COMPUTED TOMOGRAPHY IMAGING PRESENTATION IN THORACIC HYDATID CYSTS

Sonja Nikolova
Institute of Radiology, Faculty of Medicine, University "Ss. Cyril and Methodius", Skopje, North Macedonia, sonikmk@gmail.com

Abstract: Hydatid cysts are widespread zoonosis that originate from the larval embodiment of the Echinococcus and can be frequently found in the lung and liver parenchyma, in addition, they emerge in various atypical locations in the thoracic cavity such as the mediastinum, its vascular compounds and the heart, the interlobar fissures, the pleural and pericardial space, as well as the structures of the chest wall and the diaphragm. Computed tomography as one of the most utilized instruments of radiology imaging has a crucial role in the diagnosis of hydatid cysts, depiction of their exact size and location, as well as estimation of impending complications.
The aim of this pictorial review is to offer full scale understanding of the recurrent imaging findings in thoracic hydatid disease as well as to display some rare, extra parenchymal involvement and a summary of the complications and differential diagnosis.
We did an in depth analysis of 55 chest CT scans of patients with thoracic hydatid cysts from North Macedonia and all patients underwent a contrast enhanced chest CT according to appropriate diagnostic protocol on a 16- slice Somatom GO computed tomograph (Siemens Healthineers, USA).
Hydatid cysts in all 55 patients were divided by location and appearance in two by two categories, uncomplicated parenchymal and extra parenchymal, and complicated or ruptured parenchymal and extra parenchymal cysts. Uncomplicated parenchymal hydatid cysts were presented by well circumscribed, low attenuating, homogenous lesions with smooth walls of varying thickness, whereas complicated or ruptured hydatid cysts could be categorized in two forms, contained or complete rupture. The most frequent imaging findings were the air crescent sign, waterlily sign and dry cyst sign. Uncommon extra parenchymal hydatid cysts' locations were the mediastinum, pericardium and the diaphragm.
Computed tomography plays an important diagnostic role in common thoracic hydatid cysts and aids in the evaluation of rare and complicated cases.
Keywords: hydatid cysts, Echinococcus, lung parenchyma, multidetector computed tomography (MDCT), extra parenchymal

1. INTRODUCTION

Hydatid cysts (HC) are omnipresent zoonosis that most frequently originate from the larval embodiment of the Echinococcus granulosus (EG). Less common but more aggressive strain is the Echinoccocus multilocularis (1, 2). The disease echinococcosis has been mentioned over a period of 2000 years, but the term "hydatid" was derived from a Greek word meaning a watery vesicle, and was only introduced by Rudoplhy in 1808 (3, 4, 5). The hydatid disease is endemic in countries that breed sheep, such as the Meditherranean, Australia, New Zealand, The Middle East, Africa and South America (6, 7, 8).
Despite the fact that in adult population they exhibit predilection for the liver parenchyma (75%), hydatid larvae may also hematogenously spread to the lung parenchyma, which is the most common site, especially in children, and in addition, they can rarely emerge in various atypical locations inside the thoracic cavity such as the anterior mediastinal space, middle mediastinal vascular compounds and the heart, the interlobar fissures, the pleural and pericardial space, as well as the extra thoracic structures presented by the chest wall and the diaphragm (9, 10). Hydatid cysts can involve any organ except the integumentary system.
The majority of liver and thoracic hydatid cysts have established features by means of location, size, shape and number, so simpler imaging modules such as ultrasound and conventional xray may aid the final diagnosis. In cases of atypically located or extensive hydatid cysts that are more prone to complications, the computed tomography imaging is the diagnostic method of choice, and magnetic resonance imaging can contribute in certain cases, especially mediastinal or chest wall cysts. Computed tomography as one of the most utilized instruments of radiology imaging has a crucial role in the diagnosis of hydatid cysts, depiction of their exact size and location, as well as estimation of impending complications (2, 11).
Nearly all of the hydatid cysts with a predilection to the lungs emerge in childhood and are usually diagnosed incidentally on routine chest x rays because of their tendency to be asymptomatic and dormant for long periods of time (12). Chest pain, dyspnea and coughing are common symptoms with larger hydatid cysts and are usually provoked by the mass effect on the surrounding lung tissue, whereas complicated or ruptured cysts can also cause

hemoptysis, anaphylactic reactions or expectoration of the membranes or hydatid sand which has been described in almost one third of the cases (13- 18). There are several frequent complications that transpire in half of the patients and they are cyst rupture which can be contained or direct communicating, as well as seeding and infection. Complicated hydatid cysts that present with detachment of the outermost layer or pericyst from the inner layer or endocyst, are classified as contained ruptures, and direct or communicating are those in which the cyst content, membranes and hydatid sand, are expectorated into the airways through a draining bronchus (19, 20, 21).
The aim of this pictorial review is to offer full scale understanding of the recurrent imaging findings in thoracic hydatid disease as well as to display some rare, extra parenchymal involvement and a summary of the complications and differential diagnosis.

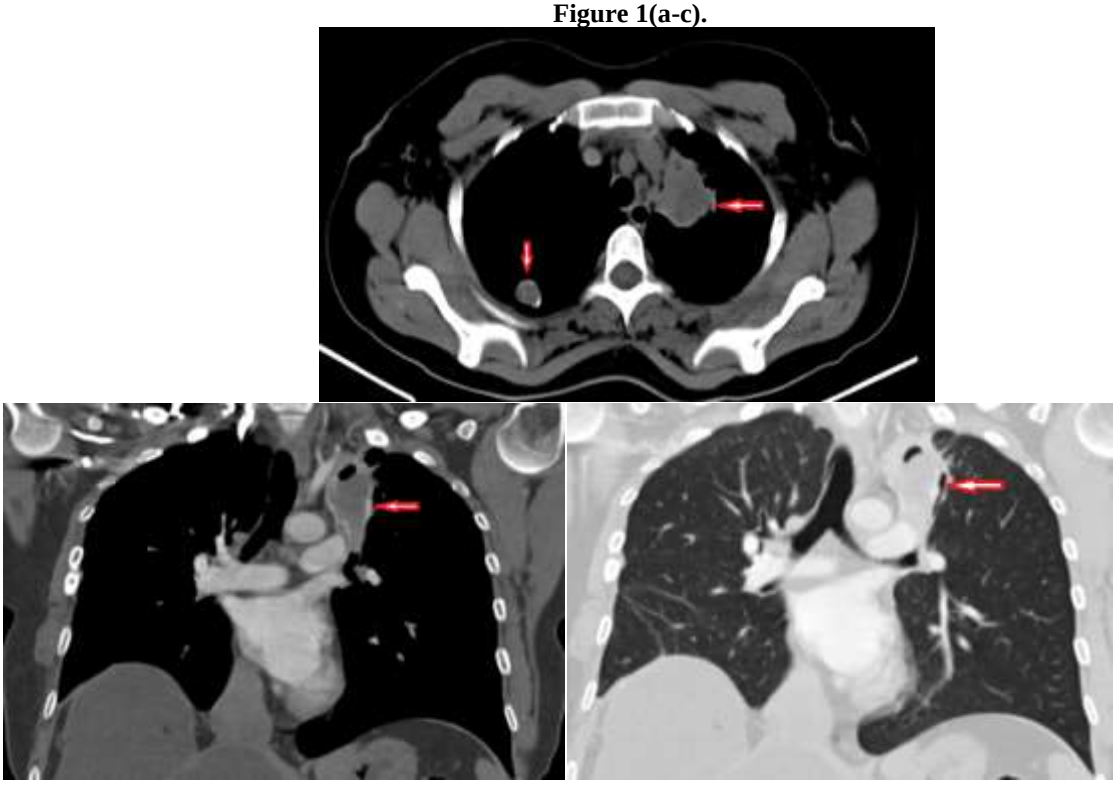
2. MATERIALS AND METHODS

Non enhanced CT is usually applied for the evaluation of majority of typically located lung parenchymal cysts, whereas contrast enhanced CT plays a major role in the diagnosis of extra thoracic hydatid cysts, especially those who are found in the mediastinal space.
We did an in depth analysis of 55 chest CT scans of patients with thoracic hydatid cysts from North Macedonia and all patients underwent a contrast enhanced chest CT according to appropriate diagnostic protocol on a 16- slice Somatom GO computed tomograph (Siemens Healthineers, USA). Scans were acquired with the patients on the table in a supine position, arms overhead and with a single breath hold during the scan time. A power injector was used for the introduction of the iodinated contrast agent into a cubital vein, and an early arterial and delayed venous phase were performed in a craniocaudal direction from the base of the neck to the upper abdomen. The CT parameters were 100 mAs, 120 kVp, rotation time 0.25s, and collimation of 192 × 0.6mm with a pitch of 2.5. Images were obtained in an axial plane with the possibility of post processing and multi planar reconstruction. All 55 CT scans were thoroughly evaluated by a radiologist with a subspecialty in thoracic and vascular radiology and features such as location, shape, size and signs of complications, as well as the most common differential diagnoses of the hydatid cysts were summarized.

3. RESULTS

After the liver, lungs are considered second most frequent location for hydatid cysts in adults. The most common areas involved are the lower lobes (60% of patients), especially the right lower lobe, and the disease is bilateral in almost 20% of cases (22, 23). Computed tomography is a diagnostic module of choice although the conventional x-ray can offer enough diagnostic information in cases with simple hydatid lung cysts, while the ultrasound can aid to the diagnosis of pleural based lesions as well as evaluation of pleural complications such as pleural seeding or empyema.
Hydatid cysts in all 55 patients were divided by location and appearance in two by two categories, uncomplicated parenchymal and extra parenchymal, and complicated or ruptured parenchymal and extra parenchymal cysts. 35 patients (64%) were diagnosed with either solitary or multiple parenchymal hydatid cysts without signs of complication or impending rupture. 10 patients, all children, had concomitant multiple liver cysts. The remaining 20 patients (36%) had complicated parenchymal and atypically located hydatid cysts.
On conventional chest x- ray, uncomplicated hydatid cysts resemble canon ball on the AP projection or rugby ball on the lateral, while on computed tomography they are usually oval shaped, well defined lesions of varying size, with smooth and hyperattenuatiing walls and a homogenous intracystic fluid attenuation. When in the lung parenchyma, they rarely present with daughter cysts or rim calcification. These unremarkable CT features make it impossible to differentiate them from other lung cysts like the bronchogenic, esophageal duplication cysts, and others (Figure 1, a- c). In comparison liver hydatid cysts may present with rim calcification and daughter cyst formation (Figure 2 a, b).

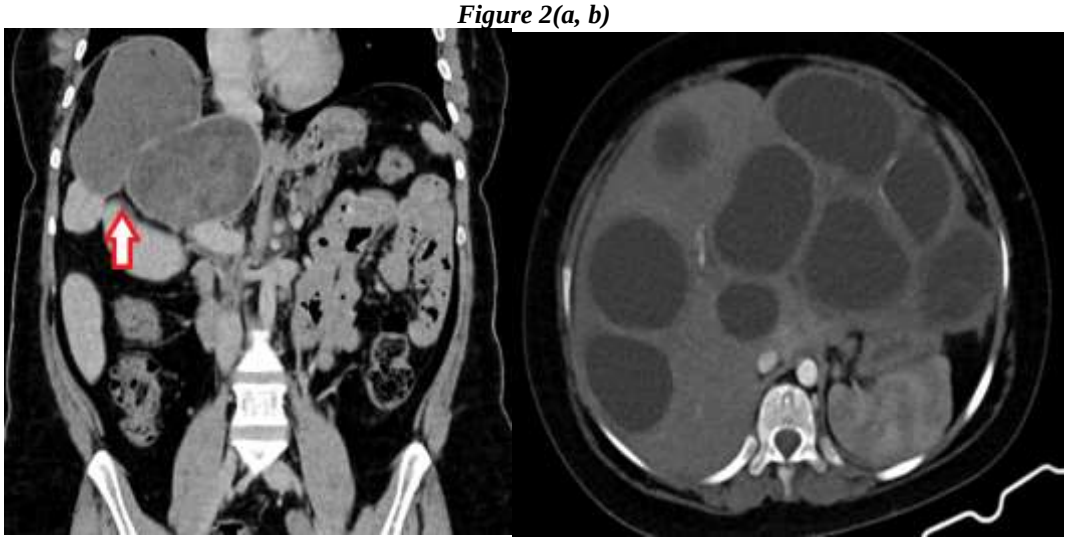
Figure 1(a-c).



a.) b.), c.)

a).Axial computed tomography image of an uncomplicated, oval shaped, well circumscribed hydatid cyst with smooth margins and homogenous fluid attenuation in the posterior segment of the upper right lobe. b.) and c.) Coronary computed tomography images, mediastinal and parenchymal window of a second, complicated hydatid cyst on an atypical location in the upper left lobe attached to the mediastinal pleura at the level of the aortic arch in the same patient.

Figure 2(a, b)



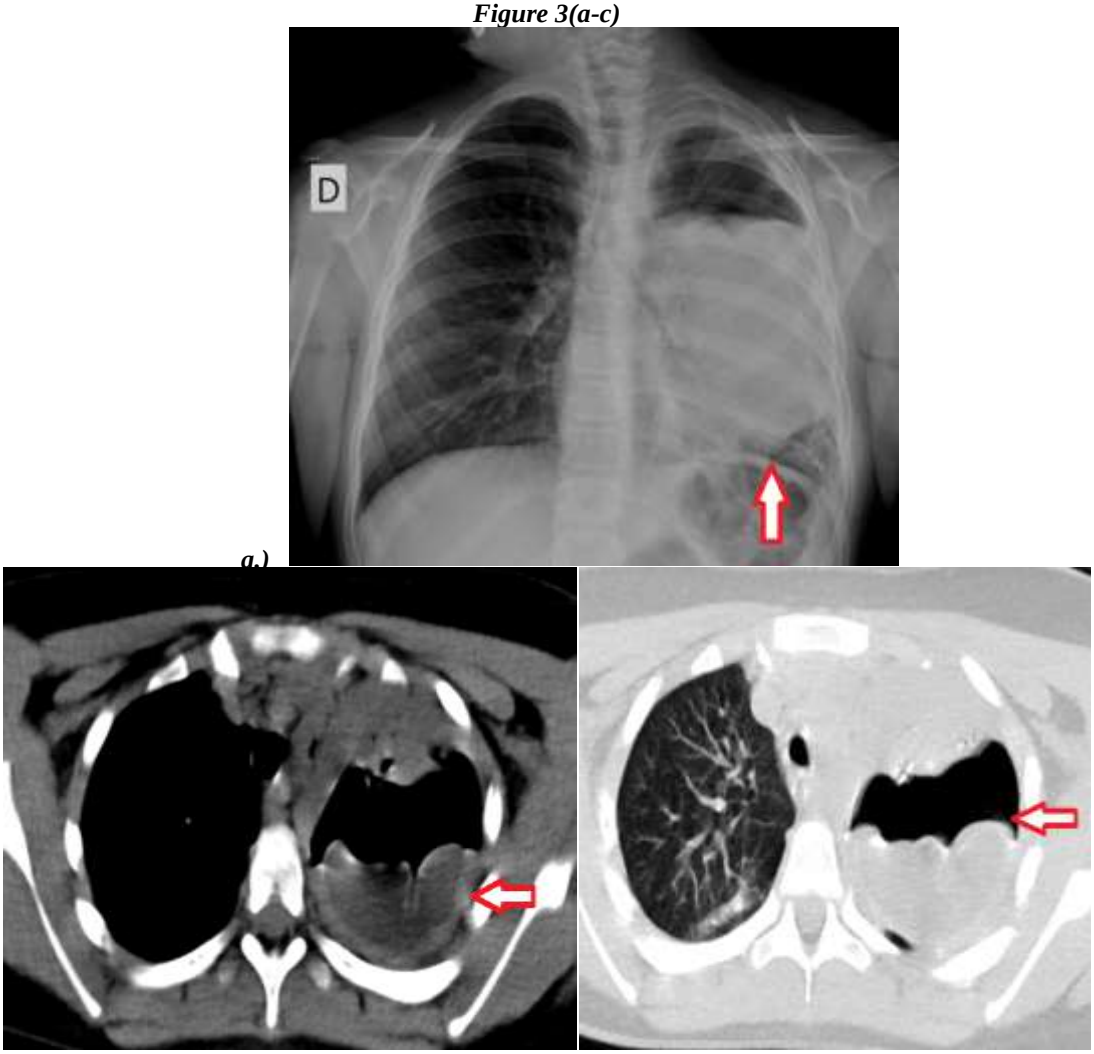
a.), b.)

a.) Coronary computed tomography image of two large hydatid cysts in the right liver lobe with daughter cyst formation and significant mass effect displacing the surrounding upper abdominal structures and the right diaphragm. b.) Axial computed tomography image of multiple hydatid cysts diffusely scattered in the liver parenchyma, and some present with rim calcifications.

On the other hand, complicated or ruptured hydatid cysts could be categorized in two forms, contained or complete rupture.

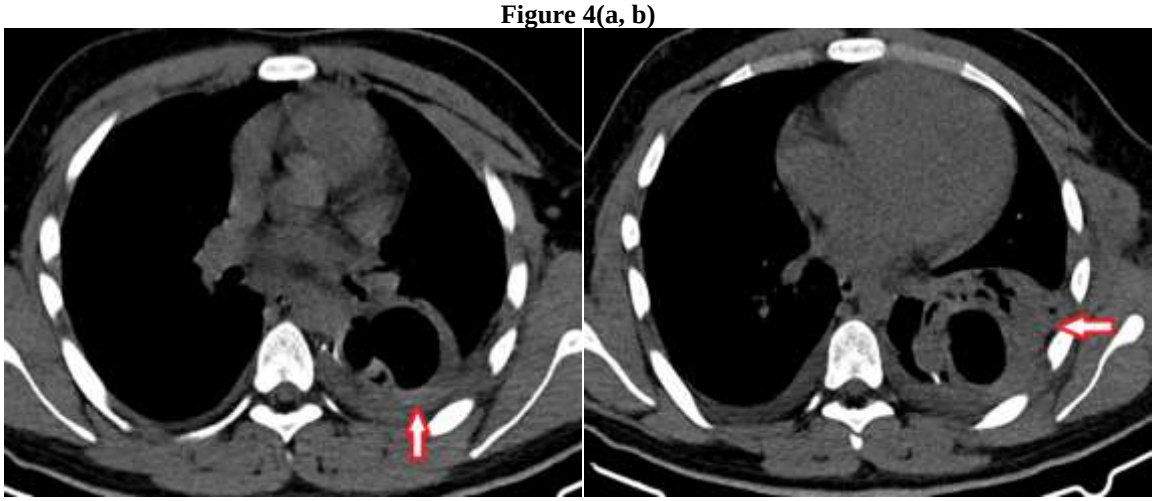
When the hydatid cyst is large, it causes surrounding lung tissue compression and often bronchial erosion, thus air enters the space between the pericyst and the endocyst and usually resembles an air crescent, or sometimes small blebs of air between the two layers give an air bubble appearance, and both are signs of impending rupture (Figure 1b, c). When air continuously enters the space between the two layers, there is a significant compression to the endocyst and it ruptures with collapse of the membranes thus forming an air fluid level and an onion peel appearance that is known as "cumbo sign". With a complete collapse of the endocyst, the squashed membranes may float on the surface of the fluid, an appearance known as "water lilly sign". When the fluid is fully expectorated, the membranes fall at the bottom of the cyst and resemble a "mass within a cavity" and when membranes are also being expectorated, "dry cyst sign"(Figure 3 a-c), (Figure 4 a, b).

Figure 3(a-c)



a.) conventional x- ray, posterior- anterior (PA) projection of a complicated hydatid cyst in the lower left lobe with a cumbo or double arch sign; b.) and c.) Axial computed tomography images of a complicated, ruptured hydatid cyst, mediastinal and parenchymal window, demonstrating a classical "water lilly sign" with the ruptured membranes floating on the surface of the fluid.

Figure 4(a, b)



a.) and b.) Axial computed tomography images of a complicated, ruptured hydatid cyst, showing fully expectorated fluid and crumpled endocyst at the bottom of the cyst resembling a "mass within a cavity. There can also be noted a surrounding reactive pneumonia and mild bilateral pleural effusion.

5 patients (9%) had atypically located solitary hydatid cysts without signs of complication and the most common locations we observed were the anterior mediastinum, the pericardium as well as the diaphragm. We also had an atypical case of calcified mediastinal hydatid cyst in an older patient, diagnosed incidentally on a routine chest CT for a different clinical indication (Figure 5,a, b), (Figure 6), (Figure 7, a, b).

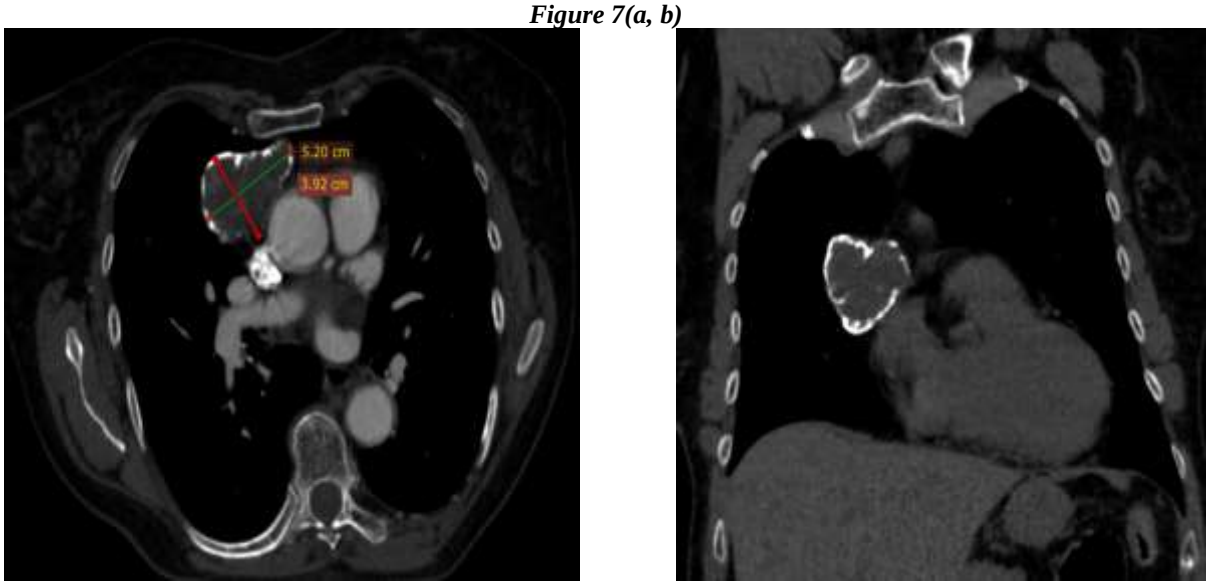
Figure 5(a, b)

a.) and b.) axial and sagittal computed tomography images of a patient with uncomplicated hydatid cysts on an atypical location in the inferior anterior mediastinal space and attached to the pericardium at the level of the right ventricle. b.) there are concomitant liver hydatid cysts with discrete rim calcification in the same patient on the sagittal image.

Figure 6

sagittal computed tomography image of a patient with uncomplicated hydatid cysts on an atypical location attached to the diaphragm on the posterior.

Figure 7(a, b)



a.) and b.) axial and coronal computed tomography images of an asymptomatic patient with incidental atypical finding of a completely calcified hydatid cyst in the anterior mediastinum and attached to the pericardium at the level of the right atrium.

3. CONCLUSIONS

Computed tomography as one of the most utilized instruments of radiology imaging, has a crucial role and an important contribution in providing accurate diagnosis or a spectrum of most likely differential diagnosis of simple lung hydatid cysts, depiction of their exact size, location and internal structure, assisting in the evaluation of rare, atypically located and complicated cases, and predicting impending complications or rupture by giving a full scale information on the morphology of the cystic hydatid lesions as well as the internal arrangement.

REFERENCES

Aletras, H., & Symbas, P. N. (2000). Hydatid disease of the lung. General Thoracic Surgery, 5th ed. Philadelphia, Lippincott Williams & Wil-kins, 1113-1122.

Bakir, (1967). F. Serious complications of hydatid cyst of the lung. Am Rev Respir, 96: 483-493.

Balikian, J. P. & Mudarris, F. F. (1974). Hydatid disease of the lungs. A roentgenologic study of 50 cases. Am J Roentgenol Radium Ther Nucl Med, 692-707.

Beggs, I. (1985). The radiology of hydatid disease. AJR, Am J Roentgenol, 145:639–648.

Dogan, R., Yüksel, M., Cetin, G., Süzer, K., Alp, M., Kaya, S., Unlü, M., & Moldibi, B. (1989). Surgical treatment of hydatid cysts of the lung: report on 1055 patients. Thorax, 44: 192-199.

Jerray, M., Benzarti, M., Garrouche, A., Klabi, N., & Hayouni, A. (1992). Hydatid disease of the lungs. Study of 386 cases. Am Rev Respir Dis, 146: 185-189.

Judd, L. (2018). Clinical Practice Manual for Pulmonary and Critical Care Medicine, ISBN: 9780323399524, ClinicalKey

Haliloglu, M., Saatci, I., Akhan, O., Ozmen, M. N., & Besim, A. (1997). Spectrum of imaging findings in pediatric hydatid disease. AJR, Am J Roentgenol, 169:1627–1631.

Kervancioglu, R., Bayram, M., & Elbeyli, L. (1999). CT findings in pulmonary hydatid disease. Acta Radiol, 40: 510-514

Khuroo, M. S. (2002). Hydatid disease: current status and recent advances. Ann Saudi Med, 22: 56-64.

King, C. H. (1995). Cestodes (tapeworms). Principles and practice of infectious diseases. 4th ed. New York, NY, Churchill Livingstone, 2544- 2553.

Lawrence R. Goodman (2020). Felson's Principles of Chest Roentgenology,ed.5.,

Mehta, P., Prakash, M., & Khandelwal, N. (2016). Radiological manifestations of hydatid disease and its complications. Trop Parasitol, 6:103–112.

Michelle.M.C., (2018). Respiratory Physiology, ed.2, ISBN: 9780323595780, ClinicalKey

Michael G.Levitzky, (2019). Pulmonary Physiology, Ninth Edition, ISBN: 9781260019339, ClinicalKey

Milicevic, M. (1994). Hydatid disease. Surgery of the liver and biliary tract. 2nd ed. Edinburgh, Churchill Livingstone, 1121-1150.

Mowlavi, G., Kacki, S., Dupouy-Camet, J., Mobedi, I., Makki, M., Harand,i M. F. & Naddaf, S. R. (2014). Probable hepatic capillariosis and hydatidosis in an adolescent from the late Roman period buried in Amiens(France). Parasite, 21: 9.

Neva, F. A. (1994). BHIhIBpN, Conn. Appleton&Lange, 128-133.

Pedrosa, I., Saiz, A., Arrazola, J., Ferreiros, J. & Pedrosa, C. S. (2000). Hydatid disease: radiologic and pathologic features and complications. Radiographics, 20:795–817.

Pumarola, A., Rodriguez- Torres, A., García Rodriguez, J.A. & Piedrola Angulo, G. (1990). Microbiología y parasitología médica. 2nd ed. Barcelona, Spain, Salvat.

Reeder, M. M. & Palmer, P. E. S. (1981). The radiology of tropical diseases with epidemiological, pathological and clinical correlation. Baltimore: Williams &Wilkins.

Solak, H., Yeniterzi, M., Yüksek, T., Anil, N., Göktogan, T. & Ceran, S. (1990). The hydatid cyst of the lung in children and results of surgical treatment. Thorac Cardiovasc Surg, 38: 45-47.

Steven E.Weinberger, Barbara A.Cockrill; J.Mandel, (2018),Principles of Pulmonary Medicine, ISBN: 9780323523714

Uccheddu, A., Cois, A., Gromo, C., Dessena, M. & Cagetti, M. (1993). Acutecomplications of pulmonary hydatidosis. Apropos 44 cases. G Chir 1993, 14: 431-435.

von Sinner, W. N. (1991). New diagnostic signs in hydatid disease; radiography, ultrasound, CT and MRI correlated to pathology. Eur J Radiol, 12: 150-159.