Medical Journal of the
Islamic Republic of Iran

Volume 18
Number 1
Spring 1383
May 2004

Original Articles: Clinical Science

THE SURGICAL MANAGEMENT OF COMPLICATED PULMONARY HYDATID CYSTS

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ABSTRACT

Iran is recognized as an endemic area for lung hydatidosis. Surgical removal of some hydatid cysts may have serious morbid consequences. To determine the characteristics of these special cysts, a retrospective survey was carried out on patients admitted to Modarres Hospital in Tehran between 1989 and 1998. We have found that ruptured, bilateral, lung located, and giant cysts (>10 cm) cause more surgical and anesthetic complications, thus we named them "complicated cysts".

Of 110 patients, 62(56.4%) had complicated hydatid cysts. Of these, 2 individuals died during anesthesia induction because of hypoxemia. Since sudden severe hypoxemia did not respond to all essential measures, the patients were returned to the supine position (from lateral decubitus position), then rigid bronchoscopy was performed for drainage of cyst secretions and fragments of laminated membrane.

At the time of induction of anesthesia, the contents of a ruptured cyst may spill into the airway and cause hypoxemia and even death. In order to prevent this complication, two different approaches were used: (1)A chest tube was introduced into the cyst through the chest wall and its contents were drained; (2) Patients were placed in the sitting position during intubation.

Double lumen endotracheal tube (DLT) may allow salvage of unaffected lung from inadvertent leakage of cyst contents or laminated membrane emboli formation, but it does not guarantee a safe operation. Thus, rigid bronchoscopy should always be available.

Cystostomy was the most common surgical technique performed in our center (80%). Massive air leakage, bronchial fistula, and permanent lobar collapse were the main indications for lung resection in our series. Surgical complication rates of our study were higher than reports from the west.

Coordination and cooperation of experienced surgeons and anesthetists can result in better outcomes following complicated cyst removal.

MJIRI, Vol. 18, No. 1, 1-5, 2004.

Keywords: Hydatid cyst of lung, sitting intubation, double-lumen endotracheal tube (DLT), residual cavity of hydatid cyst.

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INTRODUCTION

Hydatid disease or echinococcosis, which has been known since ancient times, has a worldwide distribution.[1] The disease is most seen in areas where animal husbandry is current and sheep are more affected. Iran is an area of high hydatidosis endemicity. The disease is caused by *Echinococcus granulosus*; a tapeworm of the genous Echinococcus. *Echinococcus granulosus* develops in the intestine of dogs and other carnivors. Humans act as accidental or incidental intermediate hosts.[2] Cysts are most commonly found in the liver and lung[4] but may be found in any organ. There is no relation between human characteristics (age, sex...) and disease involvement. The growing cyst might not induce clinical manifestations but an increase in cyst size, terminates in either host or parasite death.[3]

Low resistance of the underlying lung tissue provides a parasite with a favorable condition for growth.[5] Chest-X ray is a diagnostic method of choice in an endemic area,[6] while surgery is still known as a certain cure for pulmonary hydatid cyst.[7]

In this retrospective study, we have presented the outcome of surgery and the role of surgical technique in patients admitted to Modarres Hospital between 1989 and 1998.

MATERIALSAND METHODS

"Complicated hydatid cyst" is a term referred to a giant cyst (cyst measuring more than 10 cm), or a ruptured cyst, or bilateral pulmonary hydatid cysts. All patients who met at least one of the afore-mentioned criteria were eligible for the study.

Surgical removal of complicated hydatid cysts could lead to serious complications and even death, thus a full work-up should be completed before the procedure.

Postero-anterior radiographs were the only method of cyst size estimation. The actual size of the cyst was measured during the time of surgery. Although CT scan is the most accurate imaging technique, it had not been performed because of low availability and high cost during the time of study.

Anesthesia

Anesthesia is of greatest importance in surgical removal of complicated hydatid cysts and particularly ruptured cysts. Spillage of laminated membrane could probably occur at any stage of anesthesia including induction, maintenance, positioning and positive pressure ventilation, causing airway obstruction and further hypoxemia and asphyxia.

In adult patients with ruptured hydatid cysts, surgery was performed under general anesthesia and a No. 7.5 PVC left-sided double lumen tracheal tube was used to achieve lung separation in order to limit spreading of cyst contents into the contralateral lung.[8] Double lumen intubation, performed with caution to prevent its potential complications.[9] In some cases, besides careful breath sounds examination, a fiberoptic bronchoscope was used for accurate tube placement confirmation.[13]

For patients with ruptured cysts who presented with severe dyspnea, premedication was given in the operating room just before induction of anesthesia, which consisted of administering intravenous midazolam 2-3mg (a good anesthetic and rapid-acting benzodiazepine) and fentanyl 4-5 μg/kg. This unconventional method was used because of necessity for urgent operation.

Patients were anesthetised with 5mg/kg thiopental. Then intravenous succinylcholine was given at a dosage of lmg/kg for rapid sequence intubation. All the patients had received xylocaine lmg/kg intravenously before intubating.[6]

Electrocardiogram and oxygen saturation were continuously monitored by means of electrocardiography and pulse-oxymetry. In some patients, arterial line access was established using a 19 gauge catheter to analyze arterial blood gases.

Anesthesia was maintained with a mixture of 0.5% halothane and 100%O_2 to which 25-30 μg/kg/hour of fentanyl was added.

Whenever DLT placement failed, the patient was intubated with a sigle-lumen tube. Having the location of the tube examined, it was fixed. Then the patient was rolled to the lateral decubitus position (left or right side) and the location of the tube was rechecked by using fiberoptic bronchoscopy and lung auscultation.

In some cases who presented with ruptured cyst, supine positioning was impossible because of severe dyspnea, productive cough and expectoration of laminated membrane. These patients were intubated in the sitting or semisitting position in order to prevent cyst content aspiration. To our knowledge, no such method has previously been described in the literature. So we named this new technique "sitting intubation".

Surgery

Surgery was always performed under general anesthesia. Patients received prophylactic antibiotics and 100 mg of hydrocortisone before the procedure.

In 45 patients a posterolateral thoracotomy in the fifth or sixth intercostal space was performed. The cyst was exposed and the surgical field and wound were walled off with gauze pads moistened with 0.5% silver nitrate from surrounding structures to prevent inadvertent implantation of scolices. Before any further manipulation, an angiocatheter was introduced into the cyst in order to decrease internal cyst pressure and confirm the diag-

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nosis. Then, cyst contents were aspirated by a trocar. Following cyst material aspiration, the laminated membrane was evacuated completely through the cyst opening. Specimen was taken from either preoperatively perforated cysts or infection-suspected cysts, for gram staining and culture. For giant cysts with high internal pressure, decompressing and evacuating of contents was performed before retractor setting to prevent inadvertent cyst rupture. In bilateral cysts, selection of left or right-sided lung for first thoracotomy relied on surgeon's judgement.

Managing the residual cavity

Management of the residual cavity consisted of pericyst cavity and bronchial opening obliteration. Bronchi of more than 2-3mm diameter were obliterated with 2-0 or 3-0 silk sutures (not very tight). Prior to closing the chest, the operation field was filled with water and the lungs were inflated to 40cm H_2O pressure to examine significant air leaks. The pericystic zone was obliterated with chromic continuous sutures to prevent bleeding.

Fibrous destruction of a large area of underlying lung necessitated lobectomy in a number of patients. Cyst size had not modified our judgment on lobectomy. A chest tube was inserted and complete expansion of the lung was examined before closure of the wound.

Finally, medical treatment, techniques of surgery, and early and late complications were evaluated.

Table I. Nature of complicated pulmonary hydatid cysts.

Nature	Frequency(%)
Giant cyst	29 (46.8)
Ruptured cyst	14 (22.6)
Bilateral cysts	19 (30.6)
Total	62 (100)

Table II. Surgical technique distribution of patients with pulmonary hydatid cyst.

Surgical technique	Frequency(%)
Cystostomy	43 (86)
Lung resection	6 (12)
Capitonage	1 (2)
Total	50 (100)

RESULTS

Between 1989 and 1998, 110 patients including 52 males and 58 females with pulmonary hydatid disease were admitted to our department. Patients ranged in age from 5 to 81 years (mean 35.8±17 years). 62 cases (56.4%) had complicated cysts that are indicated in Table I.

Of 62 patients suffering from complicated hydatid cysts, 12 had received medical therapy or had not been allowed for surgery, therefore, surgery was achieved in 50. Cystostomy was the most common surgical technique in our cases (86%) (Table II).

6 patients underwent lung resection because of persistent lobar collapse (3 cases), massive air leakage (one case), bronchobiliary fistula formation (one case) and multivesicular hydatid cyst (one cyst).

Surgical removal of bilateral cysts (11 cases) was performed via a sequential thoracotomy (6 cases), and clamshell and median sternotomy (5 cases).

Postoperative complications were reported in 11 patients (19%), of whom 8 were early (within 30 days of operation) and 3 were late complications (Table III).

5 patients begun vigorously coughing, as they had

Table III. Postoperative complications of patients with complicated pulmonary hydatid cyst.

	Complication	Frequency
Early complications	unexpanded lung	2
	empyema	2
	wound infection	1
	pneumothorax (following chest tube removal)	1
	fistula	1
	seroma formation	1
Late complications	recurrence	2
	bronchobiliary fistula	1

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been lying supine, therefore they were placed in sitting position for induction of anesthesia. Despite rapid intubating and suctioning, in 2 patients chemical pneumonia developed and they died of ARDS. Two of these 5 had been intubated in the sitting position and tube-drainage was performed immediately. Then the tube cuff was inflated and the position of patients was changed to supine position, thereafter they were rolled to lateral decubitus. For the fifth patient, we shaped a bronchocutaneous fistula (pneumonostomy) by insertion of a chest tube into the cyst and evacuating its contents under local anesthesia.

In an attempt to correct surgery-induced hypoxemia, 15 patients were shown to have unsuccessful tracheal tube drainage. Thus the procedure was stopped and tube drainage was performed through a rigid bronchoscope (after rolling the patient to supine position). Despite all efforts, one patient died in such a situation.

Hospital and operative mortality were 4.8%. 2 patients died because of hypoxemia during induction of anesthesia. One patient, who underwent removal of a multivesicular hydatid cyst and lobectomy, died because of sepsis which developed in the post-operative period.

DISCUSSION

Surgery was necessary for 80% of patients. Traditional treatment of pulmonary hydatid cyst entails surgical removal of the cyst. However chemotherapy (with mebendazole or albendazole) is partially effective and percutaneous needle aspiration is not effective at all. Surgery is still known as the method of choice. To our knowledge, complicated hydatid cyst has not previously been described in the literature.

Of 19 patients with bilateral cysts, 8 had more than five small cysts in each lung. We believed that surgical procedure could lead to serious injuries, thus they were treated by mebendazole at a dosage of 10mg/kg/d. The remaining 11 patients underwent surgical procedure in accordance to the cyst location and surgical judgement. 6 patients underwent sequential thoracotomy over a period of 3 months, where larger or ruptured cysts were resected at the time of first operation. Surgical removal of cysts that were located in anterior and medial segments of the lung was performed via a clamshell or midsternotomy incision. Despite less surgical exposure in comparison with standard thoracotomy, clamshell and midsternotomy approaches had minimal postoperative complications. The most cosmetically accepted scars resulted from the clamshell incision. There were no instances of infection with the midsternotomy approach. Although these two techniques are clean contaminated procedures, the risk of infection must always be considered. Clamshell and midsternotomy approaches have economic benefits because of a short post operation period and only one admission (instead of 2 in thoracotomy).

For the residual cavity, the operative approaches are different.[5,6,10,12,14,17] The most common procedure performed in our 43 series consisted of obliteration of bronchial openings while leaving the cyst wall open.

Factors such as multivesicular pulmonary cysts and also surgeon unacquaintance result in lung resection (lobectomy) in non-endemic areas.[6,12,13] Such radical procedures should be avoided, since hydatid cyst rarely destroys underlying lung parenchyma.[3,10] During our study, 6 patients underwent lung resection. We could not find an obvious reason for failure to expand the lung in 3 cases, despite using a bronchoscope and even performing bronchotomy. There was one patient with massive air leakage in whom obliteration of all bronchial openings was impossible. One had a multivesicular hydatid cyst that had destroyed the underlying parenchyma.

Capitonage method, the surgical closure of a cyst cavity by applying continuous sutures, was not performed in our patients because of two reasons: first, biloptysis occurred in a patient in whom this method was applied previously. During surgery, we noted moderate inflammation at the site of stitches, which had extended to the diaphragm and liver and formed a fistula between the bronchus and biliary tract. Second; it is practically impossible to obliterate the cyst completely by this method.[5,10]

Complications at the time of surgery

Hypoxemia occurred in 20 patients. For these patients measures as follow were performed step by step; tube drainage, changing one-lung anesthesia to two-lung anesthesia, supine positioning, and new DLT replacement. One patient died because of severe hypoxemia. Double lumen intubation was performed in 3 of 20 patients.

During drainage and after decompression of the cyst, gentle manipulation and evacuation of laminated membrane are of utmost importance.[3]

We must emphasize that sometimes, despite applying DLT, cyst contents can spill into another lobe of the same or contralateral lung. A rigid bronchoscope with a suction tube must always be available when detached parts of laminated membrane cannot be drained through a double lumen endotracheal tube.[17]

Post-operative complications

Early complication rate was 16%, which is higher than other reports.[5,10,11,15,16,18] It must be considered that we have studied patients with high possibility of complications; meanwhile, almost all procedures were performed by residents who were supervised by the attending surgeons.

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Failure of lung expansion was the most common post-operative complication. There was no evidence of air leakage and despite respiratory physiotherapy, lungs were not reexpanded up to 7 days after surgery. Persisting air leakage within 5 days of surgery was seen in one patient, in whom repeat surgery showed a missed bronchial opening.

Ruptured hydatid cysts were complicated with empyema and wound infection, although results of microbial cultures were negative.

Recurrence of hydatidosis occurred in 2 cases in the chest wall. This recurrence is undoubtedly due to unapplying Silver Nitrate at the time of surgery.

Chemotherapy wasn't administered in our series as a preventive method of post-operative recurrence. A retrospective study must be instituted to examine the values of medical therapy in recurrence prevention.

CONCLUSION

Results have revealed that complications during surgery are most common in patients with giant and ruptured cysts. Anesthesia is a vital step in surgical removal of these cysts. Co-operation of surgeons and the anesthesiologist is essential to manage critical situations which occur during surgery. Hypoxemia (decrease in oxygen saturation) is the most predictive criterion of the consequential complications thus all attempts must be focused on the cause of hypoxemia. Although DLT decreases airway complications, it does not gaurantee a safe intraoperative course. The most important factor is precise attention of the surgeon and anesthesiologist to the oxygen saturation during the procedure. In cases of ruptured hydatid cyst of the lung, where the patient has continuous expectoration of cyst contents, induction will cause spillage of cyst contents to the other lung and subsequent severe pneumonitis and ARDS. In these situations we suggest intubation in sitting or semisitting position.

Surgical techniques are different in various countries and the choice of technique depends on surgeon experience. We feel (unlike that of others) that cyst size offers no indication for lung resection. Lung parenchyma must be preserved as much as possible because the damaged lung has a great capacity for recovery. Although complications of lung saving procedures (i.e. cystostomy) are reversible, loss of pulmonary reserve following radical procedures is permanent.

In our opinion, insertion of two chest-tubes may prevent failure of lung expansion. In conclusion, we think the source of infection must be controlled for hydatid cyst eradication in endemic areas.

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