

Comparison of chest radiographic findings between severe fever with thrombocytopenia syndrome and scrub typhus

Single center observational cross-sectional study in South Korea

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Abstract

Severe fever with thrombocytopenia syndrome (SFTS) is an emerging infectious disease caused by SFTS virus (SFTSV) which involves multiple organ systems, including lungs. However, there is limited data on lung involvement of SFTS. Therefore, the present study investigated the chest radiographic findings of SFTS, including computed tomography (CT), and compared these with those of scrub typhus, which is the most common tick-borne illness in South Korea and share risk factors and occur in similar settings.

Medical records of patients with confirmed SFTS and scrub typhus in a tertiary hospital in Seoul (South Korea), between January 2014 and June 2018, were reviewed. Initial chest radiography and CT were reviewed by 2 experienced radiologists.

A total of 39 patients with SFTS and 101 patients with scrub typhus were analyzed. All patients except 3 patients with scrub typhus in both groups received chest radiography. Cardiomegaly (90%) and patchy consolidation with ground glass opacity (GGO) pattern (31%) were more common in SFTS group than scrub typhus group (20%, $P < .001$ and 2%, $P < .001$, respectively). About half of each group received chest CT. Consolidation (29%) and pericardial effusion (24%) were more common in SFTS group than scrub typhus group (6%, $P = .02$ and 4%, $P = .008$, respectively). Interstitial thickening in chest radiography (58%) and chest CT (65%) was more frequent in scrub typhus group than SFTS group (18%, $P < .001$ and 19%, $P < .001$, respectively).

Cardiomegaly with/without pericardial effusion and patchy consolidation with GGO pattern were more frequent in SFTS group, whereas interstitial thickening was more frequent in scrub typhus group. These findings will assist the early differentiation of SFTS from scrub typhus.

Abbreviations: aPTT = activated prothrombin time, CRP = C-reactive protein, CT = computed tomography, GGO = ground glass opacity, IFA = immunofluorescence assay, IgG = immunoglobulin G, LFT = liver function test, RT-PCR = reverse transcription-polymerase chain reaction, SFTS = severe fever with thrombocytopenia syndrome, SFTSV = severe fever with thrombocytopenia syndrome virus.

Keywords: chest radiographic findings, computed tomography, scrub typhus, severe fever with thrombocytopenia syndrome

1. Introduction

Severe fever with thrombocytopenia syndrome (SFTS) is an emerging infectious disease caused by novel bunyavirus, SFTS virus (SFTSV), which was first identified in China in 2011.^[1]

SFTS causes a characteristic clinical presentation which includes fever, thrombocytopenia, lymphadenopathy, bleeding tendency, vomiting, diarrhea, and multiple organ impairment.^[1–7] Patients present with symptoms ~4 to 15 days following exposure to

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SFTSV via a tick bite or exposure to body fluid of an infected individual. The mortality rate was reported to 6.3% to 30% in China,^[1,4,8] 31% in Japan,^[9] and 32.6% in Korea.^[10] In Korea, the incidence of laboratory-confirmed SFTS has increased annually since 2013. A total of 272 cases of laboratory-confirmed SFTS were reported in 2017.^[11] It shows seasonality from May to October and nationwide distribution.^[10] SFTSV involves multiple organs, including the liver, muscles, central nervous system, and lungs.^[1,12,13] It is reported that ~9.6% to 28.7% of patients with SFTS experience respiratory symptoms including cough, sputum, and dyspnea, and radiographic abnormalities are present in 29% to 45% of patients with SFTS.^[3,7,14–16] However, there is limited data regarding the detailed lung involvement of SFTS, including some case reports and a cohort study.^[3,6,17]

Scrub typhus is caused by *Orientia tsutsugamushi*, transmitted via chigger bite.^[18] In Korea, 5000 to 6000 cases were reported annually. The clinical features of scrub typhus are similar to those of SFTS, including fever, lymphadenopathy, and multiple organ impairment in severe cases.^[19] Some clinical features including eschar and rash were more common in scrub typhus than SFTS.^[14,16] Therefore, careful history taking and physical examination are important to differentiate between 2 diseases. However, these findings were also documented in some SFTS cases and absent in some scrub typhus cases.^[14,16,19] Furthermore, risky behavior and seasonality overlap between the 2 diseases. These similarities make it difficult to distinguish SFTS from scrub typhus. However, cause of the differences in treatment, prognosis, and infection control in terms of human-to-human transmission between 2 diseases, early differential diagnosis between SFTS and scrub typhus is important in patients with suspected tick-borne illness in South Korea. Therefore, comparison of laboratory and radiologic findings, which can be obtained immediately, were needed to differentiate SFTS from scrub typhus. There were efforts to distinguish SFTS from scrub typhus by laboratory findings including leukopenia, thrombocytopenia, and low C-reactive protein (CRP) in previous studies.^[14] However, there are few studies that compared the differences between radiologic findings of SFTS and scrub typhus.

In the present study, the characteristics of chest radiographic findings of SFTS, including chest computed tomography (CT) scan, were described and compared with those of scrub typhus, which is the most common tick-borne disease in South Korea.

2. Methods

2.1. Study population and clinical data

We performed a retrospective observational cross-sectional study including adult patients, aged ≥ 16 years, who were diagnosed with SFTS and scrub typhus at the Asan Medical Center in Seoul, South Korea, between January 2014 and June 2018. The patients' medical charts were reviewed retrospectively and the data of the baseline characteristics, clinical presentations, laboratory findings, treatments, and outcomes were collected. The study protocol was approved by the Institutional Review Board of Asan Medical Center (IRB No. 2016–0748).

2.2. Diagnostic tests

SFTS was diagnosed when the SFTSV was identified by reverse transcription-polymerase chain reaction (RT-PCR) analysis of plasma samples, using a DiaStar 2X OneStep RT-PCR Pre-Mix

kit (SolGent, Daejeon, South Korea), as described previously.^[16,18,20] The diagnosis of scrub typhus was confirmed according to the following criteria, as described previously^[16]: a single positive immunoglobulin G (IgG) result (titer $\geq 1:320$) or an >4 -fold increase in IgG titer between 2 consecutive samples. An immunofluorescence assay (IFA; SD Bioline Tsutsugamushi Assay; Standard Diagnostics) was used to measure antibody titer.^[21]

2.3. Radiologic data acquisition

The anteroposterior chest radiographs and posteroanterior and lateral projection radiographs were obtained using digital radiography equipment (GE Definium 8000, GE Healthcare and GC85A, Samsung Healthcare) with a standardized technique (90 kV, 5 mAs, and 72-in. film-focus distance for an anteroposterior view, broad tube focus; 120 kVp, 2 mAs, and a 72-in. film-focus distance for a posteroanterior radiograph). All the images were reviewed on a PACS (Picture Archiving and Communication System) viewer. Chest CT examinations were performed using 128-slice CT scanners (Somatom Definition AS+, Siemens Healthcare, Forchheim, Germany). The parameters were set to 120 kV, 100 mA with dose modulation. The reconstruction intervals included 3/5-mm thickness and 3/5-mm intervals without gaps using the B50 algorithm and 1-mm reconstruction with a 5-mm gap using the B60 algorithm. Iodine contrast material was administered for 16 of 21 CT examinations in patients with SFTS and 39 of 49 CT examinations in patients with scrub typhus. For chest CT scan with enhancement, 100 mL of intravenous iopromide 300 (300 mg/mL iodine) (Ultravist; Bayer Pharma, Berlin, Germany) was administered at a rate of 2.5 mL/s using a power injector with a fixed delay (50-second). All axial and coronal CT images were reviewed in the PACS viewer using mediastinal (width, 450 HU; level, 50 HU), lung (width, 1500 HU; level, 2700 HU), and bone (width, 1000 HU; level, 200 HU) window settings.

2.4. Chest radiography and chest CT analysis

Two chest radiologists, who had 19 and 8 years of experience, respectively, reviewed all chest radiographic images and CT examinations in consensus. On the chest radiography at the time of admission, the lung parenchyma was classified as normal or abnormal. The abnormalities were characterized further as patchy consolidation (opacification obscuring the underlying vessels) and ground glass opacity (GGO; increased attenuation without obscuring the underlying vessels) pattern, interstitial pattern, lobar consolidation pattern, and diffuse GGO pattern. Cardiomegaly was defined as a cardiothoracic ratio >0.5 on chest radiography or the size of the cardiac silhouette on chest radiography at the time of admission was higher than that on a previous chest radiograph or the size of the cardiac silhouette was decreased on the chest radiograph taken following improvement of the disease. The abnormalities on chest CT were characterized as consolidation, GGO, centrilobular nodules, nodules, and interstitial thickening as a per-segment basis (6 lobes in each patient, i.e., right upper lobe, right middle lobe, right lower lobe, left upper lobe, lingula segment, and left lower lobe). The anatomic distribution was characterized as unilateral or bilateral, and the lobe involvement was assessed. The presence of lymph node enlargement, pleural effusion, and pericardial effusion was recorded. Any additional lung findings were recorded.

2.5. Statistical analysis

SPSS version 21.0 (SPSS, Inc., Chicago, IL) was used to analyze data. Categorical variables were analyzed using the chi-squared test or Fisher exact test and continuous variables were analyzed using Student *t* test. All tests were 2-tailed and differences were considered significant at $P < .05$.

3. Results

3.1. Study populations

A total of 39 patients with SFTS and 101 patients with scrub typhus were analyzed in the present study. All patients with SFTS were confirmed by RT-PCR analysis. All patients with scrub typhus were confirmed by IFA, which was used to evaluation antibodies. Among patients with scrub typhus, 58 patients (57%) exhibited a rise in IgG titer >4-folds in paired samples and 43 patients (43%) had IgG titer >1:320 at initial test; 3 patients (3%) with 1:320, 9 patients (9%) with 1:640, and 33 patients (33%) with $\geq 1:1280$.

3.2. Baseline characteristics and clinical features

Table 1 shows the baseline characteristics between patients with SFTS and patients with scrub typhus. There were no significant differences in age, geographic distribution, or underlying diseases between the 2 groups. SFTS was more common in men (22 [56%]) and occurred more frequently in the spring–summer season (19 [49%]), between March and August, than scrub typhus (35 [35%], $P = .02$ and 5 [5%], $P < .001$, respectively). Patients with SFTS complained of general weakness ($P < .001$), gastrointestinal symptoms ($P = .006$), and central nervous system symptoms ($P < .001$) more frequently than scrub typhus patients did. Bleeding episodes, including epistaxis, bruising, petechiae, and gum bleeding, were observed in 6 (15%) of the patients with SFTS ($P < .001$). Respiratory symptoms, including a cough, sputum, and dyspnea, were similar between the 2 groups (9 [23%] in SFTS, vs 25 [25%] in scrub typhus, $P = .84$).

3.3. Laboratory findings, treatments, and outcomes

Tables 1 and 2 show comparison of laboratory findings, treatments, and outcomes between 2 groups. Leukopenia and thrombocytopenia were more common in the SFTS group than in the scrub typhus group ($P < .001$), and leukocytosis was more common in the scrub typhus group than in the SFTS group ($P < .001$). The proportion of patients with abnormal liver function tests (LFT) and renal function tests was similar between 2 groups. Increases in cardiac markers, including creatine kinase-muscle/brain and troponin-I, were more common in the SFTS group (10/31 [32%]) than in the scrub typhus group (5/39 [13%], $P = .049$). The levels of creatine kinase and lactate dehydrogenase were higher in the SFTS group than in the scrub typhus group ($P = .003$ and $P = .002$, respectively). A normal range of CRP and prolonged activated prothrombin time (aPTT) were observed more frequently in the SFTS group than in the scrub typhus group ($P = .001$ and $P < .001$, respectively).

The provision of care in an intensive care unit and use of a ventilator were more frequent in the SFTS group than in the scrub typhus group ($P < .001$). Mortality rate was higher in the SFTS group (18%) than in the scrub typhus group (1%, $P = .001$).

Table 1

Demographic findings, clinical features, and outcomes of patients with severe fever with thrombocytopenia syndrome (SFTS) and patients with scrub typhus.

Variables	SFTS (n = 39)	Scrub typhus (n = 101)	P value
Age, mean years \pm SD	61 \pm 10	64 \pm 13	.22
Gender, male	22 (56)	35 (35)	.02
Seasons, (months)			<.001
Spring–Summer (March–August)	19 (49)	5 (5)	
Autumn (September–November)	19 (49)	96 (95)	
Geographic distribution: Seoul metropolitan area	18 (46)	65/94 (69)	.09
Underlying disease	18 (46)	44 (44)	.78
Diabetes mellitus	9 (23)	14 (14)	.19
Cardiovascular and cerebrovascular disease	7 (18)	14 (14)	.54
Chronic lung disease	5 (13)	6 (6)	.18
Chronic renal disease	0	2 (2)	>.99
Chronic liver disease	1 (3)	9 (9)	.28
Autoimmune disease	3 (8)	3 (3)	.35
Solid tumor	2 (5)	16 (16)	.09
Hematologic malignancy	0	2 (2)	>.99
Transplant recipient	0	4 (4)	.58
Clinical features			
Fever	39 (100)	100 (99)	>.99
Febrile period, mean days \pm SD	4.4 \pm 4.5	2.5 \pm 1.6	.01
General weakness	28 (72)	35 (35)	<.001
Myalgia	20 (51)	37 (37)	.11
Bleeding	6 (15)	0	<.001
Respiratory symptoms	9 (23)	25 (25)	.84
Abdominal pain	7 (18)	21 (21)	.71
Nausea and vomiting	19 (49)	25 (25)	.006
Diarrhea	18 (46)	8 (8)	<.001
Headache	14 (36)	33 (33)	.72
Altered mentality	16 (41)	8 (8)	<.001
Skin rash	6 (20)	67 (66)	<.001
Eschar	10 (26)	75 (74)	<.001
Lymphadenopathy	10 (26)	15 (15)	.14
Treatment			
Doxycycline	28 (72)	98 (97)	<.001
Azithromycin	1 (3)	8 (8)	.44
Ribavirin	11 (28)	1 (1)	<.001
Plasmapheresis	18 (46)	1 (1)	<.001
Plasmatherapy	3 (8)	0	.02
Outcomes			
Intensive care unit care	15 (39)	9 (9)	<.001
Ventilator care	12 (31)	4 (4)	<.001
Mortality	7 (18)	1 (1)	.001

Data are no. (%) of patients, unless otherwise indicated.

SD = standard deviation, SFTS = severe fever with thrombocytopenia syndrome.

3.4. Radiologic findings

All of the patients with SFTS and 98 (97%) of the patients with scrub typhus underwent chest radiography. Time from symptoms onset to chest x-ray and time from admission to chest x-ray were comparable between 2 groups ($P = .12$ and $P = .80$, respectively) (Table 3). Anteroposterior portable bedside radiographs were obtained in 22 (56%) patients of SFTS group and in 55 (56%) patients of scrub typhus group and the remainders had posteroanterior projection radiographic images. The findings of chest radiography are summarized in Table 3 and shown in Figs. 1 and 2. In both groups, ~60% of patients presented with abnormal initial chest radiographic findings. Cardiomegaly was

Table 2**Laboratory findings of patients with severe fever with thrombocytopenia syndrome (SFTS) and patients with scrub typhus.**

Variables	SFTS (n = 39)	Scrub typhus (n = 101)	P value
Laboratory findings			
Leukocytosis (WBC >10,000/mm ³)	1 (3)	32 (32)	<.001
Leukopenia (WBC <4000/mm ³)	32 (82)	14 (14)	<.001
Hemoglobin, g/dL ± SD	13.8 ± 2.0	12.5 ± 1.7	<.001
Thrombocytopenia (platelets <150 × 10 ³ /mm ³)	38 (97)	64 (63)	<.001
Duration of thrombocytopenia, mean days ± SD	8.2 ± 6.2	2.5 ± 2.8	<.001
Abnormal LFT (AST or ALT >40 IU/L)	38 (97)	88 (87)	.11
Alkaline phosphatase, IU/L ± SD	122 ± 129	133 ± 93	.56
Total bilirubin, mg/dL ± SD	0.6 ± 0.6	0.8 ± 0.8	.10
Renal dysfunction (eGFR <60 mL/min/1.73 m ²)	11 (21)	24 (24)	.59
Increased cardiac marker (CK-MB >5 ng/mL or troponin-I >1.5 ng/mL)	10/31 [‡] (32)	5/39 [‡] (13)	.049
Rhabdomyolysis features			
Creatine kinase*, IU/L ± SD	2114 ± 3542	181 ± 434	.003
Lactate dehydrogenase†, IU/L ± SD	1298 ± 1507	479 ± 184	.002
Myoglobin, ng/dL ± SD	729 ± 1568	158 ± 166	.24
Normal C-reactive protein	30 (77)	6 (6)	.001
Prolonged prothrombin time	12 (31)	36/96 [‡] (38)	.46
Prolonged aPTT (aPTT >35 second)	34 (87)	23/93 [‡] (25)	<.001

Data are no. (%) of patients, unless otherwise indicated.

ALT = alanine aminotransferase, aPTT = activated partial thromboplastin time, AST = aspartate aminotransferase, CK-MB = creatine kinase-muscle/brain, eGFR = estimated glomerular filtration rate, LFT = liver function test, SD = standard deviation, SFTS = severe fever with thrombocytopenia syndrome, WBC = white blood cells.

* Results of creatine kinase were available in 35/39 patients with SFTS and 52/101 patients with scrub typhus.

† Results of lactate dehydrogenase were available in all of patients with SFTS and 93/101 patients with scrub typhus.

‡ No. of patients with a positive test result/number of patients tested.

the most common chest radiographic pattern of the SFTS group and was more common in the SFTS group (90%) than in the scrub typhus group (20%, $P < .001$).

Chest CT was performed in 21 (54%) patients of SFTS group and 49 (49%) patients of scrub typhus group. Time from symptoms onset to chest CT and time from admission to chest CT were comparable between 2 groups ($P = .07$ and $P = .27$, respectively) (Table 4). The CT findings are summarized in Table 4 and shown in Figs. 2 and 3. Lobar or segmental consolidation was the most common CT finding of the SFTS group (6/21 [29%]) and was more frequently observed in the SFTS group than in the scrub typhus group (3/49 [6%], $P = .02$). Most consolidation involved bilateral lungs (4/6 [67%]), and lower lobes (5/6 [83%]) (Supplement Table 1, <http://links.lww.com/MD/D361>).

4. Discussion

In the present study, SFTS was found to develop more frequently in men and during the spring-summer seasons than scrub typhus. Clinical features, including general weakness, bleeding, nausea and vomiting, diarrhea, and altered mentality were more common in patients with SFTS than in patients with scrub typhus. The rate of symptoms was similar to the previous studies.^[9,10,15] Skin rash and eschar were more common in patient with scrub typhus than in patients with SFTS. These findings were also compatible with the previous study.^[16] In laboratory findings, leukopenia, thrombocytopenia, increased cardiac marker, and prolonged aPTT were more frequent in SFTS patients than in scrub typhus patients. Neutropenia and thrombocytopenia were marked findings of SFTS and observed in most of SFTS patients in previous study.^[9,10,15] Normal

Table 3**Chest radiographic findings of patients with severe fever with thrombocytopenia syndrome (SFTS) and patients with scrub typhus.**

Findings	SFTS (n = 39)	Scrub typhus (n = 98)	P value
Time from symptoms onset to chest x-ray, days ± SD	8.5 ± 8.7	6.5 ± 4.7	.12
Time from admission to chest x-ray, days ± SD	0.5 ± 1.3	0.6 ± 1.4	.80
Abnormal chest x-ray findings	25 (64)	59 (60)	.67
Patch consolidation with GGO pattern	12 (31)	2 (2)	<.001
Interstitial pattern	7 (18)	57 (58)	<.001
Lobar consolidation pattern	4 (10)	0	.006
Diffuse ground glass opacity pattern	2 (5)	0	.08
Cardiomegaly	35 (90)	20 (20)	<.001

Data are no. (%) of patients, unless otherwise indicated.

GGO = ground glass opacity, SD = standard deviation, SFTS = severe fever with thrombocytopenia syndrome.

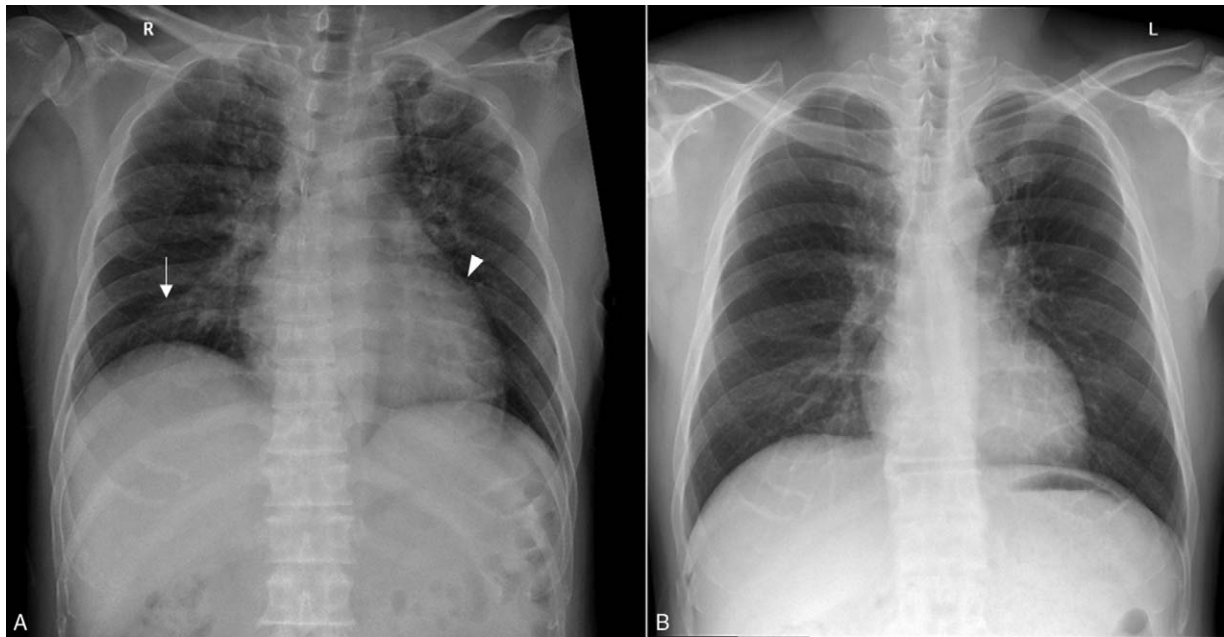


Figure 1. Chest radiography of a patient with severe fever with thrombocytopenia syndrome. A. Bilateral patchy consolidation with ground glass opacity in both upper lung zone (↓) and right lower lung zone are present. Cardiomegaly (▼) is also present. B. Following resolution of symptoms, the abnormal findings are no longer apparent.

range of CRP was more common in SFTS patients than in scrub typhus patients. Despite the differences in epidemiologic and clinical characteristics between the SFTS and scrub typhus groups, overlapping of seasonality and similarities in the risks of exposure^[9] and clinical presentations sometimes

make it difficult to distinguish SFTS from scrub typhus. So, rapid available conventional clinical tests may provide further clinical clues for the differentiation between 2 diseases. However, there are limited data on radiologic findings between 2 diseases.

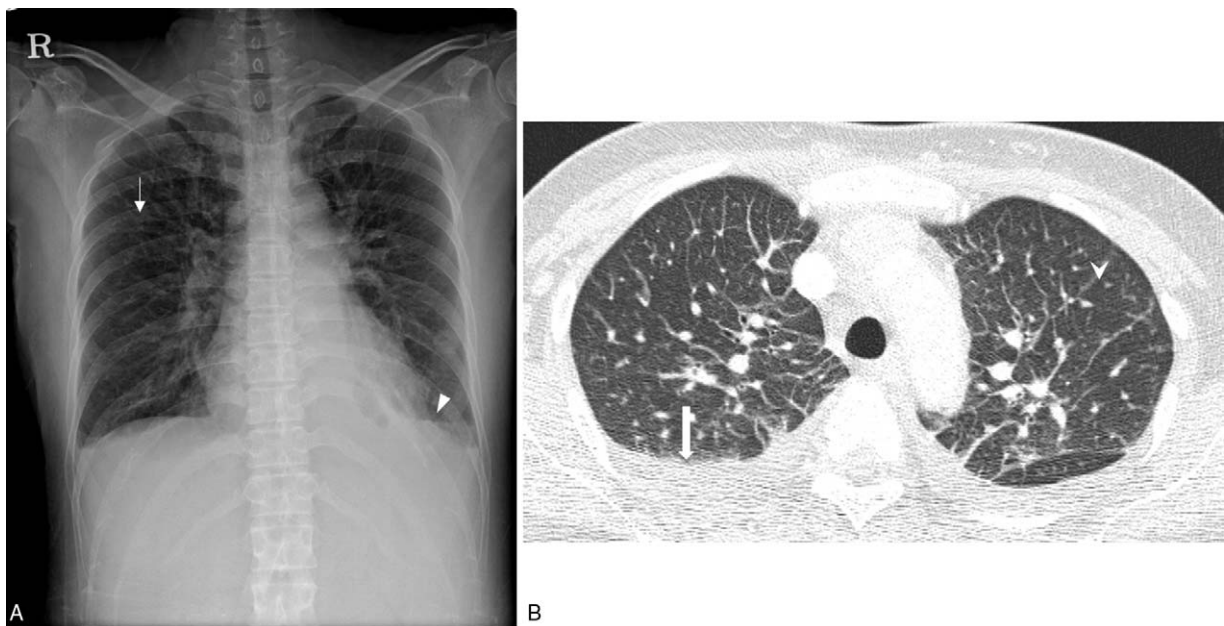


Figure 2. Chest radiography and CT of a patient with scrub typhus. A. Chest radiograph shows diffuse and mild interstitial thickening (↓) in the bilateral lungs. A small amount of bilateral pleural effusion (▼) is noted. B. Axial chest CT shows smooth interlobular septal line thickening (▼), axial interstitial thickening, and bilateral pleural effusion (↓). CT=computed tomography.

Table 4
Chest computed tomography (CT) findings of patients with scrub typhus and patients with severe fever with thrombocytopenia syndrome (SFTS).

Findings	SFTS (n=21)	Scrub typhus (n=49)	P value
Time from symptoms onset to chest CT, days \pm SD	9.5 \pm 10.5	6.8 \pm 5.0	.07
Time from admission to chest CT, days \pm SD	0.1 \pm 1.5	0.7 \pm 1.9	.27
Abnormal chest CT findings	13 (62)	35 (71)	.43
Consolidation	6 (29)	3 (6)	.02
Bilateral	4	2	
Ground glass opacity	3 (14)	2 (4)	.16
Bilateral	2	2	
Centrilobular nodule	1 (5)	0	.30
Bilateral	1		
Nodule	1 (5)	0	.30
Unilateral	1		
Interstitial thickening	4 (19)	32 (65)	<.001
Pleural effusion	8 (38)	22 (45)	.60
Bilateral	7	22	
Pericardial effusion	5 (24)	1 (4)	.008
Lymphadenopathy	5 (24)	21 (43)	.13
Mediastinal	3 (14)	4 (8)	.42
Extra-mediastinal	2 (10)	19 (39)	.021

Data are no. (%) of patients, unless otherwise indicated.

CT=computed tomography, SD=standard deviation, SFTS=severe fever with thrombocytopenia syndrome.

Of note, the majority (90%) of patients with SFTS presented with cardiomegaly on chest radiographs, and this was more common in the SFTS group compared with the scrub typhus group. However, only 25% of patients with SFTS who underwent chest CT presented with pericardial effusion and one-third of patients with SFTS had elevated cardiac enzymes (Table 2). Therefore, these findings are not sufficient to explain the remaining patients with SFTS with cardiomegaly. Further investigations on this area are required.

Patchy consolidation with GGO pattern was the most common chest radiographic pattern of lung involvement in the SFTS group and patchy consolidation was the most common CT finding in SFTS group. These radiologic findings are nonspecific and can be manifestations of several diseases, including bacterial or viral infection. However, these findings may be distinguished from the typical radiologic findings of scrub typhus. Typical chest CT findings of scrub typhus have been reported as interlobular septal thickening and lymphadenopathy.^[22,23] And the chest radiographic and CT findings of scrub typhus in the present study were consistent with those of previous reports. Therefore, the radiologic findings of SFTS may assist the physician to early differentiate SFTS from scrub typhus.

The proportion of patients with SFTS who had abnormal chest radiography, 64% in chest radiography and 62% in chest CT, was higher than in previous studies (29%–45%).^[3,16] Patchy shadowing was observed in 21/44 (48%) SFTS patients with abnormal chest radiography in a previous study.^[3] This finding is consistent with the present study which identified patchy consolidation with GGO in 12/25 (48%) SFTS patients with abnormal chest radiography. However, pleural effusion and pericardial effusion were more frequently observed in the present study (38% and 24%, respectively) than in the previous study (23% and 14%, respectively).^[3] This may be associated with differences in modalities, disease severity, and the experience of the thoracic radiologists.

The present study has some limitations. First, the study was performed retrospectively. There were missing data in laboratory findings, including cardiac markers. In total, ~50% of patients with SFTS and scrub typhus initially underwent chest CT scans because chest CT was performed to evaluate the other causes of fever in the patient with severe disease or abnormal chest x-ray, and/or no obvious fever focus. If the patients had typical clinical presentation of scrub typhus or SFTS, chest CT was not performed in patients with suspected SFTS and scrub typhus. Therefore, our estimates on abnormal chest CT findings might be overestimated. Although we did not access whether CT findings affected clinical decision in patients with suspected SFTS of scrub typhus, further studies are needed on the clinical impact of chest CT on the differential diagnosis of SFTS and scrub typhus, especially in patients who had atypical presentation of scrub typhus or SFTS. Second, the present study was conducted in a tertiary center in South Korea. So, some kind of selection bias toward more severe disease might occur. Third, although the majority of CT scans were performed in the emergency department, CT scans at heterogeneous clinical stages of patients with SFTS and scrub typhus were analyzed as hospital visits varied following symptom onset. Despite these limitations, to the best of our knowledge, the present study is the first to systemically evaluate the differences in chest radiography and chest CT findings between SFTS and scrub typhus, which are the most common tick-borne illness in South Korea.

5. Conclusions

Cardiomegaly with/without pericardial effusion, patchy consolidation with GGO pattern, and lobar consolidation were more frequent in patients with SFTS, whereas interstitial thickening was more frequent in patients with scrub typhus. These findings will assist in the early differentiation of SFTS from scrub typhus.

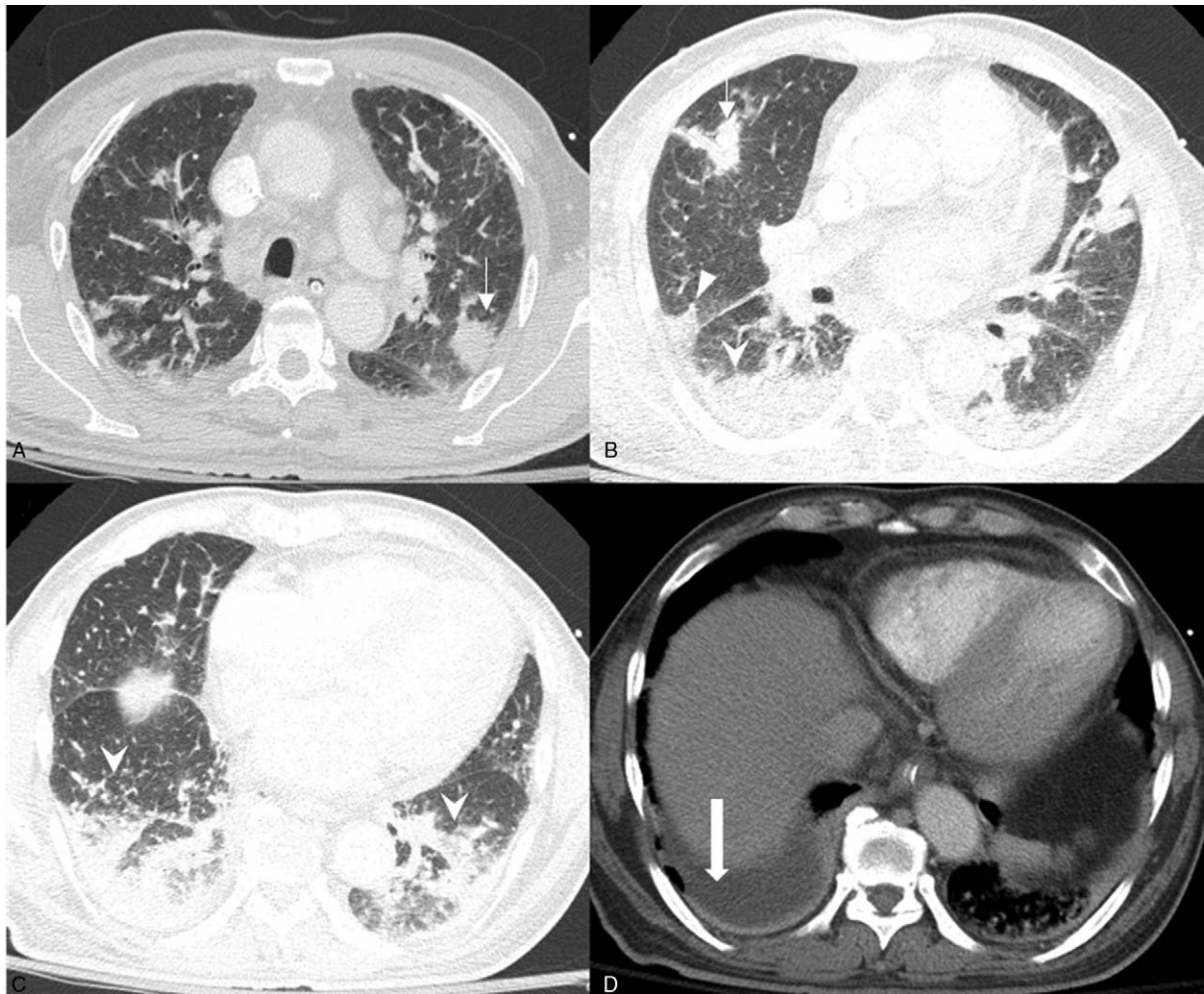


Figure 3. Chest CT of a patient with severe fever with thrombocytopenia syndrome. A. Multifocal patchy consolidations are present in both upper lobes (↓). B. Multifocal patchy consolidations are present in right upper, middle (▼), and both lower lobes. C. Multifocal patchy consolidations are present in both lower lobes (▼). D. A small amount of right pleural effusion (↓) is present, whereas no pericardial effusion is noted. CT = computed tomography.

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