

# Is Bilateral Staged Muscle-Sparing Thoracotomy Performed within 1 Week for Lung Hydatid Cysts Safe for Pediatric Patients?

Ömer Önal , Ömer Faruk Demir 

Department of Thoracic Surgery, Erciyes University School of Medicine, Kayseri, Turkey

**Cite this article as:** Önal Ö, Demir ÖF. Is bilateral staged muscle-sparing thoracotomy performed within 1 week for lung hydatid cysts safe for pediatric patients? Turk Thorac J 2018; 19; 84-8.

## Abstract

**OBJECTIVES:** Median sternotomy or staged thoracotomies are generally the preferred surgical treatment options for bilateral lung hydatid cysts. According to literature, it is usually recommended to wait from 3 weeks to 3 months between bilateral staged thoracotomies. The aim of this study is to compare postoperative complications, hospitalization days and morbidity and mortality ratios between unilateral thoracotomy and bilateral staged thoracotomy groups and to evaluate the safety of performing bilateral staged thoracotomy within 1 week for lung hydatid cysts in pediatric patients.

**MATERIAL AND METHODS:** In total, 112 patients under the age of 16 years who underwent surgery between 2000 and 2016 because of pulmonary hydatid cysts were included in this study. The patients were classified into two groups as Group 1 (unilateral muscle-sparing thoracotomy) and Group 2 (bilateral staged muscle-sparing thoracotomy applied within 1 week).

**RESULTS:** There were 91 patients in Group 1 and 21 patients in Group 2. No statistically significant differences were detected when both groups were compared by age, gender, perforation rates, follow-up period and postoperative complications.

**CONCLUSION:** To prevent hydatid cysts complications, the elapsed time between two thoracotomies should be not only long enough to evaluate the postoperative complications but also relatively short to prevent possible complications that may develop in the other lung. In our opinion, a patient follow-up of 3-7 days between thoracotomies is sufficient for the assessment of patients' clinical status and possible complications.

**KEYWORDS:** Hydatid cyst, pediatric, surgery, thoracotomy

**Received:** 09.05.2017

**Accepted:** 13.12.2017

## INTRODUCTION

Bilateral lung hydatid disease occurs in 7.6-26.7% of all lung hydatid cysts cases [1,2]. Median sternotomy or staged thoracotomies are generally the preferred surgical treatment options for bilateral lung hydatid cysts. According to literature, it is usually recommended to wait from 3 weeks to 3 months between bilateral staged thoracotomies [3-6]. The aim of this study was to compare the postoperative complications, hospitalization days and morbidity and mortality ratios between unilateral thoracotomy and bilateral staged thoracotomy groups and to evaluate the safety of performing bilateral staged thoracotomy in within 1 week for lung hydatid cysts in pediatric patients.

## MATERIAL AND METHODS

In total, 136 patients under the age of 16 years who underwent surgery between January 2000 and January 2016 because of pulmonary hydatid cyst were retrospectively evaluated. Overall, 24 patients who had more than one cyst in each lung were excluded from the study to create more homogenous groups. In total, 112 patients who had one hydatid cyst in each lung were enrolled in this study. The patients were classified into two groups. Group 1 consisted of 91 patients aged <16 years with one hydatid cyst and who underwent unilateral musclesparing thoracotomies. Group 2 consisted of 21 patients aged <16 years who had one hydatid cyst in each lung and who underwent bilateral staged muscle-sparing thoracotomies within 1 week. Cystotomy and capitonnage were performed on all patients via muscle-sparing thoracotomy. All patients were treated with intercostal blockade using 5 mg/kg prilocaine before the thoracotomy incision was closed. After the operation, patients were given 2 mg/kg tramadol drops for the first 3 days and then, 5-10 mg/kg ibuprofen was orally administered for pain management. In Group 2, the largest cysts and intact cysts were operated on first. The second thoracotomy was planned after the evaluation of hemodynamic, pulmonary, and blood parameters of the patients. The

**Address for Correspondence:** Ömer Önal, Department of Thoracic Surgery, Erciyes University School of Medicine, Kayseri, Turkey  
E-mail: omeronal@erciyes.edu.tr

©Copyright 2018 by Turkish Thoracic Society - Available online at [www.turkthoracj.org](http://www.turkthoracj.org)

chest drain located on the first surgery side was removed after the second thoracotomy. Patients were followed up by daily chest radiography. The chest drains were removed after the detection of lung expansion and daily chest tube drainage below 100 cc. The patients were followed up monthly for 3 months after discharge. Then, they were followed up every 6 months. Informed consent was obtained from the parents of all the patients. This study was approved by the ethics committee of our university (No: 2016/365).

**Statistical Analysis**

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) 15.0 software (SPSS Inc.; Chicago, IL, USA). Parametric numerical data were analyzed using the Student’s t test, and nonparametric numerical data were analyzed using the Mann-Whitney U test between the two study groups. p values less than 0.05 were considered to be statistically significant.

**RESULTS**

The characteristics of the patients and the cysts are summarized in Table 1. In total, 133 cysts were removed via cystotomy and capitonnage techniques. Perforation was detected in 41.4% (n=55) of the cysts. No blood transfusions were required during or after operations. All patients were extubated in the operating room. Atelectasis was the most common postoperative complication in both groups. No statistically

significant difference was detected in the perforation rates of the cysts between the two groups (p=0.319). Perforated hydatid cysts had significantly higher postoperative complication rates than intact hydatid cysts (27.3% and 2.6%, respectively; p<0.001). The median time between bilateral staged thoracotomies was 5 days (minimum: 3 days, maximum: 7 days). No statistically significant differences were detected when both groups were compared by age, gender, perforation rates, follow-up period, and postoperative complications (Table 1,2). The cyst size, duration of chest drain, and hospitalization were significantly higher in Group 2 (p=0.02, p<0.001, and p<0.001, respectively).

Simultaneous bilateral staged thoracotomy was performed on an 11-year-old female patient who was followed up in the pediatric intensive care unit via mechanical ventilation because of respiratory distress. She had an uncontrolled fever despite wide spectrum antibiotic treatment and also had decreased oxygen levels. This patient was not included in the statistical analysis. No recurrences or mortalities occurred in either of the groups during the follow-up period.

**DISCUSSION**

The number of studies based on the surgical treatment of bilateral lung hydatid disease is very low. Experiences regarding surgical procedures performed for bilateral lung lesions were usually obtained from studies involving patients who underwent surgery for metastatic diseases [7]. Median sternotomy, bilateral synchronous thoracotomies, bilateral staged thoracotomies, and Clamshell incisions are the surgical treatment options for patients with bilateral pulmonary disease [8]. In recent years, video-assisted thoracoscopic surgery (VATS) had an increased popularity in hydatid cyst treatment because of its good cosmetic results, low postoperative pain, and fewer complications [9,10]. However, some limitations, such as central location of the cyst, more than two cysts, and adhesion to the pleural cavity, have been reported for VATS [11]. Although Clamshell incision provides a good exposure to all the areas of the lung, it is rarely performed [8]. Median sternotomy has some advantages such as reducing thoracic muscle and nerve damage, decreasing pleural adhesions, and facilitating possible reoperation. In addition, it offers better postoperative patient comfort and involves a shorter hospital stay [12]. However, serious difficulties may be encountered within lower lobe cysts and large cysts, which are settled close to the hilum, and particularly cysts located in the posterior segment of the lower lobes; therefore, surgery may fail [12]. Mediastinitis is more likely to develop specifically in the complicated cysts because of a prolonged air leak and postoperative lung and pleural infections [13]. For this reason, we recommend bilateral staged thoracotomy for the treatment of bilateral lung hydatid cysts [13-16].

Staged thoracotomy has some disadvantages such as the implementation of anesthesia twice in different sessions, second-time patient hospitalization, and repetition of preoperative preparations. Also, the possibility of developing a complication related to hydatid cyst persists between two thoracotomies. Therefore, a 1-week time frame between the two thoracotomies is sufficient for the evaluation of possible

**Table 1.** Characteristics of the patients and the hydatid cysts

Characteristics	Group 1	Group 2	p
Male/Female <sup>a</sup>	63/28 (69.2/30.8)	16/5 (76.2/23.8)	0.528
Age (years)	10.9±3.9	12.0±3.2	0.173
Number of cysts <sup>a</sup>	91 (68.4)	42 (31.6)	
Perforation rate of cysts <sup>a</sup>	35 (38.5)	20 (47.6)	0.319
Size of cysts (cm) <sup>b</sup>	5.5 (3-12)	5 (3-10)	0.02
Duration of chest tube (days) <sup>b</sup>	6 (4-15)	9 (8-15)	<0.001
Length of hospital stay (days) <sup>b</sup>	7 (5-18)	11 (9-18)	<0.001
Follow-up period (months)	36.9±24.2	42.6±34.8	0.38

<sup>a</sup>Data are presented as n (%)

<sup>b</sup>Data are presented as median (minimum-maximum)

**Table 2.** Postoperative complications calculated based on groups

Complications	Group 1	Group 2	Total	p
Atelectasis	4 (4.4)	1 (4.8)	5 (4.4)	0.977
Pneumothorax	3 (3.3)	1 (4.8)	4 (3.5)	
Bronchopleural fistula and prolonged air leak	1 (1.1)	0	1 (0.9)	
Pneumonia	1 (1.1)	0	1 (0.9)	
Intraoperative hypoxia	1 (1.1)	0	1 (0.9)	
Total	10 (11.0)	2 (9.6)	12 (10.7)	

Data are presented as n (%)

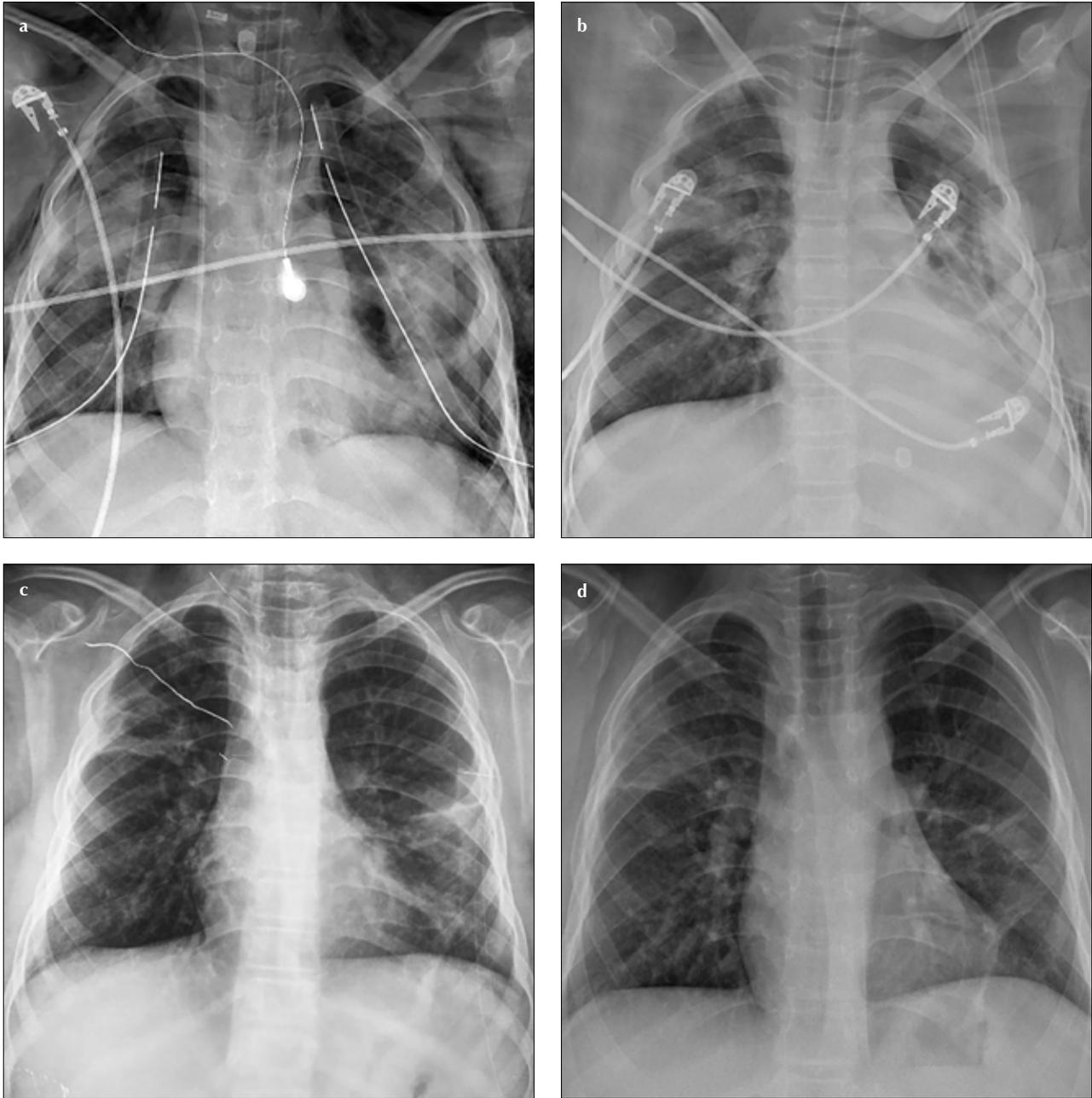


**Figure 1. a-d.** Axial planes of chest computed tomography demonstrating bilateral giant hydatid cysts (intact on the right side, perforated on the left side)

respiratory and surgical complications after the first operation. In addition, if complications develop in the other lung, required interventions can be implemented instantly because the patient is still in the hospital. We prefer performing the second thoracotomy before the removal of the chest drain from the first thoracotomy side. Thus, life-threatening complications, such as pneumothorax, which may develop during the second operation because of ventilation with high pressure, can be prevented. Also, full-expansion of both the lungs and the elimination of atelectasis can be achieved through potent ventilation. The chest drain located in the first thoracotomy side can be removed more safely subsequent to the evaluation of control chest X-rays after the second thoracotomy. Pain levels are a concern for patients having two thoracotomies within 1 week. In this study, an intercostal blockade with 5 mg/kg prilocaine was intraoperatively administered for pain control. For the first 3 days after the operation, patients received 2 mg/kg tramadol drops and then, 5-10 mg/kg ibuprofen was orally administered. No patient complained of extreme pain. These drug dosages were sufficient for pain management in both groups.

The underlying reasons for performing bilateral staged thoracotomy are the length of anesthesia, potential intraoperative bleeding, possibility of requiring lung resection, and evaluation of postoperative pulmonary complications [5,6]. However, literature does not disclose the reason for waiting for approximately 3 weeks-3 months for the second thoracotomy. In our study, it was found that a period of 1 week between the two thoracotomies in children is sufficient for the evaluation of all complications. Zarraug et al. [6] reported the results of bilateral simultaneous thoracotomy in the pediatric age for metastatic diseases. They reported a statistically significant decrease in the postoperative recovery time, duration of intensive care unit stay, and duration of chest tube, drainage, hospitalization time, and start time of chemotherapy. There was only one case of simultaneous bilateral thoracotomy in our clinic. The patient was followed up in the pediatric intensive care unit on mechanical ventilation. Fever was uncontrolled despite wide spectrum antibiotic treatment. She underwent surgery because of deterioration in vital parameters. Bilateral simultaneous thoracotomy and cystotomy/capitonnage were performed. The patient was extubated on the seventh postoperative day and discharged on the twentieth postoperative day. Although it was a single case, it was important to show the momentous consequences of hydatid disease when surgical treatment was delayed (Figure 1,2).

The complication rates of the surgical treatment of hydatid cysts are reported as 12.5-19.4% [17,18]. Findik et al. [19] reported the rate of atelectasis as 17.5% for pediatric age groups. They identified the causes of atelectasis as compliance deficiencies that lead to the retention of secretions, failure to medicate appropriate analgesics, respiratory muscle dysfunction, and deterioration of chest wall stabilization and displacement of the endotracheal tube during surgery. In this study, the complication rates were 11% (n=10) in Group 1 and 9.6% (n=2) in Group 2. The most common complication was atelectasis in both groups. Blood or cyst fluid leakage into the bronchial system can be seen as edema and atelectasis in the postoperative chest X-rays. Double lumen intuba-



**Figure 2. a-d.** Postoperative chest x-ray demonstrating bilateral pneumothoraxes (a); control chest x-ray 1 week after the operation demonstrating chest tube and subcutaneous emphysema on the left side (b); control chest x-ray before discharging the patient demonstrating no complication (c); no abnormality noted on the control chest x-ray 2 months after the operation (d)

tion is very effective to prevent this condition [20]. It is also necessary to aspirate the cyst cavity frequently during surgery and provide positive ventilation before thoracotomy closure. Postoperative atelectasis can be treated using respiratory physiotherapy, cold steam, and bronchodilators. However, bronchoscopy may be necessary in the case of existing atelectasis [21]. In our study, the postoperative atelectasis rates were 4.4% (n=4) in Group 1 and 4.8% (n=1) in Group 2. Breathing exercises were sufficient for the improvement of atelectasis.

Air leakage continuing for more than a week is defined as a prolonged air leak and generally results in empyema [22]. Topçu et al. [15] reported that residual air gap and prolonged air leaks were the most common postoperative complica-

tions. Mirshemirani et al. [17] reported 12 severe air leak cases in 72 patients. Although air leaks extended the length of the hospital stay, Mirshemirani et al. [17] highlighted that all the patients recovered without surgical treatment. In this study, prolonged air leak and bronchopleural fistula were detected in 1.1% (n=1) of the patients only in Group 1. The fistula was repaired via re-thoracotomy.

Balci et al. [18] reported morbidity and mortality rates of 14.4% and 1.5% in intact cysts, respectively. They also stated that complication rates and mortality rates might increase in patients who underwent a delayed operation. They remarked that some symptoms, particularly fever, may be resistant to medical treatment such as antibiotics, analgesics, and anti-pyretics [18]. This study also shows that perforated hydatid

cysts had statistically higher postoperative complication rates than intact cysts (27.3% and 2.6%, respectively;  $p < 0.001$ ).

The duration of chest tube and length of hospital stay were significantly higher in Group 2 than those in Group 1 because the total duration of chest tube and length of hospital stay after the two thoracotomies were calculated for Group 2. Otherwise, there was no statistically significant difference between the unilateral thoracotomy group and bilateral staged thoracotomy group in terms of postoperative complications.

To prevent hydatid cysts complications, the elapsed time between two thoracotomies should be long enough to evaluate the postoperative complications and be relatively short to prevent possible complications that may develop in the other lung. In addition, the second operation must be within an appropriate time interval to allow recovery and pain management.

In our opinion, a patient follow-up time of 3-7 days between thoracotomies is sufficient for the assessment of patients' clinical status and possible complications. Based on our results, we conclude that bilateral staged muscle-sparing thoracotomy within 1 week is a safe for treating lung hydatid cysts in pediatric patients.

**Ethics Committee Approval:** Ethics committee approval was obtained for this study from the ethics committee of Erciyes University School of Medicine (Decision No: 2016/365; Decision Date: June 10, 2016).

**Informed Consent:** Written informed consent was obtained from the parents of the patients who participated in this study.

**Peer-review:** Externally peer-reviewed.

**Author contributions:** Concept - Ö.Ö., Ö.F.D.; Design - Ö.Ö., Ö.F.D.; Supervision - Ö.Ö., Ö.F.D.; Resource - Ö.Ö., Ö.F.D.; Materials - Ö.Ö., Ö.F.D.; Data Collection and/or Processing - Ö.Ö., Ö.F.D.; Analysis and/or Interpretation - Ö.Ö., Ö.F.D.; Literature Search - Ö.Ö., Ö.F.D.; Writing - Ö.Ö., Ö.F.D.; Critical Reviews - Ö.Ö., Ö.F.D.

**Conflict of Interest:** No conflict of interest was declared by the authors.

**Financial Disclosure:** The authors declared that this study has received no financial support.

## REFERENCES

- Akgül Ozmen C, Onat S. Computed tomography (CT) findings of pulmonary hydatid cysts in children and the factors related to cyst rupture. *Med Sci Monit* 2017;23:3679-86. [\[CrossRef\]](#)
- Dogan R, Yuksel M, Cetin G, et al. Surgical treatment of hydatid cysts of the lung: report on 1055 patients. *Thorax* 1989;44:192-9. [\[CrossRef\]](#)
- Kuzucu A, Soysal O, Ozgel M, et al. Complicated hydatid cysts of the lung: clinical and therapeutic issues. *Ann Thorac Surg* 2004;77:1200-4. [\[CrossRef\]](#)
- Cangir AK, Şahin E, Enön S, et al. Surgical treatment of pulmonary hydatid cysts in children. *J Pediatr Surg* 2001;36:917-20. [\[CrossRef\]](#)
- Talaiezadeh, AH, Maraghi S. Hydatid disease in children: a different pattern than adults. *Pak J Med Sci* 2006;22:329-32.
- Zarroug AE, Hamner CE, Pham TH, et al. Bilateral staged versus bilateral simultaneous thoracotomy in the pediatric population. *J Pediatr Surg* 2006;41:647-51. [\[CrossRef\]](#)
- Vodicka J, Spidlen V, Simanek V, et al. Surgical therapy of pulmonary metastases - 10-year results. *Bratisl Lek Listy* 2013;114:218-24. [\[CrossRef\]](#)
- Petrov DB, Terzinacheva PP, Djambazov VI, et al. Surgical treatment of bilateral hydatid disease of the lung. *Eur J Cardiothorac Surg* 2001;19:918-23. [\[CrossRef\]](#)
- Alpay L, Lacin T, Ocakcioglu I, et al. Is video-assisted thoracoscopic surgery adequate in treatment of pulmonary hydatidosis? *Ann Thorac Surg* 2015;100:258-62. [\[CrossRef\]](#)
- Eroglu A, Aydın Y, Altuntas B. Video-assisted thoracoscopic surgery is safe and effective in the treatment of pulmonary hydatid cyst. *Ann Thorac Surg* 2016;101:829. [\[CrossRef\]](#)
- Ma J, Wang X, Mamatimin X, et al. Therapeutic evaluation of video-assisted thoracoscopic surgery versus open thoracotomy for pediatric pulmonary hydatid disease. *J Cardiothorac Surg* 2016;11:129. [\[CrossRef\]](#)
- Keles M, Dudu C, Tezel C, et al. One-stage operation via median sternotomy and phrenotomy for bilateral lung and liver hydatid disease. *J Thorac Cardiovasc Surg* 2005;21:167-70.
- Shehatha J, Alizzi A, Alward M, et al. Thoracic hydatid disease; a review of 763 cases. *Heart Lung Circ* 2008;17:502-504. [\[CrossRef\]](#)
- Cetin G, Doğan R, Yüksel M, et al. Surgical treatment of bilateral hydatid disease of the lung via median sternotomy: experience in 60 consecutive patients. *Thorac Cardiovasc Surg* 1988;36:114-7. [\[CrossRef\]](#)
- Topçu S, Kurul IC, Taştepe I, et al. Surgical treatment of pulmonary hydatid cysts in children. *J Thorac Cardiovasc Surg* 2000;120:1097-101. [\[CrossRef\]](#)
- Hasdıraz L, Onal O, Oguzkaya F. Bilateral staged thoracotomy for multiple lung hydatidosis. *J Cardiothorac Surg* 2013;8:121. [\[CrossRef\]](#)
- Mirshemirani AR, Razavi S, Sadeghian S. surgical treatment of pulmonary hydatid cyst in 72 children. *Tanaffos* 2009;8:56-61.
- Balci AE, Eren N, Eren S, et al. Ruptured hydatid cysts of the lung in children: clinical review and results of surgery. *Ann Thorac Surg* 2002;74:889-92. [\[CrossRef\]](#)
- Findik G, Aydoğdu K, Hazer S, et al. The management of postoperative complications in childhood pulmonary hydatid cysts. *Turk Gogus Kalp Dama* 2012;20:850-56. [\[CrossRef\]](#)
- Mixa V, Nedomova B, Rygl M. Selective lung intubation during pediatric thoracic surgeries. *Bratisl Med J* 2016;117:397-400. [\[CrossRef\]](#)
- Findik G, Gezer S, Sirmali M, et al. Thoracotomies in children. *Pediatr Surg Int* 2008;24:721-5. [\[CrossRef\]](#)
- Findik G, Aydoğdu K, Ağaçkırın Y, et al. İntratorasik ekstrapulmoner multipl kisthidatik. *Solunum Hastalıkları* 2008;19:109-12.