

## The management of postoperative complications in childhood pulmonary hydatid cysts

*Çocukluk çağı akciğer kist hidatiklerinde ameliyat sonrası komplikasyonların yönetimi*

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**Background:** This study aims to evaluate and discuss the postoperative complications of hydatid cysts.

**Methods:** Ninety seven patients (61 male, 36 girl; mean age 10.3 years; range 1 to 16 years) under 16 years of age with hydatid cysts who were operated on between January 2001 and January 2007 in our clinic were retrospectively analyzed. All patients were followed up with physical examination and chest X-ray following surgery. Microbiological culture was collected from the patients with suspected infection. The complications occurred within the first 48 hours following surgery were defined as early complications, while the complications occurred between 48 hours to 30 days were defined as late complications.

**Results:** Ninety of the cysts were unilateral and seven were bilateral. Forty five of the unilateral hydatid cysts were located in the right lung, while the others were located in left lung. Eight patients had concomitant lung and liver hydatid cysts. Within the first 48 hours following surgery, atelectasis was observed in 17 patients (17.5% the most common complication) and these patients underwent bronchoscopi. Postural drainage and nebulization were also administered. One patient developed pneumonia and he was treated with antibiotics. Prolonged air leak was observed in four patients (4.1%) and they were treated with continued tube thoracostomy. Two patients with prolonged air leak were ventilated with positive pressure under general anesthesia. Wound infection was seen in two patients. Regular wound dressing change and antibiotic treatment were performed on these patients. Empyema was occurred in two patients. These patients were treated with antibiotics and continued tube thoracostomy.

**Conclusion:** Atelectasis, which is the most common postoperative complication, should be immediately treated. It must be kept in mind that early treatment of atelectasis prevents the development of more severe complications in children.

**Key words:** Childhood; hydatid cysts; postoperative complication; treatment.

**Amaç:** Bu çalışmada kist hidatiğin cerrahi sonrası görülen komplikasyonları değerlendirildi ve tartışıldı.

**Çalışma planı:** Kliniğimizde Ocak 2001 - Ocak 2007 tarihleri arasında kist hidatik nedeniyle ameliyat edilen 16 yaş altı 97 hasta (61 erkek, 36 kız; ort. yaş 10.3 yıl; dağılım 1-16 yıl) geriye dönük olarak değerlendirildi. Cerrahi sonrası tüm hastalar fizik muayene ve akciğer grafisi ile takip edildi. İnfeksiyondan şüphelenilen hastalardan mikrobiyolojik kültür alındı. Ameliyat sonrası ilk 48 saatte gelişen komplikasyonlar erken komplikasyonlar olarak tanımlanır iken, 48 saat-30 gün içinde gelişenler geç komplikasyonlar olarak tanımlandı.

**Bulgular:** Kistlerin 90 tanesi tek taraflı ve yedi tanesi çift taraflı yerleşimli idi. Tek taraflı kistlerin 45'i sağ taraf akciğer yerleşimli iken, diğerleri sol taraf akciğer yerleşimli idi. Sekiz hastada akciğer kist hidatiği ile eş zamanlı karaciğer kisti vardı. Ameliyat sonrası ilk 48 saatte 17 hastada atelektazi görüldü (%17.5 ile en sık komplikasyon) ve bu hastalara bronkoskopi yapıldı. Postural drenaj ve buhar tedavisi de verildi. Bir hastada pnömoni gelişti, bu hasta antibiyoterapi ile tedavi edildi. Dört hastada uzamış hava kaçağı gelişmesi nedeni ile tüp torakostomi ile tedavilerine devam edildi. Uzamış hava kaçağı olan iki hasta, genel anestezi altında pozitif basınçla ventile edildi. İki hastada yara yeri enfeksiyonu görüldü. Bu hastalara düzenli yara yeri pansumanı ve antibiyotik tedavisi uygulandı. İki hastada ampiyem gelişti. Bu hastalara antibiyotik verildi ve tüp torakostomiye devam edildi.

**Sonuç:** Atelektazi, en sık görülen ameliyat sonrası komplikasyonu olup, hemen tedavi edilmelidir. Çocuklarda atelektazinin erken tedavisinin daha büyük komplikasyonların oluşmasını engellediği akıld tutulmalıdır.

**Anahtar sözcükler:** Çocukluk çağı; kist hidatik; ameliyat sonrası komplikasyon; tedavi.



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Hydatid disease (HD), also known as echinococcosis or hydatidosis, is one of the most serious zoonotic diseases in the world and is caused by the larval stages of various species of the tapeworm of genus *Echinococcus*.<sup>[1,2]</sup> It is seen three times more often in children than in adults, and in studies which have analyzed childhood HD, it was found that males contract the disease more often than females.<sup>[3]</sup>

The postoperative process and complications of HD have not been evaluated much in the literature. While some studies have presented the complications, the management of morbidities has been discussed less, yet morbidity in pediatric patients can be diminished with proper early intervention.<sup>[4]</sup> The aim of this study was to review pediatric patients with pulmonary HD by assessing the clinical features, surgical complications, and management of these complications.

## PATIENTS AND METHODS

Ninety-seven HD patients under 16 years of age who had been operated on between January 2001 and January 2007 were included in the study. The total number of all the patients with hydatid cysts (HCs) was 856, and there were 112 cases of childhood HD. However, we only analyzed 97 of the adolescent patients (61 males, 36 females; mean age 10.3 years) because we could not get detailed information on the other 15. Complications occurred in 17 patients (17.5%), with 11 of these being male (11.3%) and six being female (6.1%). In these patients, cysts were located in the left lung in eight patients (8.2%), in the right lung in six patients (6.1%) and bilaterally in three patients (3.09%). The average length of hospital stay was 22.17 days. Both patients with and without complications are shown in Table 1. Eleven patients underwent a radiological evaluation, including chest roentgenogram, thoracic computed tomography (CT), and abdominal ultrasonography (USG). None

**Table 1. Comparison of patients with and without complications**

	With complications	Without complications
Number of patients	17	80
Gender		
Male	11	50
Female	6	30
Side		
Left	8	37
Right	6	39
Bilaterally	3	4
Length of hospital stay (days)	22.17	11.22
Perforated	8	5

of the patients had atelectasis preoperatively. Casoni's skin test, the Weinberg complement fixation test, and eosinophil counts were not routinely used. The results of these tests did not affect our surgical decision as the radiological findings were the major factors taken into account regarding the need for surgery. Cysts that were 10 cm in diameter on CT were accepted as giant cysts. All patients were operated on, and cystotomies, partial pericystectomies, and capitonnage were the most commonly performed surgical procedures. During surgery, the cyst was isolated with compresses soaked in a povidone-iodine solution, and attention was given to prevent spillage of the cystic contents into the thorax. The cystic fluid was aspirated with 12-14 gauge needles from the place where the lung parenchyma was the thinnest. Then a pericystectomy was performed, and all of the cyst membrane was removed. The cystic cavity was wiped with povidone-iodine-soaked sponges. Bronchial openings were sutured, and cyst cavities were capitonnated with 3/0 and 2/0 absorbable sutures. Next, the bronchial openings were closed with "Z" sutures, and cyst cavities were capitonnated from the bottom upwards with circular sutures.

All of the patients were admitted to the intensive care unit (ICU) postoperatively and were checked by examinations and chest X-rays. Effective analgesic treatment, prophylactic antibiotics, and mucolytic drugs were given routinely.

A bronchoscopy was performed if atelectasis was present, but it is difficult to determine micro-atelectasis with a chest X-ray. Preoperative radiographs can be helpful for comparison. Hypoxemia, tachypnea, dyspnea, tachycardia, fever, inspiratory crackles, and bronchial sounds can be determined with an examination.

In addition, thoracic CT was performed for each patient that had a prolonged air leak, an opened, capitonnated cystic cavity, or empyema.

## RESULTS

Ninety-seven patients with a pulmonary hydatid cyst were operated in our clinic. The admission complaints were cough (n=41), chest pain (n=29), expectoration of the cyst and sputum (n=23), fever (n=21), dyspnea (n=18), gastrointestinal system disturbance (n=10), myalgia (n=9), sweating (n=3), and axillary lymphadenopathy (n=1). Two patients were asymptomatic.

The HCs were located in the right lung in 45 patients (upper lobe in 18, middle lobe in four, lower lobe in 23), in the left lung in 45 patients (upper lobe in 23, lower lobe in 22), and bilaterally in seven patients. Eight had synchronous lung and liver HCs, but in only one of these

**Table 2. Surgery type, localization, and cyst structure**

Surgery type	n	Localization	n	Structure	n
Thoracotomy-cystectomy and capitonnage	88	Lung+liver	7	Giant	22
Thoracotomy-enucleation and capitonnage	1	Lung+liver+brain	1	Ruptured	13
Thoracotomy-cystotomy and capitonnage-decortication	5	Right hemithorax	45	Giant and ruptured	4
		Upper lobe	18		
		Lower lobe	23		
		Middle lobe	4		
Thoracotomy-wedge resection	2	Left hemithorax	45	Multiple involvement in the same lung	5
		Upper lobe	23		
		Lower lobe	22		
Thoracotomy-middle lobectomy	1	Bilateral	7		

was the cyst left-sided. Another patient had synchronous lung, liver, and brain HCs. Five had more than one cyst in the same lung, 13 had ruptured cysts, and 22 had giant cysts. Of the 22 cases with giant cysts, four were ruptured. The largest giant cyst measured 20x20x15 cm in an 11-year-old girl. One patient had multiple cysts measuring 1 cm in diameter in the parenchyma, for which we speculate that the etiology was bronchial spreading. We performed cystectomy and capitonnage in 81 patients. We also performed a wedge resection in two patients, partial decortication in five patients, a middle lobectomy in one patient, and enucleation in the another (Table 2). In patients with bilateral HCs, consecutive bilateral thoracotomies were performed in different sessions instead of a median sternotomy. When all of the cysts were non-ruptured on the bilateral side, surgery was performed on the largest ones first. In seven patients with synchronous liver and right lung HCs, a phrenotomy, cystotomy, and capitonnage were performed in the same session. In addition, one patient with synchronous liver and left lung HCs had consecutive bilateral thoracotomies in different sessions.

### Complications

We considered complications that occurred in the first 48 hours after surgery to be early postoperative complications. Complications that occurred between 48 hours and 30 days after the operation were considered to be late postoperative complications.

Early postoperative complications were seen in 17 patients (17.5%) (Tables 3 and 4), and atelectasis was present in all of them. Improvement was seen in 13 of the patients with repeated bronchoscopies, and they were then discharged without any further issues (Figures 1 and 2). The lungs of two patients were hyperventilated with positive pressure under general

anesthesia by using a rigid bronchoscopy after the secretions were cleaned. Only one patient had pneumonia secondary to atelectasis, and recovery occurred with proper antibiotic therapy. Prolonged air leak was seen in four patients (4.1%). Of these, two also had wound infection and two had empyema. One of the empyema patients had undergone a middle lobectomy, and, therefore, also had postoperative bronchopleural fistula and prolonged air leak. Clinical improvement could not be obtained despite a second tube thoracostomy and proper antibiotic therapy, so fistula repair and thoracomyoplasty were performed. This patient was lost due to pneumonia in the contralateral lung in the fourth postoperative year. The other empyema patient recovered with a prolonged catheter thoracostomy (Table 4).

The capitonnated cystic cavity of two patients opened in the late postoperative period (Figure 3). We think this occurred due to either inadequate capitonnage or the use of the thinner absorbal 4/0 sutures used during the procedure. One of these patients was re-operated on due to hemoptysis, and a cavitectomy and capitonnage were performed. The other was treated conservatively.

### DISCUSSION

Children present a different physiology and anatomy of the respiratory system along with a respiratory control

**Table 3. Postoperative complications**

Complications	n
Atelectasis	17
Pneumonia	1
Wound infection	2
Prolonged air leak	4
Empyema	2

**Table 4. Analysis of patients with complications**

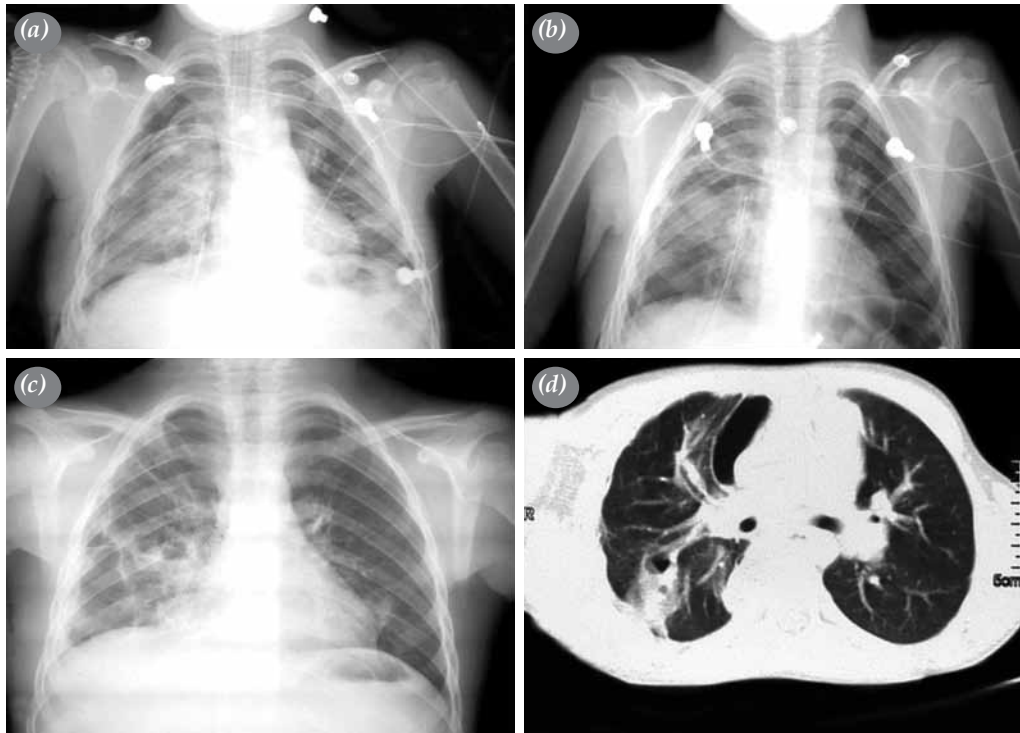
Patient	Age/ gender	Operation	Side	Size (cm)	Length of hospital stay (day)	Perforated	Complain
1	5/M	1- Left thoracotomy + cystotomy + capitonnage 2- Left re-thoracotomy + air leakage control 3- Right thoracotomy + cystotomy + capitonnage	Bilateral	L: 6x6x5 R: 5x5x4	19	+	Fever
2	11/F	1- Left thoracotomy + cystotomy + capitonnage 2- Right thoracotomy + cystotomy + capitonnage + phrenotomy + liver cystectomy + phrenoraphy	Bilateral	L: 8x7x7 R: 5x5x4	17	-	Dyspnea, fatigue
3	4/M	Left thoracotomy + cystotomy + capitonnage	Left	8x7x7	13	+	Hemoptysis, cough
4	9/M	Right thoracotomy + cystotomy + capitonnage	Right	4x4x3	13	+	Nause, vomiting, sputum
5	10/M	Left thoracotomy + cystotomy + capitonnage	Left	3x3x3	14	-	Fever, cough
6	14/M	Right thoracotomy + cystotomy + capitonnage + phrenotomy + liver cystectomy + phrenoraphy	Right	6x6x6	11	-	Right chest pain
7	7/F	Left thoracotomy + cystotomy + capitonnage	Left	10x10x10	10	+	Hemoptysis
8	15/F	Left thoracotomy + cystotomy + capitonnage	Left	8x7x7	8	+	Left chest pain, hemoptysis
9	10/M	1-Left thoracotomy + cystotomy + capitonnage 2-Right thoracotomy + cystotomy + capitonnage	Bilateral	L: 10x10x10 5x4x4 R: 8x6x6 4x4x4 4x4x2	12	-	Chest pain, fatigue
10	4/M	Left thoracotomy + cystotomy + capitonnage	Left	15x10x10	10	-	Right chest pain
11	10/F	Right thoracotomy + cystotomy + capitonnage + phrenotomy + liver cystectomy	Right	8x8x7	8	-	Abdominal pain, fatigue
12	10/F	Right thoracotomy + cystotomy + capitonnage	Right	15x10x10	10	-	Right chest pain
13	14/M	1-Right thoracotomy + cystotomy + capitonnage 2-Right rethoracotomy + upper lobectomy + decortications 3-Right rerethoracotomy + fistula repair	Right	15x10x10	153	-	Fever, cough
14	13/F	Left thoracotomy + cystotomy + capitonnage	Left	10x8x8	15	+	Hemoptysis, cough
15	5/M	Right thoracotomy + cystotomy + capitonnage	Right	15x15x10 6x5x3 3.5x2x2	8	-	Cough
16	14/M	1-Left thoracotomy + cystotomy + capitonnage 2-left rethoracotomy + wedge resection	Left	15x15x10	53	+	Hemoptysis
17	14/M	Left thoracotomy + cystotomy + capitonnage	Left	4x4x4	53	+	Hemoptysis, chest pain

mechanism than it is found in adults; thus, different types of anesthesiological and surgical procedures should be considered for them. Moreover, they may have disparate pre- and postoperative periods, and the complications may vary.<sup>[5]</sup> Furthermore, thoracic surgery entails some crucial aspects that need to be assessed carefully in children who underwent thoracic procedures, such as positioning, single lung ventilation, exposure of the thorax, lung collapse, the presence of blood, and secretion in the airways.<sup>[6]</sup>

The majority of pulmonary HCs (51.5%) are located in the left hemithorax while 44% are found in the right hemithorax, and 4.5% occur bilaterally.<sup>[5,7]</sup> The most commonly involved lobe is the right lower lobe

(38%) as it has more blood flow than the others.<sup>[5,8]</sup> In our study, the most commonly involved lobes were the right lower and left upper lobes (24%). In the literature, involvement of the liver in lung HD patients occurs at a rate of 6-11%,<sup>[5,6]</sup> and our rate of 8% was within this same range.

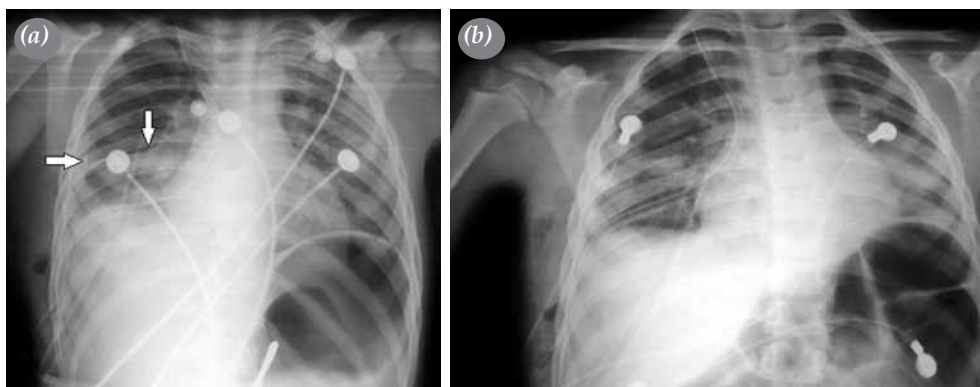
Safioleas et al.<sup>[9]</sup> reported that the most commonly seen complications in surgery for HD involving the removal of HCs were atelectasis (4%) and wound infections (4%).<sup>[10]</sup> However, their study included adults and did not mention morbidity management. Kürkçüoğlu et al.<sup>[3]</sup> reported that the complication ratio was 10% and that the most prevalent complications were wound infection and prolonged air leak. Many



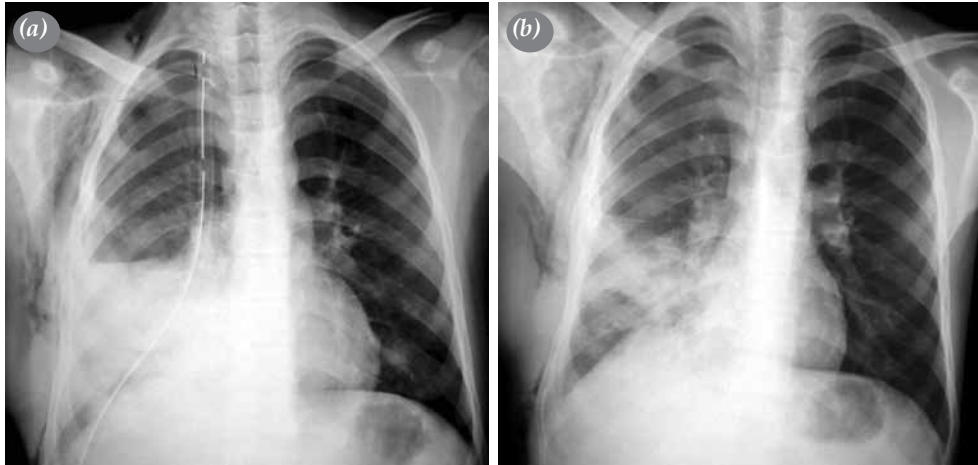
**Figure 1.** (a) The postoperative chest X-ray showed atelectasis. The patient could not be extubated after surgery. (b) The atelectasis partially resolved, and the patient was extubated after the bronchoscopy. (c) A chest X-ray before discharge from the hospital showed an opened, capitonnated hydatid cyst. (d) A computed tomography image of the opened, capitonnated hydatid cyst.

studies in the literature have reported that atelectasis is the complication seen most often, as was the case in our study. Furthermore, atelectasis was present in the 17.5% of patients with complications in our retrospective study. However, this rate decreased to 4.1% after treatment. The causes of atelectasis in pediatric patients include the following: a lack of patient compliance and lack of appropriate analgesia resulting in retention of the secretion, dysfunction of the respiratory muscles, chest wall instability, and

dislocation of the endotracheal tube during surgery. Oozing of blood and other fluids from bronchial openings in the cyst cavity into the bronchial system may appear as postoperative edema and atelectasis. To avoid this condition, frequent aspiration of the cyst cavity during surgery should be performed along with ensuring that the anesthesiologist performs ventilation with positive pressure just before closing the thoracotomy to be sure that there is no atelectatic area in the lungs.



**Figure 2.** (a) Postoperative right middle lobe atelectasis. (b) Chest X-ray showing atelectasis which decreased after repeated bronchoscopy.



**Figure 3.** (a) Atelectasis seen on chest X-ray. (b) Atelectasis was resolved after a bronchoscopy.

Stretching of the chest wound during normal respiration causes pain, and the expiratory muscles contract to decrease pain and do not relax, even during inspiration. As a result, a continuous state of expiration is encountered, and pain-provoking cough reflexes are inhibited. This results in the accumulation of secretions and occlusion of the airways.<sup>[11]</sup> Atelectasis may be treated via ventilatory physiotherapy and inhalation of vapor and bronchodilator agents. However, unresolved atelectasis warrants a bronchoscopy.<sup>[4]</sup> The secretions were cleaned via a rigid bronchoscopy under general anesthesia or by a fiberoptic bronchoscopy (FOB) with local anesthesia for those who could tolerate this procedure. After the bronchoscopy, dramatic expansion in the lung was achieved. If FOB cannot be done or expansion cannot be achieved via a bronchoscopy, the secretions of the patients are aspirated repeatedly by a rigid bronchoscopy earlier during the surgery. Additionally, ventilation with positive pressure for breakage of resistance is an advantage of the rigid bronchoscopy. Untreated atelectasis inhibits expansion of the lung and constitutes air leakage, and this lays the foundation for empyema.

One of the most challenging complications for a thoracic surgeon is prolonged air leak. The cause may be air leak from the parenchyma or bronchial opening.<sup>[12]</sup> In addition, we observed that prolonged air leak secondary to atelectasis results in empyema due to the contamination in the pleural cavity at a later period. On the other hand, the pleural cavity can be contaminated with pneumonia secondary to atelectasis. Furthermore, empyema results in atelectasis. We observed prolonged air leak, which we defined as air leak continuing for more than seven days, in four patients. Two of these needed a re-thoracotomy. One was performed on the patient who underwent the middle lobectomy, and the cause was identified as

bronchopleural fistula. The cause in the other patient was leakage from the parenchyma and cyst periphery. Empyema developed in these patients, and decortication via a thoracotomy was performed. Our results led us to the conclusion that atelectasis may be a predecessor to all other complications. If the patient has prolonged air leak, the complication is considered as one advanced stage.

In pediatric patients with HC, the treatment of choice is parenchyma-saving surgery, and if possible, a resection should not be performed. Atelectasis, which is the most common complication, should immediately be treated, and it should be kept in mind that it may be a predictor of greater complications in children. The decision to re-operate may be made in cases of prolonged air leak in order to prevent advanced complications.

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