

*Tanaffos* (2008) 7(4), 11-18

©2008 NRITLD, National Research Institute of Tuberculosis and Lung Disease, Iran

# Presentation of a Surgical Technique and Results in the Treatment of Lung Hydatid Cyst

Azizollah Abbasi Dezfouli <sup>1,2</sup>, Mehrdad Arab <sup>1,3</sup>, Saviz Pejhan <sup>1</sup>, Abolghasem Daneshvar Kakhki <sup>1</sup>, Mohammad Behgam Shadmehr <sup>1,2</sup>, Roya Farzanegan <sup>1</sup>, Golbahar Abbasi Dezfouli <sup>1</sup>

<sup>1</sup> Department of Thoracic Surgery, <sup>2</sup> Lung Transplantation Research Center, <sup>3</sup> Tracheal Disease Research Center, NRITLD, Shahid Beheshti University M.C, TEHRAN-IRAN.

## ABSTRACT

**Background:** Due to the diversity of surgical techniques and great differences in the incidence of pulmonary hydatid cysts around the world, the most appropriate surgical technique has not yet been substantiated. We presented the results of a single surgical technique in a consecutive group of patients and described the technical details.

**Methods and Materials:** The study was conducted during an 8-year period on 125 patients with a mean age of 33.1 yrs that were suffering from pulmonary hydatid cysts. The surgical procedure included: thoracotomy, opening the cyst, removing all its contents, removal and suturing the bronchial openings. The pericyst cavity left open into the pleural space. Surgical complications, morbidity and mortality rates were evaluated. In addition, the recurrence rate was assessed post-operatively by periodic chest radiographs.

**Results:** There were a total of 181 cysts in 125 patients; 156(86.2%) cysts were operated via the above-mentioned technique and for 25 cysts due to destruction of parenchyma, lobectomy (n=9) or segmentectomy (n=2) was performed. Complications included prolonged air leakage in 4, persistent pleural effusion in 1 and pulmonary embolism in 1 patient. There were five recurrences (2.8%) and 1 death due to pneumonia and sepsis.

**Conclusion:** Thoracotomy, evacuation of the endocyst and closure of the bronchial openings comprise an appropriate surgical technique for the treatment of hydatid cysts of the lung. (*Tanaffos* 2008; 7(4): 11-18)

**Key words:** Hydatid disease, Lung, Surgery, Treatment

## INTRODUCTION

Different parts of pulmonary hydatid cyst are schematically demonstrated in Figure 1. The pericyst portion is made of the host tissue in the form of a

concentrated fibrous layer, which is formed around the parasite structures. Most authors do not advice resection of the pericyst; however, all of the parasite structures that include laminated membrane, germinative membrane, intracystic fluid containing scoleces, and sometimes daughter cysts and hydatid sands should be removed (1,2). Different surgical

Correspondence to: Abbasi Dezfouli A

Address: NRITLD, Shaheed Bahonar Ave, Darabad, TEHRAN 19569, P.O:19575/154, IRAN

Email address: [abbasidezfooli@nritld.ac.ir](mailto:abbasidezfooli@nritld.ac.ir)

Received: 25 December 2007

Accepted: 4 August 2008

techniques are used for the resection of pulmonary hydatid cysts (3-7). The differences between these techniques are summarized in Table 1 based on the following questions:

- 1) How to remove the parasite structures?
- 2) How to manage the pericyst cavity in the lung?

Cystotomy and removal of contents, enucleation of intact cyst from the pericyst and pulmonary resections (wedge resection, lobectomy and rarely pneumonectomy) have been used for removal of the parasite structures (8, 9).

Different methods and materials have been employed to prevent infestation of live scoleces to the adjacent tissues during the surgical operation, including use of scolicedal materials before or after the evacuation, freezing the cyst, and use of electric or radioactive waves (10,11). For the management of the pericyst cavity, different methods have been used including: Leaving the cavity open into the pleural space after suturing the bronchial openings, closure of the cavity with or without suturing the openings, and occasionally eliminating the cavity by resecting the pericyst (12). The diversity of these techniques is due to the differing prevalence of the disease around the world and also due to the fact that prospective clinical studies for comparison of these different methods are difficult. Considering the high prevalence of this disease in Iran and using a single surgical technique for treatment in our department, we presented the outcomes of our patients and described the technical details.

## MATERIALS AND METHODS

From Sep. 1997 to Aug. 2005 all patients who underwent operation for lung hydatid cyst were entered the study. There were 60 females and 65 males with a mean age of 33.1 years (range 7-80 yrs,

$SD = \pm 17.6$ ). The diagnosis of hydatid cyst was based on history, chest x-ray and CT-scan. We do not usually use serologic tests for diagnosing hydatid cysts, but some patients had obtained these tests before referral to our center. Also, we do not administer anti-parasitic drugs (such as albendazole) routinely before or after surgery. Bronchoscopy was performed in all patients under general anesthesia before beginning the operation. Afterwards, a double lumen endo-tracheal tube was inserted and in the lateral position, a posterolateral thoracotomy incision was made. After opening the chest wall and releasing the adhesions, manipulating the lung should be avoided until evacuation of the cyst is finished. Before any surgical approach to the cyst, the adjacent tissues were covered by towels soaked in 0.5 percent solution of silver nitrate. Then the cyst was aspirated by a thin needle (Figure 2A). If the aspirate was a colorless transparent fluid, the diagnosis of hydatid cyst was confirmed. Without extracting the needle, the cyst wall was punctured by a trocar at a place where the lung parenchyma was the thinnest (Figure 2B) and the contents of the cyst were evacuated by a powerful suction through this trocar. There was another suction ready to be used by the assistant to remove any fluid leaking around the trocar (Figure 2C). After evacuating the cyst contents, the cyst wall collapsed. Then the pericyst was incised and opened. All of the remaining contents including portions of the laminated membrane and the remaining fluid were removed under direct vision (Figure 2D).

The pericyst cavity was washed with normal saline then, it was thoroughly inspected for any residual debris. Afterwards, a thin catheter was inserted into the bronchus through the bronchial opening within the pericyst cavity so that the parasitic materials inside of the bronchus could be

suctioned out (Figure 2E). At this time, the anesthesiologist was asked to ventilate the operated lung to detect the exact location of all bronchial openings by observing air bubbles in the saline solution (Figure 2F). All openings were closed by fine sutures (Figure 2G). Minimal air leaks from tiny openings and injured surfaces of the lung needed no treatment as they healed spontaneously. After closure of the bronchial openings the pericyst was left open into the pleural space. Resection of the pericyst was avoided unless there were excessive amounts of the extra-parenchymal portion that could be removed easily without parenchymal damage. One or two chest tubes were inserted and the chest was closed. In case of multiple cysts in the lung, first, all cysts were evacuated as mentioned above, then the bronchial repair was done with all pericyst cavities left open into the pleural space. Lobectomy was performed only in cases where the major portion of that lobe was destroyed as a result of infection and preserving the lobe was accompanied by the increased risk of bronchopleural fistula and empyema. Simple wedge resection was employed for small cysts located in the lung periphery. In cases whose cysts had been located in both sides, those with a ruptured cyst or a huge cyst with an immediate probability of rupture and in case of developing complications like hemoptysis and infection, operation performed at the first step. Nonetheless, the surgeon's clinical judgment played an important role to define which side should be operated first. The only situation in which surgery had been performed on both lungs via a single incision was that cysts had been placed in middle-superior zone of the lungs with an anterior position.

After discharge from the hospital, the patients were followed up periodically by regular visits to the hospital where a simple chest x-ray was obtained. If signs of recurrence were detected on the chest x-ray,

further evaluations with CT-scan were done.

This study was approved by the medical ethics committee and the editorial board of the National Research Institute of Tuberculosis and Lung Diseases (NRITLD).

## RESULTS

During the study period, 129 surgical operations were performed on 125 patients for the management of pulmonary hydatid cysts. The number of resected cysts, their location and type of surgical procedures are summarized in Figure 3 as well as Tables 1 and 2. All operations were done through a posterolateral thoracotomy incision except for 2 cases with bilateral cysts which were operated on through a clam shell incision and 2 other cases which were operated through a midsternotomy incision. Other patients with bilateral cysts were operated in two stages with two different thoracotomies. The postoperative hospitalization period was 3 to 23 days (mean 7.1 days). At the time of surgery (while evacuating the cyst) 2 patients developed rapid decrease of oxygen saturation associated with increased resistance of the airway as the result of cyst components entering the bronchi. This problem could not be corrected by suctioning the bronchi through fiberoptic bronchoscopy; therefore, the patients' position on the operating bed was changed and by rigid bronchoscopy the bronchi were suctioned and cleaned. They were then repositioned and the operation continued. Early postoperative complications (in the hospital) included 4 cases of prolonged air leak from the chest tube (for more than 7 days), 1 case of fluid accumulation in the pleura after lobectomy and 1 case of pulmonary embolism. These complications were treated accordingly. Complications which occurred late after discharging from the hospital included one case of persistence of

the air fluid level in the pericyst cavity on chest x-ray and 5 cases of recurrence (one at the same pericyst and 4 in the same lung). One death occurred in the hospital in a patient with a large hydatid cyst and developed pneumonia and empyema postoperatively. She died as the result of progression of infection and septicemia in spite of adequate supportive therapy. Mean duration of follow-up was 13.8 months (range 1-96 months); 24 patients (19.2%) were lost during the follow-up. Chi-square test showed that there was no significant correlation between the location of the cysts and the risk of cyst rupture. ( $P=0.3$ )

**Table 1.** Surgical techniques for treatment of pulmonary hydatid cyst

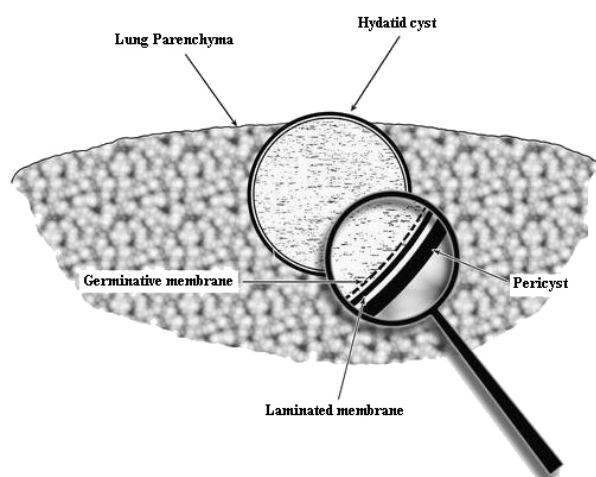
- 1) Cystotomy\*, removal of contents (cystectomy), suture closure of bronchial openings, leaving pericyst open into the pleural cavity.
- 2) Cystotomy, removal of contents (cystectomy), suture closure of bronchial openings, closure of the pericyst (capitonage)
- 3) Cystotomy, removal of the contents, removal of the pericyst, closure of bronchial opening.
- 4) Cystotomy, enucleation of intact cyst from the pericyst, closure of bronchial openings, leaving pericyst open into the pleural cavity.
- 5) Enucleation of intact cyst from the pericyst, closure of bronchial openings, closure of pericyst (capitonage).
- 6) Wedge resection of the lung.
- 7) Major resections (lobectomy).

\* Cystotomy means to incise the pericyst at a site where the overlying parenchyma is thinner.

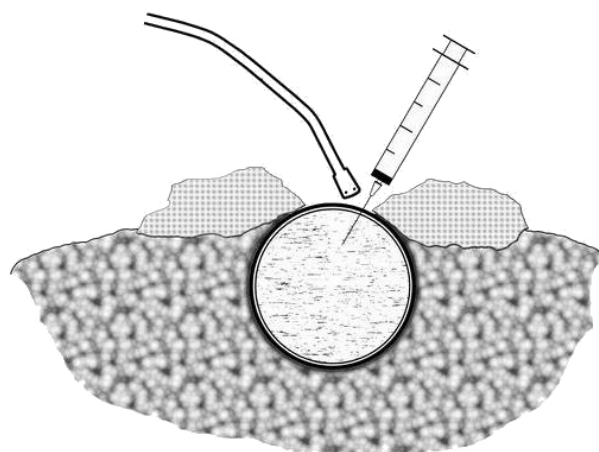
**Table 2.** Surgical techniques used for 181 cysts.

Technique	Number of cyst	Percent
Cystotomy, removal of contents, closure of bronchial openings	156	86.2%
* Lobectomy	9	5 %
Wedge resection	14	7.7 %
Segmentectomy	2	1.1 %
Total	181	100%

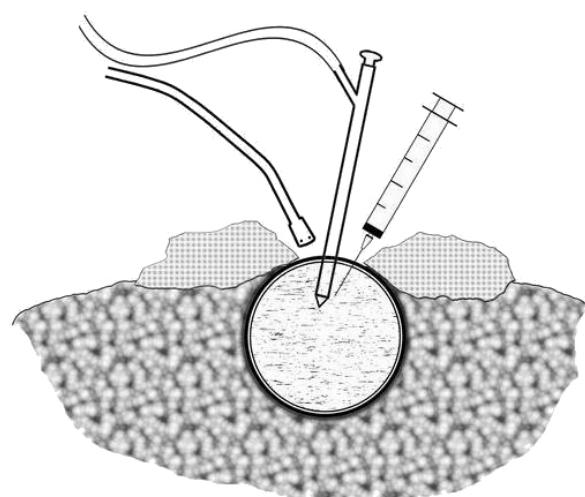
\* Six lobectomies were performed for 9 cysts in 6 patients.



**Figure 1.** Schematic diagram of a hydatid cyst of the lung.



**Figure 2 A.** Aspiration of the cyst by a fine needle.



**Figure 2 B.** Cyst contents are evacuated by a suction-trocar.

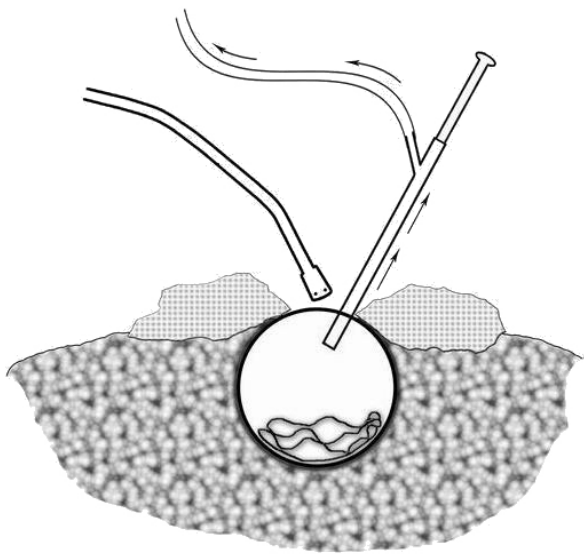


Figure 2 C. A second suction should be available to remove any leakage.

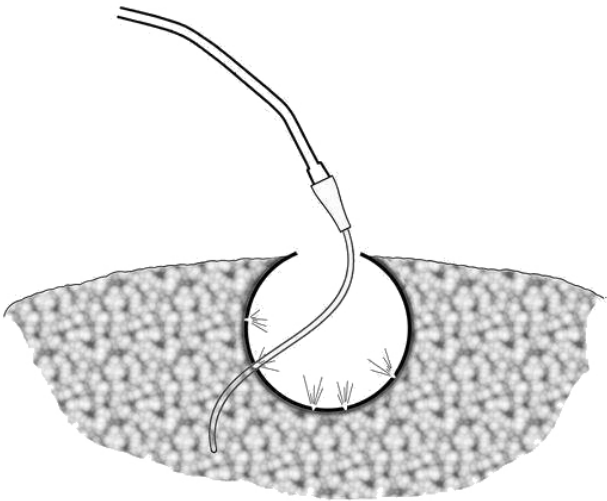


Figure 2 F. Ventilation of the lung while pericyst is filled with saline is a simple way to find bronchial openings.

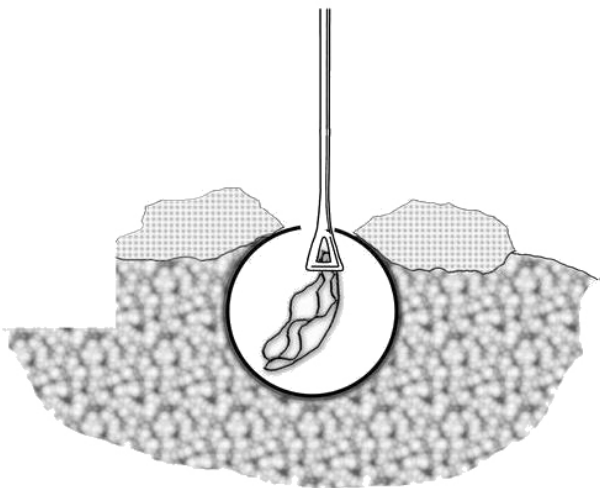


Figure 2 D. Remaining contents are removed under direct vision.

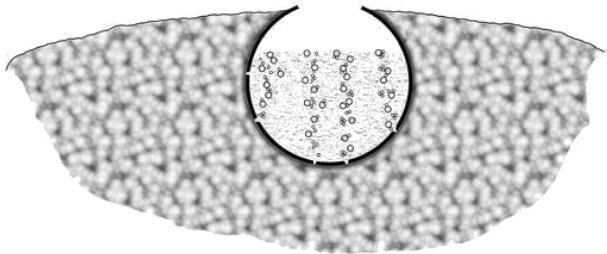


Figure 2 E. Evacuation of bronchial contamination.

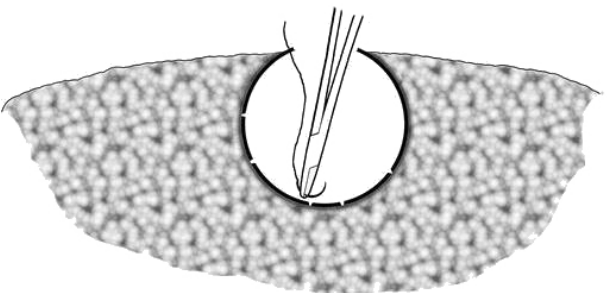


Figure 2 G. All openings are closed by fine sutures.

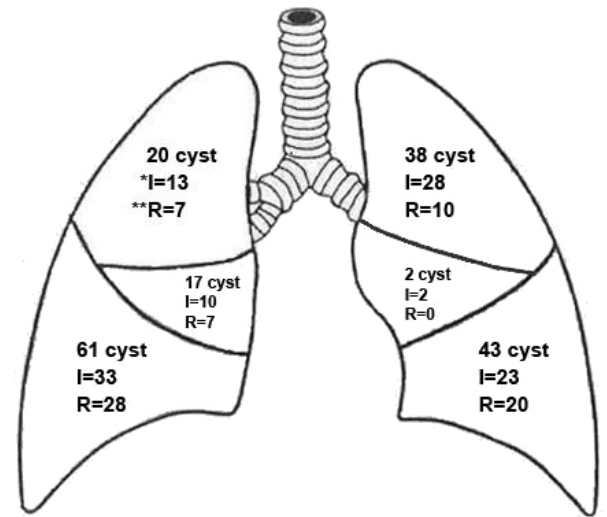


Figure 3. Characteristic of the cysts.  
\* I= Intact. □ R=Ruptured

## DISCUSSION

We believe that the following principles should be observed during surgical treatment of the hydatid cyst:

- 1) All the parasite components should be removed. These include laminated membrane, germinative membrane, intracystic fluid, floating scoleces and daughter cysts.
- 2) Bronchial openings in the pericyst should be securely sutured.
- 3) Dissemination of the fluid and live scoleces around or into the pleural space should be avoided.
- 4) Pulmonary resection is indicated only if the related parenchyma is destroyed which is rare.
- 5) Resection of the pericyst is not necessary and should be avoided since it may cause bleeding and increased air leak.
- 6) Any type of anti-scolicidal materials should be prevented from entering the bronchi. These materials can cause severe damage to the epithelial lining of the bronchi and alveoli.

Appropriate surgical exposure is necessary in order to follow the above-mentioned points. To reach this goal a posterolateral thoracotomy approach provides the maximal exposure. In case of small peripheral cysts, small incisions could be performed; but in case of a large cyst or multiple cysts, small incisions and minimal exposure may be associated with a greater risk of contamination of the surrounding tissue by hydatid fluid and live scoleces. Also, complete evacuation of the cyst from the residual particles and closure of the bronchial openings cannot be performed efficiently through small incisions. Before evacuation of the cyst the surrounding tissue should be covered by towels and gauze preferably soaked with scolicidal materials. This will kill the live scoleces if they are present. In thoracoscopic surgery it is difficult to cover the

surrounding tissue during evacuation. Therefore, there is a greater risk of infestation of the surrounding tissues. Bronchial openings which are usually located in the pericyst cavity between the folds are difficult to repair through a small incision or by thoracoscopic surgery. For this reason we believe that thoracoscopy is not a good choice for management of pulmonary hydatid cysts. Injection of anti-scolex materials into the cyst cavity before its evacuation is not a good practice and is dangerous. At the time of injection the cyst may rupture or the fluid may leak around the site of needle insertion. Also, injection of these materials before evacuation of the cyst causes quick dilution and neutralization, and they may enter larger bronchi and go to the opposite lung bronchi. In a study conducted by the author, the mean pressure of the hydatid cysts was 45 cm of water in liver cysts and 32 cm of water in lung cysts (13). Therefore, there is always some risk of sudden rupture of the cyst during evacuation by any surgical technique. Through our method, the risk of unwanted rupture is low (because of good access and use of a trocar-suction). In case of rupture the risk of contamination is also minimal. This is not true for thoracoscopy or enucleation. In the latter 2 techniques, unwanted ruptures result in remarkable and uncontrolled contamination of surrounding tissues and pleural cavity. In an experimental study conducted by the author, it was demonstrated that all commonly used scolicidal materials are detrimental to the epithelial lining of the biliary channels (14). Therefore, we believe it is not acceptable to irrigate the pericyst cavity with scolicidal materials even after evacuation of the cyst, because there is still a risk of these substances entering the airway. Repeated irrigation of the empty cavity with normal saline solution can effectively remove the scoleces remaining in the cavity. This is performable only if

the surgeon is able to thoroughly inspect and irrigate the empty cavity in a suitable position with adequate exposure. Closure of the bronchial opening in the pericyst cavity is an important part of the surgical procedure. Although there are many openings, a small number of them with larger diameters can cause increased air leak postoperatively if not closed properly. In our study, 262 bronchial fistulas were sutured in 54 patients. To close these openings, fine sutures should be applied thoroughly under optimal exposure. This cannot be properly performed through a small incision. Suturing these openings through thoroscopic surgery is difficult as well. Amongst the common mistakes in surgical operation of the hydatid cyst is resection of the host tissue and intact lung parenchyma. In fact, other than resecting the aforementioned parasitic components no other structure needs to be removed. For example, resection of the thick fibrous layer forming the cyst wall (pericyst) can cause severe bleeding and air leakage from the bare surface of the lung postoperatively. This bleeding can be dangerous in large cysts. This fibrous membrane is made of the host tissue and leaving it unresected does not cause any complications. With lung expansion gradual postoperative elimination of the pericyst cavity is usually expected. Of the 125 patients, only one case of remaining air fluid level on chest radiography without any symptoms was seen. Although, performing a wedge resection seems feasible and appropriate for small peripheral hydatid cysts, it is not so in most of the cysts and may sacrifice a major portion or all of one lobe. Performing lobectomy in surgical treatment of hydatid cysts is often an unacceptable sacrifice of a major part of intact lung parenchyma which should never be a routine practice. In rare cases lobectomy may be required; in our experience only 6 lobectomies for resection of 9 cysts were performed. They were mostly large cysts

that had ruptured preoperatively, or a large infected cavity had formed and major parts of a lobe had been damaged. Even in the presence of multiple cysts, lobectomy is not usually indicated because these cysts are usually located in different lobes or separate portions of a single lobe. Another common practice is simple closure of the pericyst cavity by sutures that are inserted from the bottom up (capitonage). In our opinion this is not necessary; in Turna's study this was not beneficial (15). Capitonage causes a blind contaminated cavity which remains in the lung and its complication can exceed that of an open cavity into the pleural space.

## REFERENCES

1. Saidi F. The Parasite, Historical Perspective. In Saidi F. Surgery of Hydatid Disease. W.B. Saunders. Philadelphia - London - Toronto ; 1976; 1-29.
2. Saidi F. Echinococcal Cyst in Mastery of Surgery by Baker RJ, Fischer JE. Lippincott Williams and Wilkins; 2001; 1082-1099.
3. Aletras H, Symbois PN. Hydatid Disease of the Lung in General Thoracic Surgery by Shields TW, LoCicero J, Ponn RB. Lippincott Williams and Wilkins. 2000; 1113-1122.
4. Saidi F. Hydatid Cyst of Lung. In Saidi F. Surgery of Hydatid Disease. WB Saunders. Philadelphia- London-Toronto: 1976; 181.
5. Ugon AV, Victoria A, Suarez H, Marcalin I. La Lobectomia en el Tratamiento de las Secuelas del Quiste Hidatice de Pulmon. *Boln Soc Chirug Uruguay* 1964; 17: 465-70.
6. Orueta A, Fau LF, Montero A, Prieto J, Duarte PG. Surgical treatment of hydatid cysts of the lung. *Br J Dis Chest* 1974; 68 (0): 183- 92.
7. Perez- Fontana V. Nuevo Metodo de Uperar en el Quiste Hidatico Del Pulmon. *Arch Podiatr Uruguay* 1948; 19: 5-36.
8. Isitmangil T, Sebit S, Tunc H, Gorur R, Erdik O, Kunter E, et al. Clinical experience of surgical therapy in 207 patients

- with thoracic hydatidosis over a 12-year-period. *Swiss Med Wkly* 2002; 132 (37-38): 548- 52.
9. Novick RJ, Tchervenkov CI, Wilson JA, Munro DD, Mulder DS. Surgery for thoracic hydatid disease: a North American experience. *Ann Thorac Surg* 1987; 43 (6): 681- 6.
  10. Saidi F. Hydatid Cyst of Lung. In Saidi F. Surgery of Hydatid Disease. WB Saunders. Philadelphia- London- Toronto: 1976; 41, 48.
  11. Dalimi A, Ghasemikhah R, Hashemi Malayeri B. Echinococcus granulosus: lethal effect of low voltage direct electric current on hydatid cyst protoscoleces. *Exp Parasitol* 2005; 109 (4): 237- 40.
  12. Shalabi RI, Ayed AK, Amin M. 15 Years in surgical management of pulmonary hydatidosis. *Ann Thorac Cardiovasc Surg* 2002; 8 (3): 131- 4.
  13. Abbasi A, Saidi F. The pressure within hydatid cyst. *Iranian Journal of medical sciences* 1989; 14(1): 33- 7.
  14. Abbasi A, Shishineh P, Shadmehr MB, Ghaffarnejad MH. Early and late effects of scolicial agents on liver and bile ducts an experimental study. *Iranian Journal of Medical Science* 1991; 16(1,2): 36- 9.
  15. Turna A, Yilmaz MA, Hacıibrahimoğlu G, Kutlu CA, Bedirhan MA. Surgical treatment of pulmonary hydatid cysts: is capitonnage necessary? *Ann Thorac Surg* 2002; 74 (1): 191- 5.