INTRODUCTION

Mediastinal cystic teratoma is a rare diagnosis in adolescence from a low-income setting. Pleural effusion can often mislead infections and delay the resection. We report a case from a high burden tuberculosis country and analyze data from the literature. Clinical record of an adolescent patient from the Democratic Republic of Congo reported here and 53 records from other institutions identified via Medline from its inception to November 2017 were analyzed. We described demographic, clinicopathologic characteristics, and surgery outcomes and follow-up of patients. Of 54 cases, 59% were females (mean (SD) age: 26 (12) years) and mostly from high-income countries. Cough, shortness of breath, fever, and chest pain were mostly reported. Misdiagnosis was common, with periods between the onset of clinical manifestations to accurate diagnosis ranging from 1 week to 2 years. Our case was treated twice as tuberculosis. Duration of hospitalization varied from 4 days to 6 months and septic as well neurologic complications were frequently reported. With a follow-up period ranged from 1 week to 2 years, five percent of patients died after surgery and 26 percent relapsed. The present report expands the spectrum of our knowledge showing the scarcity of reported mediastinal cystic teratoma in low-income countries and that uncontrolled pleural effusion should help evoking the diagnosis.

A teratoma is defined as a type of germ cell tumor that may contain several different types of tissue such as hair, muscle, and bone. It may be immature or mature, based on how normal cells looked under a microscope; sometimes it is a mixture of both. They may occur in different parts depending on the sex (testicles, ovaries) or either in the chest, nervous system, or abdomen. They may be benign or malignant.1,2
Mediastinal teratomas are the most common extra-gonadal germ cell tumors. They account for approximately 15% of anterior mediastinal masses in adults and 25% in children and 50%-70% of mediastinal tumors. They may be symptomatic through different ways either by mass effect, endocrine function impaired or by rupture creating pleural effusion. The pleural effusion can often lead to a misdiagnosis of respiratory infections especially in low-income settings. We report on case of a cystic teratoma in a 15-year-old girl from a low-income setting treated twice as tuberculosis. We also performed a review on cystic mediastinal teratoma with pleural effusion in the literature. In addition to our patient, we reviewed. Fifty-three records from other institutions identified via Medline from inception to November 2017 that were well documented. Our review focused on analysis of clinical presentations, pathology findings, surgery procedures, and immediate and follow-up outcomes.

2 | METHODS

2.1 | Patients

All cases were identified through Medline from different institutions using predefined MeSh terms [mediastinal teratoma] OR [mature mediastinal teratoma] OR [mature teratoma] OR [immature teratoma] AND [pleural effusion] from database inception to November 2017 (Figure 1). Mediastinal teratoma was diagnosed by anatomo-pathologic findings after surgery resection or during medico-legal expertise. The records of 54 patients were used for clinical analysis. We excluded 10 patients from whom clinical details and surgery outcomes were not obtained through our search. From full-text articles, we extracted age of the patient at diagnosis, sex, country, first symptoms developed, type of surgery, anatomo-pathologic findings (mature/immature, benign/malignant, type of tissue found) as reported and patients' outcomes after surgery (death/relapse). The time to diagnosis was calculated from the first onset of respiratory symptoms and the confirmation of diagnosis through histological analysis after surgery resection or autopsy. Chest X-ray and CT examination were the major tools for establishing preoperative diagnosis. Descriptive analysis was essentially conducted for the report of the literature review. Categorical variables were expressed as proportions and continuous variables were expressed by means and standard deviations (±SD). Data were captured on a Microsoft Excel spreadsheet and exported to STATA version 14.1 (StataCorp LP, College Station, Texas 77 845 USA). Written consent was secured from our patient prior the study commenced.

![Flow Chart Diagram of literature search of cases presenting a mature teratoma with pleural effusion through Medline between May 2017 and November 2017](image-url)
3 | RESULTS

3.1 | Case report

3.1.1 | Patient presentation

A 15-year-old girl was transferred to our hospital with pleural effusion symptomatology along with respiratory distress (RD) which had occurred on multiple occasions. Her respiratory distress could have been relieved only by repetitive pleural tapping as much as 36 times for the last 3 years at the sequence of every 4 weeks before the actual transfer. She came from a rural setting in the East of DR Congo and resided in an informal settlement. Her medical history acknowledged that she was born healthy to nonconsanguineous parents, the sixth of eight healthy children. She apparently started developing the symptoms 3 years prior to the transfer with an increasing shortness of breath (SB) requiring medical assistance and incapacitated her to pursue studies and to accomplish ordinary activities. She had then been twice on 6 months of antituberculosis drugs first line regimen and had completed the treatment 6 months before the transfer. According to the medical report that accompanied the patient, she was treated for extra-pulmonary tuberculosis with negative microscopy in accordance with national recommendations after both smear and pleural fluid were negative for Zielh-Neelsen test and respiratory symptoms did not resolve after nonspecific antibiotic therapy. Of note, culture and GeneXpert testing could not have been conducted in the patient’s geographical area nor samples been sent elsewhere due to political instability. On examination, weight was 53.2 kg, blood pressure: 100/70 mm Hg, heart rate: 82/min, and respiratory rate: 22/min and 36.5°C. Our clinical assessment confirmed a woody note and a silent auscultation on the left thorax. The right thorax presented a normal vesicular breath sound. Hemoglobin was slightly low: 11 g/dL (range: 12-15) and both hepatitis C antibodies and hepatitis B surfaces antigen were nonreactive. The chest X-ray (Figure 2A) and the CT-Scan (Figure 2B) revealed a giant mediastinal mass with a collapsed left lung and consolidation. In brief, there was evidence of a large well defined complex cystic mass lesion involving antero-superior mediastinum and extending to left to occupy the entire left hemithorax. The lesion consists of solid component with fatty elements, calcic foci, and multiple loculated cystic areas.

FIGURE 2 Chest X-ray and CT Scan: a 15-y-old girl presenting with a large teratoma expressed by pleural effusion in South Kivu, Democratic Republic of Congo
| Title | Age | Sex | Country | Clinics at presentation \(^a\) | Pathology |
|-------|-----|-----|---------|-------------------------------|-----------|
| **Children under 1 y old** | | | | | |
| Agarwal A et al, 2017 (Agarwal et al 2018) | 28 wk GA | NS | NS | Large pericardial effusion | Encapsulated immature teratoma |
| Dorterler ME et al, 2016 (Dorterler, Boleken, and Koçarslan 2016) | 7 mo | F | NS | Persistent pulmonary infection and SOB exacerbated at rest | Benign mature teratoma |
| Gobbi D et al, 2007 (Gobbi et al 2007) | 31 wk GA | F | Italy | Sudden symptomatology: cardiorespiratory distress, diffuse edema, abdominal distension, and no heart murmur | Encapsulated, multilobulated, cystic soft immature teratoma |
| Grebille AG et al, 2003 (Grebille et al 2003) | 30 wk GA | F | France | Fetal hydrops | Pericardial teratoma |
| **Children and adolescents between 1 and 17 y old** | | | | | |
| Montebello A et al, 2017 (Montebello et al 2017) | 17 y | M | NS | SOB and pleuritic pain | Benign cystic teratoma |
| Tanupriya A et al, 2016 (Agrawal et al 2016) | 12 y | M | NS | Intermittent shoulder and chest pain | Mature mediastinal cystic teratoma with subtotal unidirectional pancreatic differentiation |
| Kuroda H et al, 2014 (Kuroda et al 2014) | 16 y | F | | Severe right chest pain and dyspnea | Mature cystic teratoma |
| Miyazawa M et al, 2012 (Miyazawa et al 2012) | 15 y | M | Japan | Sudden onset of left-sided severe chest pain and dyspnea | Cystic mature teratoma |
| Sarkar A et al, 2010 (Sarkar et al 2010) | 14 y | M | India | Heaviness of the left side of the chest side and SOB | Immature Teratoma |
| Kimura C et al, 2003 (Kimura et al 2003) | 17 y | F | Japan | Anterior chest pain | Mediastinal mature teratoma perforating into the lung |
| Matsubara K et al, 2001 (Matsubara et al n.d.) | 12 y | F | Japan | Severe chest pain and respiratory distress | Benign mediastinal cystic teratoma into the right pleural cavity |
| Matsubara K et al, 2001 (Matsubara et al n.d.) | 14 y | F | Japan | Severe chest pain and respiratory distress | Benign mediastinal cystic teratoma into the right pleural cavity |
| Krishnan S et al, 1983 (Krishnan et al n.d.) | 17 y | F | USA | Chest pain | Benign cystic teratoma with many Charcot-Leyden crystals |
| **Adults above 17 y old** | | | | | |
| Mohd Esa NY et al, 2016 (Mohd Esa et al 2016) | 41 y | M | NS | Cough, weight loss, appetite, intermittent fever, intermittent pleural effusions | Benign cystic teratoma |
| Acharya MN et a, 2016 (Acharya et al 2016) | 24 y | F | NS | Cough productive of green sputum, dyspnea, fever | Differentiated teratoma without malignant transformation (2.0 × 7.8 × 4.5-cm) |
| Time to diagnosis | Type of surgery | Hospitalization | Recovery time | Evolution |
|-------------------|-----------------|-----------------|---------------|-----------|
| 4 wk              | Pericardiocentesis and surgery resection (EXIT procedure) | NS              | NS            | NS        |
| 20 d              | Right posterolateral between 4 and 5 interthoracal thoracotomy | NS              | NS            | Good after 3 mo FU |
| 26 d              | Median sternotomy with resection of the mass | 3 wk            | 5 mo          | Good after 12 mo FU |
| 3 wk              | Thoracoamniotic shunting | 6 mo            | 15 d          | Good after 6 mo FU |
| 2 mo              | Thoracotomy and resection of the mass on the left after re-accumulation of the fluid previously drained | NS              | NS            | Good with no recurrence |
| NS                | Extensive resection | NS              | NS            | Good       |
| 2 y               | Thorascopy resection | 4 d            |               | Good after 6 mo FU |
| 5 mo              | Thoracotomy with combined partial resection of the left brachiocephalic vein and mediastinal pleura | NS              | NS            | Good on FU |
| 3 mo              | Left thoracotomy was performed and a large anterior mediastinal tumor removed | NS              | NS            | Loss to FU |
| NS                | Total resection of the tumor with adherent parts of the left lung | NS              | NS            | Good on FU |
| NS                | Thoracotomy       | NS              | NS            | Good on FU |
| NS                | Thoracotomy       | NS              | NS            | Good on FU |
| NS                | Surgery           | NS              | NS            | NS        |
| 1 y               | Thoracotomy and resection | NS              | Long          | Unusual bacterial infection of the thoracotomy wound |
| 2 mo              | Posterolateral right thoracotomy extended through the same intercostal space | 30 d            | 28 d          | Good after 3 mo FU |

(Continues)
| Title | Age | Sex | Country | Clinics at presentation | Pathology |
|-------|-----|-----|---------|-------------------------|-----------|
| Gautam M et al, 2016 (Mandal et al 2016) | 28 y | F | India | Progressive SOB, heaviness of chest and low-grade fever for last 1 mo | Mature cystic mediastinal teratoma with left sided pleural effusion |
| Liu CH et al, 2014 (Liu et al 2014) | 23 y | M | NS | History of fever, dyspnea, and right-sided chest pain | Mature cystic mediastinal teratoma complicated by superior vena cava syndrome, acute mediastinitis, and pleural effusion |
| Chow MB et al, 2014 (Chow and Lim 2014) | 24 y | F | China | Increasing SOB | Mature teratoma |
| Inoue Y et al, 2011 (Inoue et al 2011) | 29 y | M | NS | Gradually worsening vague pain in the left chest | Mediastinal mature |
| Machuca JS et al, 2010 (Machuca et al 2010) | 51 y | F | USA | Intermittent cough and precordial chest pain associated with SOB | Mature cystic teratoma |
| Yang CJ et al, 2007 (Yang et al 2007) | 45 y | F | Taiwan | No symptoms | Ruptured cystic teratoma |
| De Castro MA Jr et al, 2007 (de Castro et al n.d.) | 27 y | F | Brazil | Chest pain and progressive dyspnea | Benign mediastinal teratoma |
| Yuri T et al, 2006 (Yuri et al 2006) | 19 y | M | Japan | Fever and dyspnea | Mixed choriocarcinoma and mature teratoma |
| Yang WM et al, 2005 (Yang, Chen, and Lin n.d.) | 45 y | F | Taiwan | Chest pain and dyspnea after accident | Ruptured cystic mature teratoma |
| Mori T et al, 2005 (Mori et al 2005) | 20 y | F | Japan | Chest pain and palpitations | Mature teratoma |
| Kogure Y et al, 2005 (Kogure et al 2005) | 28 y | M | Japan | Sudden onset of chest pain | Mature mediastinal cystic teratoma |
| Kogure Y et al, 2005 (Kogure et al 2005) | 36 y | F | Japan | Sudden onset of chest pain | Mature teratoma |
| Popp G et al, 2003 (Popp and Dragnev 2003) | 27 y | M | USA | Progressive SOB | Mature teratoma, as well as pleural nodules with adenocarcinoma |
| Beduneau G et al, 2002 (Beduneau et al 2002) | 25 y | M | France | Chest pain, fever | Benign mature mediastinal teratoma |
| Nagata K et al, 2002 (Nagata et al 2002) | 27 y | M | Japan | Cough | Mature teratoma |
| Panicker JN et al, 2001 (Panicker et al 2001) | 26 y | F | India | Catamenial dry cough and wheeze | Mediastinal teratomatous cyst with luteinized ovarian tissue |
| Smahi M et al, 2000 (Smahi et al 2000) | 12 patients with mean 32 y | 7 F^5 M | France | Chest pain was present in 10 cases; cough, dyspnea, and septic episodes were present in 5 cases | Mature teratoma |
| Yamamoto T et al, 1999 (Yamamoto et al n.d.) | 27 y | M | Japan | NS | Immature teratoma |
| Ooshima M et al, 1999 (Ooshima et al 1999) | 23 y | M | Japan | Right-sided chest pain | Matured teratoma |
| Time to diagnosis | Type of surgery | Hospitalization | Recovery time | Evolution |
|-------------------|----------------|-----------------|--------------|-----------|
| 1 mo              | Left anterolateral thoracotomy with debulking of mediastinal mass | 37 d | 30 d | Good on regular FU |
| 6 d               | Urgent median sternotomy with resection | NS | NS | Good on FU |
| 4 mo              | Resection by thoracotomy | NS | NS | Good on FU |
| 7 d               | Median sternotomy necessitating partial resection of the left upper lobe with a stapler | 9 d | NS | Good after 2 y FU |
| 2 mo              | Left thoracotomy | NS | NS | Good after FU |
| 2 y               | Video-assisted thoracoscopic surgery | 8 d | | Good after 10 mo FU |
| NS                | Exploratory thoracotomy | NS | NS | Good after FU |
| 7 d               | Autopsy | 0 | NS | Died after acute respiratory failure |
| 11 d              | Left lateral thoracotomy | 1 d | 10 d | Good after FU |
| 1 mo              | Median sternotomy | 5 d | 5 d | Good after 23 mo FU |
| 3 wk              | Thoracotomy with resection | NS | NS | Good on FU |
| 17 d              | Thoracotomy with resection | NS | NS | Good on FU |
| NS                | Thoracotomy and excision | NS | NS | Good on FU |
| Several months    | Diagnostic mediastinotomy | NS | NS | Good on FU |
| NS                | Thoracotomy | NS | NS | Good on FU |
| NS                | Exploratory thoracotomy | NS | NS | Good on FU |
| NS                | Posterolateral thoracotomy in 11 cases and an anterior thoracotomy in one case, pneumonectomy in 1 case, basal segmentectomy in 1 case and thymectomy in 1 case. | NS | NS | Morbidity included 2 phrenic nerve palsies, 1 pyothorax after pneumonectomy, 1 case of bleeding and 1 pleural effusion. No recurrences have been observed 5 to 87 mo FU |
| NS                | Thoracotomy with resection | NS | NS | After 2 y of FU, transformation of teratoma into rhabdomyosarcoma in Klinefelter syndrome resulting in death |
| NS                | Thoracotomy with resection | NS | NS | Good on FU |
with intervening thick septae. In post–contrast scan, the solid component as well as the septae reveal definite enhancement. Few air loculi were seen within the mass lesion and many might have been related to previous diagnostic procedures. The lesion measured approximately 18.4 cm (SI) × 16.4 cm (AP) × 14.4 cm (Tr). There was partial atelectasis of the entire left lung, more so the lower lobe and seen compressed posteriorly. Mediastinum was shifted to the right side and lying lateral to the midline. However, mediastinal vessels were appeared normal as well as the right lung. No obvious focal lung lesion, septal thickening, or brochectatic changes were seen on the right side. A minimal left pleural reaction was noted.

### 3.1.2 | Surgical procedure

The surgery by left posterolateral thoracotomy noted a dense adhesion between the mass and the chest walls, pericardium and left lung. The left lower lung lobe was completely deflated and incarcerated by the mass with islands of epithelial tissue, hair, and calcified tissue. A total resection of the mass and decortication of the left lung were then conducted. Anatomopathological findings led to the diagnosis of a mediastinal mature cystic teratoma. The patient was then transferred to the intensive care unit for 3 days and required a prolonged stay in the wards due to the collapsed left lung. The latter required flexible bronchoscopy twice along with prolonged chest tube drained in situ. The chest tube was finally removed 15 days later after few trials of chest tube clamping followed by chest X-ray.

### 3.1.3 | Patient evolution

No other complication occurred during the intervention. With adequate antibiotics prescribed for 14 days along with planned physiotherapy exercises and diet restrictions, the patient did not present any late complications (infection, respiratory distress) or story of collapsed lung. The patient was then discharged with antalgic that she took for almost 3 weeks. She stays in the city within a benevolent family to avoid exposition to biomass fuel smoking and to reduce risk of pulmonary infections inherent to the rural area. After 5 years of follow-up, our patient did not complain about respiratory symptoms and she is now starting her first year at university.

### 3.2 | Review of 63 cases of mature teratoma with pleural effusion

Fifty-three cases were reported and analyzed from our search findings. 59% were females and mean (±SD) age was 26 (±12) years. Most of them come from high-income countries. Cough, shortness of breath, fever, and chest pain were mostly reported. Most cases were misdiagnosed with time to first clinical symptoms ranged from 1 week to 2 years. Further, our case was first treated twice as tuberculosis (different regimens). About 91% showed an immature aspect while 16% were malignant. Ovarian and pancreatic tissues were mostly retrieved as content. Duration of hospitalization varied from 4 days to 6 months and septic as well neurologic complications were mostly reported. With a follow-up period (of half

| Title                          | Age | Sex | Country | Clinics at presentation | Pathology                                                                 |
|-------------------------------|-----|-----|---------|-------------------------|--------------------------------------------------------------------------|
| Yamamoto N et al, 1996 (Yamamoto et al 1996) | 43 y | F   | Japan   | Sudden chest pain       | Mature cystic teratoma                                                   |
| Minami H et al, 1994 (Minami et al 1994)       | 50 y | F   | Japan   | Cough and chest pain, serum CA19-9 level was high (204.4 U/ml) | Mature teratoma                                                          |
| Suster S et al, 1994 (Suster, Moran, and Koss 1994) | Mean 23 y | 3 M and 1 F | USA | Cough, chest pain, dyspnea, and left-sided pleural effusion | Two cases of solid variant of alveolar rhabdomyosarcoma, one case of embryonal rhabdomyosarcoma and one of pleomorphic rhabdomyosarcoma |
| Hiraiwa T et al, 1991 (Hiraiwa et al 1991)      | 27 y | F   | Japan   | Chest pain               | Ruptured mediastinal cystic teratoma                                     |
| Yeoman LJ et al, 1990 (Yeoman, Dalton, and Adam n.d.) | 24 y | F   | UK      | Acute chest symptoms     | Mediastinal teratoma with fat fluid                                     |

Abbreviations: EXIT, ex utero intrapartum therapy; FU, follow-up; GA, gestational age; NS, not specified; SOB, shortness of breath.

* Presence of pleural effusion was mandatory for inclusion even if not cited.
of cases) ranged from 1 week to 2 years, roughly five percent of patients died after surgery and 26 percent relapsed (Table 1).

4 | DISCUSSION

To our knowledge, there has no previous review of literature reporting on mediastinal cystic teratoma with pleural effusion. We found that mature teratoma with pleural effusion presented a high proportion in female patients during their young adult life. However, the literature search demonstrates the occurrence of mature teratoma with pleural effusion in patients as young as at 25 weeks of gestation and as old as 51 years. Respiratory symptoms are predominant and not specific which has led often to a delay in the diagnosis for as long as 2 years. The majority of studies were reported in high-income countries. The requirement for the diagnosis to be made by CT scan and histopathology might explain the fact that such diagnosis is mostly reported in high-income countries. Tissues found in the tumor appeared mostly immature and of ovarian and pancreatic origin. Except for cases that presented complications, the duration of hospitalization was short with variable lengths of follow-up periods. Complications related to infections and metastases were reported in less than 10 cases. Relapses occurred for some cases and death was a rare outcome and was reported in 10 cases due to respiratory complications essentially.

The major strength of our study is the systematic search of literature and the number of cases reported. This will allow a more systematic assessment of the prevalence of the disease and could raise awareness among clinicians from low and middle-income countries. Our results have highlighted a substantial proportion of cases from low-income settings. Ascertainment misclassification following difficulties to diagnose mediastinal cystic teratoma might preside over the wrong impression of its rarity in poor settings. Regarding the high burden of respiratory infection diseases in such a region, clinicians might consider mediastinal tumors after an attempt to treat an infection disease not specified otherwise.

Although a systematic search of literature through Medline, among limitations of our study are the nonsystematic search of ≥3 databases and the exclusion of studies without full texts. Another limitation was related to the nature of the study that reported only on cases thus not representative of the populations from which the cases came from. However, the review has highlighted the need to consider such a differential diagnosis when assessing a patient with signs of pleural effusion especially in early childhood or young adult life.

5 | CONCLUSION

Not all is about tuberculosis in sub-Saharan Africa. We describe an original report of a giant mature cyst teratoma that required excision with left lung decortication in a young female Congolese after she has been treated twice as having pulmonary tuberculosis. This is the first documented case in the region. Diagnosis is difficult via noninvasive procedure, but clinicians should bear it in mind as a differential diagnosis to avoid delaying surgery.
ACKNOWLEDGMENTS
We would like to thank our patient and her family for their kind cooperation. We also thank the staff of the Provincial Hospital of Bukavu for their collaboration and support of the patient. The link for pre-print of the first version is https://www.authora.com/users/362738/articles/483801-mediastinal-cystic-teratoma-misdiagnosed-as-pleural-tuber-culosis-a-case-report-and-review-of-63-cases-revealed-by-pleural-effusion. PDMCK is supported by the US National Institute of Health (NIH)-Fogarty International Center (FIC) Postdoctoral Fellowship; Grant no. 1D43TW010937-01A1 and he is a CAWISA (Central and West Africa Implementation Science Alliance) Scholar. LB is Fellow of the African Paediatric Fellowship Programme (The AFP).

CONFLICT OF INTEREST
The authors declare that they have no competing interests.

AUTHORS’ CONTRIBUTION
LB: conceived and designed the study, supervised the patient follow-up, searched for reported cases, drafted the initial manuscript, and revised the manuscript after feedback. PDMCK: contributed to design the study, supervise patient care, collect the data, conceptualize the report, and review and revise the manuscript. All authors read and approved the final manuscript.

ETHICAL APPROVAL
Written informed consent was given by the patient and by her guardians for their clinical records to be used in this review.

CONSENT FOR PUBLICATION
We received written informed consent from the patient and from her guardians to publish the information in this review.

DATA AVAILABILITY STATEMENT
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

REFERENCES
1. Definition of teratoma - NCI Dictionary of Cancer Terms - National Cancer Institute. https://www.cancer.gov/publications/dictionaries/cancer-terms/def/teratoma. Accessed August 6, 2018
2. Mandal G, Bhattacharya S, Dey A, Kar S, Saha S. Mature cystic teratoma of mediastinum with pleural effusion: an uncommon entity. Niger Postgrad Med J. 2016;23(1):41-43. https://doi.org/10.4103/1117-1936.180183
3. Harms D, Zahn S, Göbel U, Schneider D. Pathology and molecular biology of teratomas in childhood and adolescence. Klinische Pädiatrie. 2006;218(6):296-302. https://doi.org/10.1055/s-2006-942271
4. Ueno T, Tanaka YO, Nagata M, et al. Spectrum of germ cell tumors: from head to toe. Radiographics. 2004;24(2):387-404. https://doi.org/10.1148/rg.242035082
5. Chen C, Zheng H, Jiang S. An unusual case of giant mediastinal teratoma with malignant transformation. Ann Thorac Surg. 2008;86(1):302-304. https://doi.org/10.1016/j.athoracsur.2007.07.087
6. Muscatello L, Giudice M, Feltli M. Malignant cervical teratoma: report of a case in a newborn. Eur Arch Otorhinolaryngol. 2005;262(11):899-904. https://doi.org/10.1007/s00405-005-0917-2
7. Travis WD, World Health Organization, International Agency for Research on Cancer, International Association for the Study of Lung Cancer, International Academy of Pathology. Pathology and Genetics of Tumours of the Lung, Pleura, Thymus, and Heart. IARC Press; 2004. https://patolog.com/who%20unge.pdf
8. Romagnani E. Mediastinal mature teratoma with an immature component—what about the treatment? Ann Oncol. 2006;17(10):1602-1604. https://doi.org/10.1093/annonc/mdl091
9. Tatsumura T, Yamamoto K, Tsuda M, Koyama S, Sugiyama S, Kimoto F. Pleural effusion due to rupture of benign cystic teratoma into left pleural cavity: a review of the Japanese literature. Nihon Kyobu Geka Gakkai Zasshi. 1984;32(11):2013-2020.
10. Krishnan S, Statsinger AL, Kleinman M, Bertoni MA, Sharma P. Eosinophilic pleural effusion with Charcot-Leyden crystals. Acta Cytol. 1983;27(5):529-532.
11. Hajdu SI, Nolan MA. Exfoliative cytology of malignant germ cell tumors. Acta Cytol. 1975;19(3):255-260.
12. Cobb Cj, Wynn J, Cobb SR, Duane GB. Cytologic findings in an effusion caused by rupture of a benign cystic teratoma into left pleural cavity: Acta Cytol. 1983;27(5):529-532.
13. Oppermann HC, Willich E. X-ray diagnosis and differential diagnosis of mediastinal tumors in childhood (author's transl). Der Radiologe. 1978;18(6):218-227.
14. Prabhakar G, Nigam BK, Williams WG. Benign mediastinal teratoma causing pericardial tamponade and pleural effusion. Eur J CardioThorac Surg. 1987;1(1):53-54.
15. Yeoman LJ, Dalton HR, Adam EJ. Fat-fluid level in pleural effusion as a complication of a mediastinal dermoid. CT characteristics. J Comput Assist Tomogr. 1990;14(2):307-309.
16. Hiraia T, Hayashi T, Kameda M, et al. Rupture of a benign mediastinal teratoma into the right pleural cavity. Ann Thorac Surg. 1991;51(1):110-112.
17. Suster S, Moran CA, Koss MN. Rhabdomyosarcomas of the anterior mediastinum: report of four cases unassociated with germ cell, teratomatous, or thymic carcinomatous components. Hum Pathol. 1994;25(4):349-356.
18. Yamamoto N, Imai S, Motohiro K, et al. A case of benign cystic teratoma growing in the thoracic cavity. Kyobu Geka. 1996;49(4):341-343.
19. Minami H, Itoyanagi N, Kubota F, Nakamura Y. A case of mediastinal mature teratoma presenting increased serum CA19-9 level. Nihon Kyobu Geka Gakkai Zasshi. 1994;42(11):2139-2143.
20. Choi SJ, Lee JS, Song KS, Lim TH. Mediastinal teratoma: CT differentiation of ruptured and unruptured tumors. AJR Am J Roentgenol. 1998;171(3):591-594. https://doi.org/10.2214/ajr.171.3.9725279
21. Robinson LA, Rikkers LF, Dobson JR. Benign mediastinal teratoma masquerading as a large multiloculated effusion. *Ann Thorac Surg.* 1994;58(2):545-548.

22. Yamamoto T, Tamura J, Orima S, et al. Rhabdomyosarcoma in a patient with mosaic klinefelter syndrome and transformation of immature teratoma. *J Int Med Res.* 1999;27(4):196-200. https://doi.org/10.1177/030006059902700407

23. Ooshima M, Takahasi T, Matsumoto H, et al. Matured mediastinal teratoma with a giant cyst resembling pleural effusion on X-ray films. *Nihon Kokyuki Gakkai Zasshi.* 1999;37(6):509-513.

24. Smahi M, Achir A, Chafik A, al Aziz AS, el Messlout A, Boubaker M. Mediastinal mature teratoma complicated by hydrops: successful fetal therapy by thoracoamniotic shunting. *Prenat Diagn.* 2003;23(9):735-739. https://doi.org/10.1002/pd.698

25. Matsubara K, Aoki M, Okumura N, et al. Spontaneous rupture of mediastinal cystic teratoma into the pleural cavity: report of two cases and review of the literature. *Pediatr Hematol Oncol.* 2001;18(3):221-227. https://doi.org/10.1080/08880010151114921

26. Panicker JN, Jothy Dev K, Sandhyamani S, et al. Teratoma masquerading as catamenial pleural effusion. *J Assoc Physicians India.* 2001;49:576-578.

27. Beduneau G, Cuvelier A, Héliot P, Métayer J, Muir JF. Mediastinal teratoma with recurrent encysted pleural effusion. *Rev Mal Respir.* 2002;19(3):367-370.

28. Nagata K, Iwasaki Y, Nakamishi M, et al. A case of mediastinal teratoma with elevated serum tumor marker levels. *Nihon Kokyuki Gakkai Zasshi.* 2002;40(1):50-54.

29. Kimura C, Kamiyoshihara M, Sakata K, Itoh H, Morishita Y. Mediastinal mature teratoma perforating into the lung with elevated serum carbohydrate antigen 19–9 (CA19-9) levels; report of a case. *Kyobu Geka.* 2003;56(3):247-250.

30. Grebille AG, Mitanchez D, Benachi A, et al. Pericardial teratoma complicated by hydrops: successful fetal therapy by thoracoamniotic shunting. *Prenat Diagn.* 2003;23(9):735-739. https://doi.org/10.1002/pd.698

31. Popp G, Dragnev K. Secondary malignant transformation of a primary mediastinal germ cell tumor with diffuse lymphangitic spread to the lungs. *South Med J.* 2003;96(7):696-698. https://doi.org/10.1097/01.SMJ.0000052064.60558.9A

32. Yuri T, Shiman N, Ohashi Y, Miki K, Tsukamoto R, Tsubura A. An autopsy case of primary mixed chorioncarcinoma and mature teratoma located in the thymic region associated with elevated human chorionic gonadotropin levels and characteristic testicular changes. *Med Mol Morphol.* 2006;39(1):49-53. https://doi.org/10.1007/s00795-006-0305-z

33. Mori T, Yoshioka M, Kadooka Y, Kobayashi H, Iwataki N, Yoshimoto K. Mature teratoma combined with schizophrenia: report of a case. *Kyobu Geka.* 2005;58(13):1166-1168.

34. Yang W-M, Chen M-L, Lin T-S. Traumatic hemothorax resulting from rupture of mediastinal teratoma: a case report. *Int Surg.* 2005;90(4):241-244.

35. Kogure Y, Kamimura M, Nomura T, et al. Two cases of mature mediastinal teratoma complaining of sudden chest pain. *Nihon Kokyuki Gakkai Zasshi.* 2005;43(6):365-369.

36. Okagawa T, Uchida T, Suyama M. Thymoma with spontaneous regression and disappearance of pleural effusion. *Gen Thorac Cardiovasc Surg.* 2007;55(12):515-517. https://doi.org/10.1007/s11748-007-0180-0

37. Gobbi D, Rubino M, Chiandebiti L, Zanon GF, Cecchetto G. Neonatal intrapericardial teratoma: a challenge for the pediatric surgeon. *J Pediatr Surg.* 2007;42(1):E3-E6. https://doi.org/10.1016/j.pedsurg.2006.11.002

38. de Castro MAM, Rosenberg NP, de Castro MAM, de Castro AP, Wietzycoscki C, Mespique C. Mediastinal teratoma mimicking pleural effusion on chest X-rays. *J Bras Pneumol.* 2007;33(1):113-115.

39. Herberg U, Berg C, Knöpfle G, et al. Intraparacardiac teratoma in the newborn—3D-echocardiography and course of disease. *Ultraschall Med.* 2006;27(6):577-581. https://doi.org/10.1055/s-2005-858039

40. Avasthi R, Chaudhary SC,Mohanty D, Mishra K. Testicular mixed germ cell tumor metastasizing to heart. *J Assoc Physicians India.* 2008;56:812-815.

41. Yang C-J, Cheng Y-J, Kang W-Y, Huang M-S, Hwang J-I. A case of dermoid cyst ruptured into the lung. *Respirology (Carlton, Vic.)* 2007;12(6):931-933. https://doi.org/10.1111/j.1440-1843.2007.01162.x

42. Sarkar A, Roy PP, Dey SK, et al. Mediastinal teratoma mimicking massive pleural effusion. *J Assoc Physicians India.* 2010;58:453-455.

43. Rowe PG, Roden AC, Corl FM, et al. Minimally invasive thymectomy: the mayo clinic experience. *Ann Cardiothorac Surg.* 2015;4(6):519-526. https://doi.org/10.3978/j.issn.2225-319X.2015.07.03

44. Das SK, Bhattacharyya TD, Bhattacharyya S, Goswami BK. Medical image. Rupture of a benign mediastinal teratoma into left pleural space. *N Z Med J.* 2011;124(1331):91-92.

45. Suzuki H, Koh E, Hoshino I, Kishi H, Saitoh Y. Mediastinal teratoma complicated with acute mediastinitis. *Gen Thorac Cardiovasc Surg.* 2010;58(2):105-108. https://doi.org/10.1007/s11748-009-0487-0

46. Machuca JS, Tejwani D, Niazi M, Diaz-Fuentes G. A large ruptured mediastinal cystic teratoma. *J Bronchol Interv Pulmonol.* 2010;17(3):269-272. https://doi.org/10.1097/LBR.0b013e3181e77872

47. Tian L, Liu L-Z, Cui C-Y, Zhang W-D, Kuang Y-L. CT findings of primary non-teratomatous germ cell tumors of the mediastinum—a report of 15 cases. *Eur J Radiol.* 2012;81(5):1057-1061. https://doi.org/10.1016/j.ejrad.2011.02.005

48. Inoue Y, Suga A, Yamada S, Iwashaki M. A ruptured mature teratoma in which follow-up computed tomography observation at short intervals was useful for a definitive diagnosis. *Interact Cardiovasc Thorac Surg.* 2011;12(6):1074-1076. https://doi.org/10.1510/icvts.2010.263798

49. Miyazawa M, Yoshida K, Komatsu K, Kobayashi N, Haba Y. Mediastinal mature teratoma with rupture into pleural cavity due to blunt trauma. *Ann Thorac Surg.* 2012;93(3):990-992. https://doi.org/10.1016/j.athoracsur.2011.08.022

50. Kim J-Y, Lee C-H, Park W-Y, et al. Adenocarcinoma with sarcomatous dedifferentiation arising from mature cystic teratoma of the anterior mediastinum. *Pathol Res Pract.* 2012;208(12):741-745. https://doi.org/10.1016/j.prrp.2012.09.005

51. Ben CM, Lim TC. Massive mediastinal teratoma mimicking a pleural effusion on computed tomography. *Singapore Med J.* 2014;55(5):e67-e68. https://doi.org/10.11622/smedj.2013211

52. Mayeur D, Akkad R, Cornelius A, Benadoud S, Porte H. Chamberlain biopsy is not necessary when mature teratoma is evident on imaging. *Rev Mal Respir.* 2014;31(1):57-60. https://doi.org/10.1510/rmr.2013.04.027

53. Kuroda H, Hashidume T, Shimamouchi M, Sakao Y. Resection of a ruptured mature cystic teratoma diagnosed two years after the
onset of perforation. World J Surg Oncol. 2014;12(1):321. https://doi.org/10.1186/1477-7819-12-321

54. Liu C-H, Peng Y-J, Wang H-H, Cheng Y-L, Chen C-W. Spontaneous rupture of a cystic mediastinal teratoma complicated by superior vena cava syndrome. Ann Thorac Surg. 2014;97(2):689-691. https://doi.org/10.1016/j.athoracsur.2013.06.112

55. Agrawal T, Blau AJ, Chwals WJ, Tischler AS. A unique case of mediastinal teratoma with mature pancreatic tissue, nesidioblastosis, and aberrant islet differentiation: a case report and literature review. Endocr Pathol. 2016;27(1):21-24. https://doi.org/10.1007/s12022-015-9393-4

56. Dorterler ME, Boleken ME, Koçarslan S. A giant mature cystic teratoma mimicking a pleural effusion. Case Rep Surg. 2016;2016:1259175. https://doi.org/10.1155/2016/1259175

57. Mohd Esa NY, Mohd Radzi AA, Bakar NS, Mohd Khalid MS, Ismail AI, Abdul Rani MF. Cystic teratoma mimicking recurrent pleural effusion, complicated by Mycobacterium abscess infection. Respirol Case Rep. 2016;4(3):e00155. https://doi.org/10.1002/rcr2.155

58. Acharya MN, De Robertis F, Popov A-F, Anastasiou N. Surgical resection of a huge ruptured mature mediastinal teratoma. Asian Cardiovasc Thorac Ann. 2016;24(7):726-728. https://doi.org/10.1177/0218492316658847

59. Montebello A, Mizzi A, Cassar PJ, Cassar K. Benign cystic mediastinal teratoma presenting as a massive pleural effusion in a 17-year-old boy. BMJ Case Rep. 2017;2017:bcr2016217439. https://doi.org/10.1136/bcr-2016-217439

60. Agarwal A, Rosenkranz E, Yasin S, Swaminathan S. EXIT procedure for fetal mediastinal teratoma with large pericardial effusion: a case report with review of literature. J Matern Fetal Neonat Med. 2018;31(8):1099-1103. https://doi.org/10.1080/14767058.2017.1306851

61. Basu Chaudhuri SK, Chakravorty BK. Malignant mediastinal teratoma. Indian J Chest Dis. 1968;10(3):161-164.

How to cite this article: Katoto PDMC, Byamungu LN. Mediastinal cystic teratoma misdiagnosed as pleural tuberculosis: A case report and review of 53 cases revealed by pleural effusion. Clin Case Rep. 2021;9:e04139. https://doi.org/10.1002/ccr3.4139