

Original Research Article

Video-assisted thoracoscopic surgery and mini-thoracotomy compared to conventional thoracotomy in the surgical management of pulmonary hydatid cyst

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Received: 22 April 2022

Revised: 11 May 2022

Accepted: 17 May 2022

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ABSTRACT

Background: Although hydatid cyst disease is not common in western countries, it is a public health issue in the Middle East, including Iraq. We describe a new method in the surgical management of the disease. Aim of the study was to evaluate the outcomes of different surgical approaches: video-assisted thoracoscopic surgery (VATS), mini-thoracotomy, and conventional thoracotomy in managing pulmonary hydatid cysts.

Methods: Retrospective analysis of the surgical treatment of pulmonary hydatid cysts between January 2017 and December 2021 in two centers. Patients' data regarding the age, sex, sign and symptoms, cyst size and location, surgical approach, operative time, the intraoperative bleeding, chest drainage, hospitalization time, and postoperative complications.

Results: A total of 122 patients were included in the study; 9 underwent VATS, 59 underwent mini-thoracotomy, and 54 had conventional thoracotomy. The VATS and mini-thoracotomy has superiority to the thoracotomy group in terms of lower duration of operation, less perioperative bleeding, early chest tube removal, and lower hospitalization time.

Conclusions: VATS and mini-thoracotomy are safe and advantageous procedures compared to conventional thoracotomy.

Keywords: Hydatid cyst, Thoracoscopic surgery, Minithoracotomy, Thoracotomy, VATS

INTRODUCTION

Rudolf Virchow, in 1855 was the first to identify pulmonary hydatid cyst; since then, more acknowledgments about the illness started to be well-shaped.¹ Echinococcus granulosus is the cause of hydatid disease, the most serious helminthic zoonosis, with an important medical, social, and economic role.²

Humans are accidental hosts for the parasite prevalent in regions like South America, the Middle East, Africa, and

India, because cattle farming is common, and they lack preventive medicine measures like deteriorated quality control in the slaughterhouses and absence of adequate control of the stray dog population.³

The most commonly infected organs are the liver (50-70%) and lungs (20-30%). However, the disease can involve virtually any organ, and multiple organ involvement is not uncommon.⁴ The right lower lobes of the lung are the most common sites because of the higher perfusion.⁵

Although thoracotomy and sternotomy are the classical methods in the treatment of pulmonary hydatid cysts, video-assisted thoracoscopic surgery (VATS) has become more popular in the last two decades due to its advantages.^{6,7}

Minithoractomy with the aid of VATS (not mini-thoracotomy alone) in the surgical management of hydatid cyst has been described in the literature as a few case series.⁸

We aim to evaluate the outcome of VATS, mini-thoracotomy and conventional thoracotomy in patients who underwent pulmonary hydatid cyst disease surgery.

METHODS

We retrospectively evaluated all the patients who had surgery for pulmonary hydatid cysts in two centers (Al-Sadir medical city in Najaf and Imam Hussein Teaching Hospital in Nasiriya) between January 2017 and December 2021. Clinical and radiological diagnoses were made for all patients by chest X-ray and computed tomography. Serologic tests were not used routinely. The demographic, clinical, radiological, and surgical data of the patients were obtained from the hospital records.

Inclusion criteria

All the patients who had surgery for pulmonary hydatid cyst in the study period.

Exclusion criteria

Patients whose hospital records were not available were not included in the study.

The age, gender, symptoms, cyst size and localization, type of surgery, operative time, blood loss, duration of the chest drainage, hospital stay, and complications were recorded. All the surgeries were performed by the three surgeons who participated in the study. The patients have been operated by thoracotomy when lobectomy or decortication are needed or in the hilar location of the cyst. The VATS procedure and mini-thoracotomy were performed in a peripheral cyst location.

Group 1 (thoracotomy group) thoracotomy was carried out with a standard posterolateral thoracotomy incision (approximately 8-16 cm) after the intubation. Following the incision and cutting or sparing of the muscles, a rib retractor was placed to open the intercostal space. After the cyst location was identified, povidone-soaked gauzes were placed around the cyst and chest wall to prevent contamination by spillage. Following the aspiration of the cystic fluid, the outer layer was opened, and the lamellar membrane was removed. The hemorrhage and bronchial air leak – if detected – were controlled, and the cyst cavity was obliterated (capitonnage). A chest tube size (28-36 Fr) was inserted, and the thoracotomy incision was closed.

Anatomical resections were carried out only in complicated cysts and irreversible changes in the adjacent parenchyma or when a giant cyst or numerous cysts had destroyed a certain anatomical substrate.

Group 2 (mini thoracotomy group)

The inclusion criteria for this group were the proximity of the cyst to the chest wall of any size, no need for lung resection, and precise diagnosis. After careful studying of the computed tomography (CT) scan of the patient, the site of mini-thoracotomy was chosen. A 4 cm incision was made in the skin, subcutaneous tissue, and muscle. Then the pleura was opened, and the cyst was identified by the visceral pleural changes induced by the cyst. According to the case, the wound may be extended to a maximum of 6 cm, especially in a patient with a thick chest wall. With the use of 3.5x magnifying loupes and headlight, we were able to operate through this keyhole. The cyst surface and the small wound edge were covered by povidone-soaked small gauze (Figure 1). We injected the cyst with povidone and aspirated it after 10 minutes if the cyst was intact. Then the adventitia was incised, and the lamellar membrane was removed. The air leak was identified easily with the aid of magnification and good lighting and closed by a long-term absorbable suture. The same suture was used for capitonnage. The air leak is tested by asking the anesthetist to inflate the lung and flushing the surgical field with warm normal saline.



Figure 1: Mini-thoracotomy for pulmonary hydatid cyst.

Group 3 (VATS group)

VATS was carried out after the double-lumen intubation. A 2 cm long utility incision was made on the 5th intercostal space in the anterior axillary line. After identifying the cyst with a 30-degree video thoracoscope, povidone-soaked gauzes were placed around the cyst to prevent contamination. After the cyst fluid aspiration with a needle, povidone was injected into the cyst, and the process was held on for 10 minutes. The fibrous capsule was opened with electro-cautery. The lamellar membrane was removed with an endo bag to prevent contamination. The cyst walls were wiped with povidone impregnated gauzes. The bronchial connections were controlled. The cyst cavity was obliterated with absorbable stitches. A

small chest tube (20-24 Fr) was placed through the utility incision. The incision closure didn't need periosteal stitches.

Hepatic cysts

Following surgery for the pulmonary hydatid cyst, a right-sided phrenotomy was performed. In cases of intact cyst is injected with povidone and aspirated after 10 minutes. Then the adventitia is incised, and the lamellar membrane is removed. Major biliary leaks are controlled by stitches. A tube drain was left in the residual cavity below the diaphragm, and the phrenotomy site was closed with a nonabsorbable suture.

All patients received preoperative prophylactic antibiotics and postoperative analgesic agents. The chest drain was removed when there was no air leak, and the daily drainage was below 100 ml. After discharge, patients were followed by radiologic imaging for six months. All patients received postoperative albendazole for three months.

Ethical approval and patient consent

Written informed consent was obtained from all the patients or their legally authorized representatives of those less than 18 years old for participating in this study and was conducted according to the ethical guidelines established by the 1964 Helsinki Declaration. The Medical Ethical Committee of Al-Sadir Medical City and Kufa University approved this study (code:2021AMC24).

Statistical analysis

We used the means and standard deviations to represent the data while describing variables presented using numbers and percentages. A two-sided paired t-test was used for variables. Statistical package for the social sciences (SPSS) version 24 (Chicago, US) was utilized for data entry and analysis. A p value of <0.05 was considered significant.

RESULTS

We included 122 patients in our study. The median age of the participants was 33.95 years (5-67 years). Forty-seven (38.52%) of them were female. Most patients came from rural areas and had a history of longstanding contact with animals, both domestic (dogs) and farming (sheep). Nine (7.37%) patients had undergone VATS, 59 (48.36%) had mini-thoracotomy, and 54 (44.26%) had conventional thoracotomy. The cough was the most common presenting symptom and was seen in 46 patients (37.7%), shortness of breath in 32 patients (26.22%), chest pain in 18 patients (14.75%), fever in 13 patients (10.65%) while and seven patients (5.73%) diagnosed accidentally by CXR for other purposes. Four patients (3.27 %) had hemoptysis. An anaphylactoid reaction leading to diagnosis occurred and manifested itself as pruritis, rash, and wheeze in one patient. We had one patient present to the ER with asphyxiation and airway obstruction, necessitating endotracheal intubation and suctioning of the hydatid cyst content (Figure 3). The most common affected lobe was the right lower lobe (RLL) in 50 patients (40.98%), right upper lobe (RUL) in 25 patients (20.49%), left upper lobe (LUL) in 20 patients (16.39%), left lower lobe (LLL) in 19 patients (15.57%), and right middle lobe (RML) in 8 patients (6.55%).

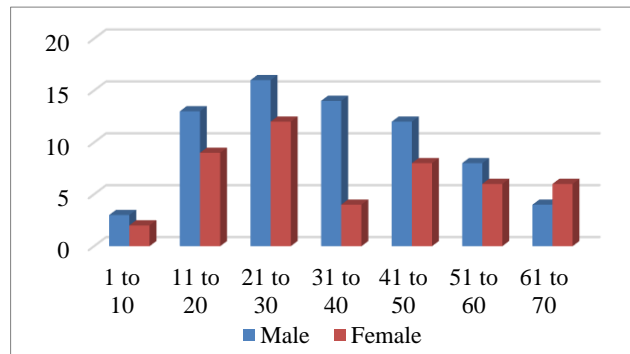


Figure 2: Demographic data of the patients.

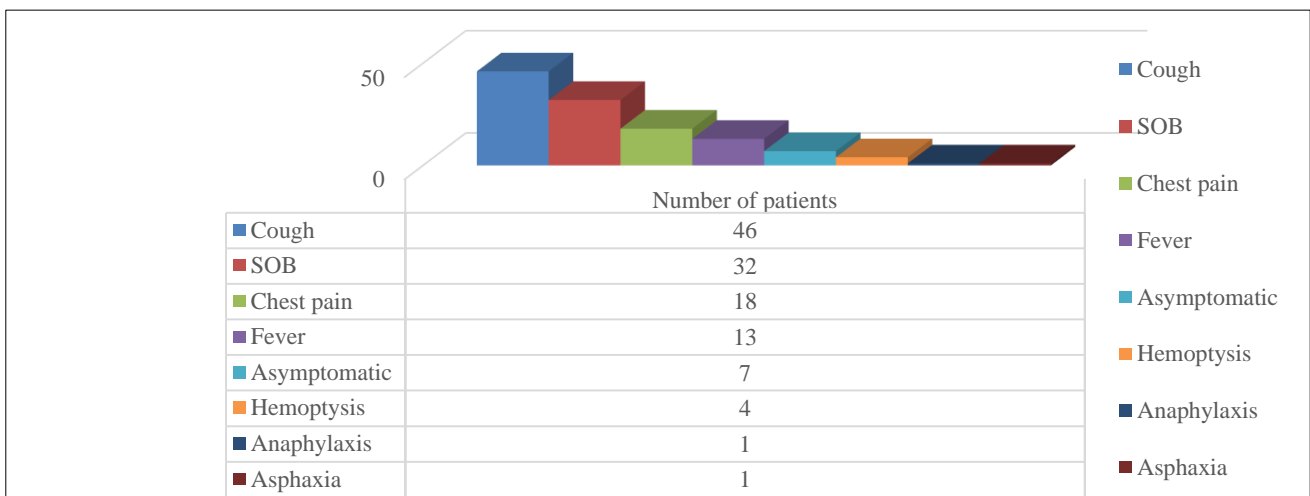


Figure 3: The presentation of the patients.

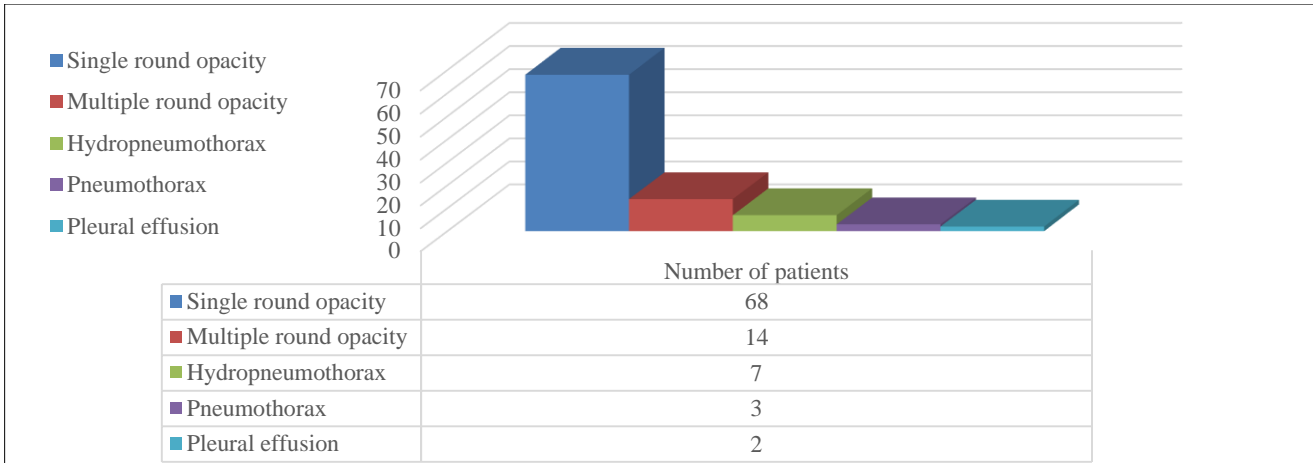


Figure 4: Radiological presentation.

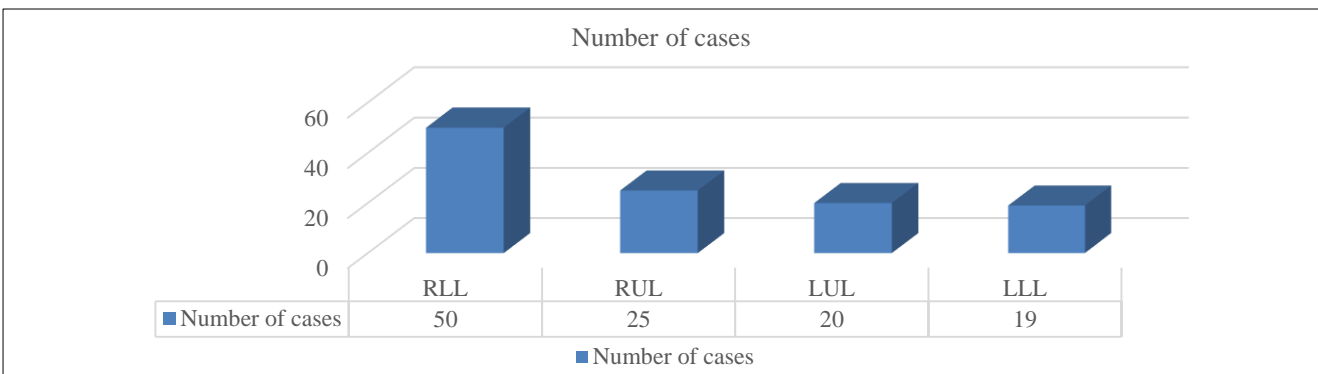


Figure 5: Localization of cyst within the lung.

Table 1: The intraoperative and postoperative complications.

Complications	Conventional thoracotomy	Minithoracotomy	VATS
Atelectasis	2	2	1
Pleural effusion	1	1	0
Hypoxia	1	1	0
Hemoptysis	1	1	0
Prolong air leak	2	2	1
Electrocautery burn	1	0	0
Superficial wound infection	2	1	0
Pneumothorax	0	1	0
Residual cavitory lesion	1	0	0
RCU admission	3	0	0

The mean and standard deviation of cyst diameter was 8.22 ± 3.51 cm. The range was from 2.5 cm to 14 cm. Extrapulmonary involvement of hydatid cyst was as follows: liver in 25 cases, chest wall in two cases, spleen in two cases, brain in one case, and gluteal region in one case.

Bilateral disease was present in 10 patients. 8 patients underwent two-stage operations via mixed classical thoracotomies and mini-thoracotomies, while two patients had one-stage operations with successive mini-thoracotomies carried out in the same anesthesia on two

patients. In 9 cases, the concomitant dome localized liver cysts were removed via right phrenotomy during the classical thoracotomy. The cyst was intact in 82 patients (67.21 %) and ruptured in 40 patients (32.27%). The intraoperative and postoperative complications are detailed in Table 1.

No intra-operative or postoperative deaths occurred. The long-term postoperative results are considered very good, with no recurrences observed during the follow-up period. We have a small number of patients in the VATS group, so we compared the data on VATS and mini-thoracotomy

with the conventional thoracotomy group. The operative time duration of surgery was 110.5 ± 9.2 minutes in the conventional thoracotomy group and 95.6 ± 8.4 minutes in the VATS and mini-thoracotomy groups. VATS and mini-thoracotomy operative time were significantly shorter than conventional thoracotomy operative time ($p < 0.0001$). The median duration of chest drainage was 5.3 ± 2.1 days in VATS and mini-thoracotomy groups and 7.7 ± 3.1 days in the conventional thoracotomy group. The duration of the chest drainage who underwent VATS and mini-thoracotomy groups was statistically shorter than thoracotomy ($p < 0.0001$). Duration of hospitalization was 3.2 ± 2.6 days in VATS and mini-thoracotomy groups, while it was 5.3 ± 4.3 days in the conventional thoracotomy group. We usually discharge the patients home with chest drain, and this explains that some patients have longer chest drain time than hospitalization time. The hospital stay time was significantly shorter in the VATS and mini-thoracotomy groups compared to the conventional thoracotomy group ($p = 0.0011$). The perioperative bleeding was 101.5 ± 16.9 cc in VATS and mini-thoracotomy groups and 198.5 ± 36.8 ccs in the conventional thoracotomy group. These results revealed that bleeding was significantly less in the VATS and mini-thoracotomy groups compared to the conventional thoracotomy group ($p < 0.0001$). The complication rate was higher in the conventional thoracotomy group compared to VATS and mini-thoracotomy groups during the follow-up period.

DISCUSSION

In this case series, we found that both mini-thoracotomy and VATS are as effective as conventional thoracotomy in managing pulmonary hydatid cysts as they eliminate the parasite, preserve the lung tissue, and prevent recurrences.

Conventional was the choice of hydatid cyst treatment for many years. The minimally invasive technique was first introduced in 1994 in pediatric patients. Despite the advance in the VATS techniques, Many surgeons are still reluctant to use VATS in pulmonary hydatid surgery for safety issues like contamination or anaphylaxis when there is spillage of the cyst content.^{9,10}

The advantages of VATS and mini-thoracotomy over conventional thoracotomy are: shorter operative time, less blood loss, decreased duration of the chest drain, shorter hospital stay, less postoperative pain, less postoperative complications.

Any lung lobe can be involved in hydatid cysts; however, lower lobes predominate in several studies.^{3,11} In our series, The right lung lobes are more involved than the left and lower lobes than the upper (Figure 5).

The presentation of hydatid cyst range from asymptomatic and accidentally discovered to dramatic and immediately life-threatening, needing immediate care. The most common symptom at presentation in our study was cough

followed by shortness of breath, chest pain, and fever, similar to what Aldahmashi et al reported in their series.¹² Alpay et al outline the relative contraindication to VATS in pulmonary hydatid cyst: multiple cysts in a single lung, intolerance to single-lung ventilation, presence of severe adhesions, history of prior thoracic surgery, cyst diameter < 2 cm or > 10 cm, and recurrent cyst. We followed their recommendation in VATS but not in mini-thoracotomy, where our only contraindications were the need for pulmonary resection and when there is doubt about the diagnosis.¹³

We didn't have a postoperative air leak and bronchopleural fistula in the VATS group. There was no significant difference between mini-thoracotomy and conventional thoracotomy in the incidence of postoperative air leak. None of our patients needed reoperation. Ocakcioğlu et al also compared VATS and Thoracotomy and did not find any difference in the incidence of postoperative air leak and other complications rates.¹⁴ VATS and mini-thoracotomy operative time were significantly shorter than conventional thoracotomy operative time. A similar finding was reported by Ma et al and Ocakcioğlu et al. They attributed the excess time in conventional thoracotomy was needed for opening and closure of the larger incision.^{14,15}

The hospital stay time and postoperative bleeding were significantly shorter in the VATS and mini-thoracotomy groups compared to the conventional thoracotomy group. A similar conclusion reported by Alpay et al and Ma et al. Agarwal et al stated the mean hospitalization.^{13,16} Ocakcioğlu et al noted that fewer pain levels cause early discharge.¹⁴ One stage operation for two hydatid cysts was done for 11 patients in our series. Two patients had bilateral mini-thoracotomy for bilateral pulmonary hydatid, and nine patients had their liver hydatid cyst removed with the pulmonary hydatid in the classical thoracotomy. Petrov et al explained the advantages of a one-stage operation as the following: minimizing the psychic trauma of two operations, avoid the possible complications of the remaining cysts between the two operations, and decrease the cost and the period of rehabilitation and disablement.¹⁷

We used CT scan images to locate the incision directly above the hydatid cyst, while in the Abbas et al. series, the location is determined by the use of the thoracoscope and the patient's CT scan images.⁸

Limitations

We were limited by the small number of cases in the VATS group, the retrospective design, and the relatively short follow-up period.

CONCLUSION

VATS and mini-thoracotomy are safe in pulmonary hydatid cyst surgery and have the advantages over

conventional thoracotomy are: shorter operative time, less blood loss, decreased duration of the chest drain, shorter hospital stay, less postoperative pain, less postoperative complications.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Al-Madhhachi B, Fahad AM, Ibrahim OO. Video-assisted thoracoscopic surgery and mini-thoracotomy compared to conventional thoracotomy in the surgical management of pulmonary hydatid cyst. *Int Surg J* 2022;9:xxx-xx.