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

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. The aim of this study was 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

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).
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 thoraco-
tomies 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 fe-
ver 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.

**RESULTS**

The characteristics of the patients and the cysts are summa-
rized in Table 1. In total, 133 cysts were removed via cystot-
omy and capitonnage techniques. Perforation was detected in
41.4% (n=55) of the cysts. No blood transfusions were re-
quired 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
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**DISCUSSION**

The number of studies based on the surgical treatment of bi-
lateral lung hydatid disease is very low. Experiences regard-
ing surgical procedures performed for bilateral lung lesions
were usually obtained from studies involving patients who
underwent surgery for metastatic diseases [7]. Median ster-
notomy, bilateral synchronous thoracotomies, bilateral staged
thoracotomies, and Clamshell incisions are the surgical treat-
ment 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 pos-
terior 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 post-
operative 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 pre-
operative 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
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 cystotomycapitonnage 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-
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 complications. 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 antipyretics [18]. This study also shows that perforated hydatid

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**Figure 2. a-d.** Postoperative chest x-ray demonstrating bilateral 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)
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.

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**REFERENCES**