position to detect the presence of PE is sufficient and may save time, money, and man-power.

Subpulmonic PE can also be detected quite rapidly by ultrasonography.<sup>10</sup> However, an ultrasonograph is usually not available in a regency hospital setting and hence obtaining a chest X-ray in the RLD position is more feasible in establishing a diagnosis of DHF.

It is advisable to obtain a chest X-ray in the RLD position, where available, for every patients with suspected DHF in a regency hospital (RS Kabupaten), in order that a diagnosis can be established, without waiting for the serological test result,

and the disease can be managed as soon as possible, which may reduce the mortality rate. However is should be kept in mind that the absence of PE does not rule out the diagnosis of DHF.

### Conclusions

The following conclusions can be drawn from this study:

- PE occurred in 77% of patients with DHF, especially in those with dengue shock syndrome.
- There is a significant correlation between the presence of PE and the serological test result, viz. a positive serological test indicates the presence of PE.
- A chest X-ray in the RLD position can be an aid in establishing a diagnosis of DHF.

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