

CAPITONNAGE VERSUS NON-CAPITONNAGE SURGERY FOR PULMONARY HYDATID CYST: A HEAD TO HEAD STUDY

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Abstract:

Background: Hydatid disease is a zoonotic disease caused by *Echinococcus granulosus*. In humans, lungs are the second common organ involved after liver. Surgical treatment is considered gold standard. Different surgical techniques has developed. However, head to head comparison of these has not yet been done in our country.

Methods: A prospective randomized study was done in the Department of Thoracic Surgery, National Institute of Diseases of the Chest and Hospital between July 2004 and June 2006. Patients with pulmonary hydatid disease were offered two surgical techniques, enucleation with or without capitonnage. Group I was offered enucleation of cyst with closure of bronchial opening. Group II was offered enucleation of cyst with capitonnage.

Results: 43 patients (age range 7 – 45 years, mean 25 years) having hydatid disease of the lung were enrolled in the study. Group I involved 23 patients, Group II involved 20 patients. There were 15 males and 28 females. Presenting complaints were chest pain [76.7%], cough without sputum [46.5%], haemoptysis [30.2%], respiratory distress [27.9%], cough with sputum [11.6%] while 23.2% were asymptomatic. The right lung was affected more [65.11%] than left lung [23.3%] and bilateral disease was found in 11%. Postoperatively, in group I, 12.9% developed air-leakage, 4.3% wound infection. In group II, 20% developed air-leakage, 5% haemorrhage and 5% empyema. None of the patient in the former group had to stay in the hospital for >15 days, where as 10% of the latter group had to stay in hospital for >15 days. The hospital stay was found to be significantly higher in the latter group compared to the former group ($p < 0.05$). There was no significant difference between groups in the development of haemorrhage, empyema, wound infection and broncho-pleural fistula. There was also no significant difference in the rate of recurrence. No anaphylaxis or death occurred in either group.

Conclusion: Capitonnage offered no added benefit rather increasing complications. So enucleation followed by closure of bronchial opening may be a reasonable approach.

Key words: Hydatid cyst, Capitonnage, Lung.

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Introduction

Pulmonary hydatid cyst is a zoonotic disease with worldwide distribution. Hydatidosis remains endemic to many parts of the world, most notably the Mediterranean region, Australia, New Zealand, the Middle East, Turkey and South America. In areas where hydatid disease is endemic, it is still a major public health problem. Most individuals who contract this parasite are young and majority

of patients are less than 40 years of age¹. In man, hydatid disease affects the liver in 50 to 60%, the lung in 18 to 35% of cases. The lungs are the second most common sites of lodgment of the parasite. Pulmonary hydatid disease affects the right lung in 60% of cases, 30% exhibit multiple pulmonary cysts, 20% bilateral cysts and 60% are located in the lower lobes².

Diagnosis of pulmonary hydatid cyst is generally based on clinical, serological and

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radiological findings. Small simple cyst located peripherally usually remains asymptomatic. Symptomatic patients may present with chest pain, cough, haemoptysis, dyspnea, fever and respiratory distress¹. Conventional radiography is routinely employed for diagnosis of the disease in our hospital. Round homogenous opacities in the lung parenchyma are characteristic of simple uncomplicated hydatid cyst, the water lily or signet ring sign is characteristic of perforated cyst. CT scan of the chest and upper abdomen may be helpful in establishing diagnosis in complicated cysts. Inverse crescent sign, signet ring sign, high CT density and thick wall can be recognized as features of pulmonary hydatid cyst on CT³.

In management of pulmonary hydatid disease, Albendazole has been used with promising result but definitive treatment still remains surgery. Different surgical techniques has developed. These are radical surgery, laparoscopic surgery, minimally invasive methods.

Minimally invasive technique like therapeutic aspiration of echinococcal cyst is being performed in liver cyst, but this is not suitable for pulmonary cyst. It may be performed in adjunct to Albendazole treatment in a patient with a large recurrent, isolated pulmonary echinococcal cyst for whom traditional therapy may result in severe morbidity².

Common surgical methods for dealing with pulmonary hydatid cysts is enucleation of intact cysts. Needle aspiration is a useful adjunctive procedure in the surgery done if there is high tension inside the cyst or there is more than three or four cyst in one lung. Closure of the bronchial opening is done by muscle pledgeted suture or by simple 3-0 silk. After bronchial opening closure of the remaining cavity can be done by capitonnage. In capitonnage the residual cavity is obliterated by imbricating sutures from within (separate purse String sutures that is places into the cavity from deepest level to the surface). The impact of capitonnage on surgical outcome is unknown and the technique continues to be performed at the choice of the surgeon⁵. Some surgeons preferred to keep the cavity open after closing

of the bronchial opening. Other methods like cystotomy with or without capitonnage, wedge resection, segmentectomy, lobectomy, pneumonectomy along with decortication may be done. Post-operative complication are pronged air leak (air leak >7 days), empyema and wound infection⁵.

Pulmonary Hydatid cyst is not uncommon in our country. National Institute of Diseases of the Chest and Hospital (NIDCH), is the only government level post-graduate chest hospital in Bangladesh. So patients were referred from all over the country. Lot of surgery is being performed on pulmonary hydatid cyst in this hospital yearly. However no study was done to compare capitonnage and non capitonnage procedure for pulmonary hydatid cyst surgery in Bangladesh.

Methods

A prospective non-randomized consecutive cross-sectional study was done from July 2004 to June 2006 in the Department of Thoracic surgery, National Institute of Diseases of the Chest and Hospital (NIDCH), Mohakhali, Dhaka. A total number of 43 patients having pulmonary hydatid cyst were selected for this study. Exclusion criteria were co-morbid diseases like acute myocardial infraction and severe diabetes mellitus where surgical intervention is prolonged. Patients were randomly divided into two groups. Group-I involving 23 patients was offered enucleation of cyst with closure of bronchial opening. Group-II involving 20 patients was offered enucleation of cyst with capitonnage. Ethical approval about the study was taken from departmental ethical committee.

Diagnostic workup: Clinical workup include history of petting dog, chest x-ray showing rounded homogeneous opacity in intact cyst, water lily sign present in perforated cysts, computer tomography scan in special cases, indirect hemagglutination assay (IHA) for echinococcosis. Besides, complete blood count, blood sugar, liver and renal function tests are done.

Operative management:

All the patients were carefully assessed preoperatively. Routine blood tests, chest

radiograph, electrocardiogram, random blood sugar were done. All patients underwent chest physiotherapy with incentive spirometer before operation. Blood transfusion and nutritional supplement were given when required. Prophylactic antibiotic was started at the time of induction of anaesthesia and continued postoperatively for 10 days.

During this procedure patient was put on pulse-oxymeter, non-invasive blood pressure monitor and a good intravenous line. After induction of anaesthesia single lung ventilation was maintained through double lumen endobronchial tube. A bi-channel foley urinary catheter was introduced and patient was positioned on lateral decubitus position. Standard postero-lateral thoracotomy was done through 5th or 6th rib bed after excising the rib or through interspace after excising a short posterior segment of the rib. The lung was freed from any pleural adhesions. The cyst was covered with water soaked mob to prevent implantation of daughter cysts in the event of rupture. The adventitia was incised carefully to avoid perforation of the cyst. The incision was enlarged in two directions using blunt scissors. The edge of the opening in pericyst was grasped with two fine forceps placed next to each other. The opening of the pericyst was enlarged to its maximum. When the cyst is from one third to one half exposed in this way, the hand is gently pushed beneath the cyst and the remaining part of it is separated from the pericyst by careful finger dissection, until cyst lies in the palm of the hand. It is then placed in a basin. The enucleation of a cyst is not easy when the cyst was large and under tension. In such cases the cystic fluid was aspirated with a large sized needle, then the cyst was opened with a 1 cm incision and a suction tip entered into the cystic cavity to evacuate the remaining fluid. Germinal membrane was removed with forceps. After flushing the cystic cavity with saline solution, the bronchial openings were closed by muscle pledged suture. Some surgeons preferred to keep the cavity open but in some cases cavity was obliterated by capitonnage by suture approximation of the pericystic tissue. Pulmonary resection like lobectomy and segmentectomy was done, when

the cyst occupied the whole lobe or has destroyed the adjacent lung. Decortication was performed in patients with pleural complications. In all patients two 32 F and 28 F chest drainage catheter was positioned posteriorly and anteriorly in a respective order and were connected with under water seal drainage system. Patients were given Albendazole in doses of 10 mg/kg body weight as a postoperative prophylactic to prevent recurrence. Postoperative patients were managed accordingly and operative outcome was observed. Patient with satisfactory outcome were discharged on 10th - 12th postoperative day after removing stitches.

Follow up:

All patients were followed up for six months at monthly interval. In every follow up patients were evaluated clinically and radiologically. Clinically any morbidity such as cough, sputum production, haemoptysis, and febrile episodes were noted. Radiologically any evidence of space infection, any suspected lesion or recurrence of pulmonary hydatid cyst was noted. However all information of the patient were recorded in an individual patient data collection sheet.

Data collection and analysis:

All relevant data were collected from each participant using predesigned individual data sheet. Collected data were expressed as mean±SD. Statistical analysis was done using computer based programme SPSS for windows version 10.0. Unpaired students T test, chi-square test and proportionate 'z' test were used for statistical analysis. The p-value of less than 0.05 was considered statistically significant.

Results

A total of 43 patients of pulmonary hydatid cysts cases were taken in our study. 41.8% of the patients were between 20-30 years of age followed by 23.3% between 10-20 years 18.6% between 30-40 years, 9.3% below 10 years and 7% was above 40 years of age. The mean age was 25±1.4 years with the lowest and the highest ages being 7 and 45 years respectively (Table-I). 65% of the patients were female and the rest 35% were male.

Table I
Distribution of the patients by age (n = 43)

| Age (years) | No (%) | Enucleation of cyst with closure of bronchial opening | Enucleation of cyst with capitonnage |
|-------------|-----------|---|--------------------------------------|
| < 10 | 04 (9.3) | 3 | 1 |
| 11 – 20 | 10 (23.3) | 6 | 4 |
| 21 – 30 | 18 (41.8) | 8 | 10 |
| 31 – 40 | 08 (18.6) | 5 | 3 |
| > 40 | 03 (7.0) | 1 | 2 |

Mean age was 25.0 ± 1 .40 years: range (7-45) years.

Nearly one-quarter (23.2%) of the patients were asymptomatic. The predominant complaints of the patients were chest pain 76.7% followed by cough without sputum 46.5%, haemoptysis 30.2% and respiratory distress 27.9%. Cough with sputum 1 1.6% (Table-II). Of the 43 patients 63% were diagnoses by X-ray chest, 28% by CT scan of chest and rest 9% by intraoperatively. 65.1% patients had right lung involvement, 23.3% had left lung involvement and the rest 11.6% both lungs involvement (Table-III).

Table II
Distribution of patients by clinical presentation (n = 43)

| Clinical Presentation | No | Percentage (%) |
|-----------------------|----|----------------|
| Asymptomatic | 10 | 23.2 |
| Cough with sputum | 05 | 11.6 |
| Cough without sputum | 20 | 46.5 |
| Chest pain | 33 | 76.7 |
| Hemoptysis | 13 | 30.2 |
| Respiratory distress | 12 | 27.9 |

Table III
Distribution of patients side of lung affected

| Side of lung | No | % |
|--------------|----|------|
| Right | 28 | 65.1 |
| Left | 10 | 23.3 |
| Both | 05 | 11.6 |

It is observed that in the right lung 6(18.2%) had upper lobe affected, 5(15.1%) had middle lobe affected and 22(66.7%) lower lobe affected. In the left lung 11(73.3%) had lower lobe

involvement, while the rest 4(26.7%) had upper lobe involvement (Table-IV). It is observed overwhelming majority 95.3% of the patients had single cyst and the rest 4.7% had 2 cysts (Table-V).

Table IV
Distribution of patients' side of lung and lobe affected

| Side of lung | Lobe of lung | | |
|--------------|--------------|------------|-----------|
| | Upper (%) | Middle (%) | Lower (%) |
| Right | 6 (18.2) | 5 (15.1) | 22 (66.7) |
| Left | 4 (26.7) | | 11 (73.3) |

Table V
Distribution of patients by number of cysts

| Number of cysts | No. | Percentage (%) |
|-----------------|-----|----------------|
| 1 | 41 | 95.3 |
| 2 | 02 | 4.7 |

It demonstrates that 58% of the patients had intact cysts and the rest 41.9% exhibited ruptured cysts. 53.4% of the patients underwent enucleation of the cysts with closure of the bronchial opening, and the rest 46.6% enucleation of cysts with capitonnage (Table-VI).

It has been shown that out of 43 patients 16.3% developed prolonged air-leakage, 4.5% had to stay in the hospital for a prolonged time, empyema, bronchopleural fistula and wound infection each was 2.3%.

It has been found that out of 23 patients who were enucleated with closure of bronchial opening 12.9% of them developed air-leakage and 4.3% developed wound infection during postoperative period. Of the 20 patients who were subjected to enucleation of cyst with capitonnage, 20% of them developed air-leakage followed 5% haemorrhage and 5% empyema. None of the patient in the former group had to stay in the hospital for >15 days, where as 10% of the latter group had to stay in hospital for >15 days. The hospital stay was found to be significantly higher in the later group compared to the former group (p<0.05) (Table-VII).

It has been shown that comparison of outcome after 6 months of follow up between enucleation of cyst with closure of bronchial

opening and capitonnage group. Of the total 43 patients 12 patients were lost during follow up. From the remaining 31 patients none but a single case of capitonnage group developed recurrence of cyst (Table-VIII).

The patient who developed haemorrhage was managed by blood transfusion, bleeding stopped spontaneously. The patient who developed prolonged air leakage managed by chest physiotherapy and tetracycline wash. Patient who developed bronchopleural fistula was managed by tetracycline wash and antibiotics. Patient who developed empyema was managed by local antiseptic and antibiotics after culture sensitivity. Patient who developed wound infection treated accordingly. No patient required re-exploration. Mortality was nil.

Table VI

Distribution of patients by type of operation (n 43)

| Type of operation | No. | Percentage (%) |
|---|-----|----------------|
| Enucleation of cyst with closure of bronchial opening | 23 | 53.4 |
| Enucleation of cyst with capitonnage | 20 | 46.6 |

Table VII

Comparison of complications between groups (n = 43)

| Post-operative complications | Types of operations | | p-value |
|------------------------------|--|---|---------|
| | Enucleation of cyst with closure of bronchial opening (n = 23) | Enucleation of cyst with capitonnage (n = 20) | |
| Haemorrhage | 00 | 1(5.0) | 0.059 |
| Prolong air leakage | 3(12.9) | 4(20.0) | 0.614 |
| Empyema | 00 | 1(5.0) | 0.059 |
| Wound infection | 1(4.3) | 00 | 0.121 |
| Bronchopleural fistula | 00 | 1(5.0) | 0.059 |
| Hospital stay (> 15 days) | 00 | 2(10.0) | 0.030 |

*Figures in the parentheses denote corresponding %.

Table VIII

Comparison of outcome after 6 months of follow up between enucleation of cyst with closure of bronchial opening and capitonnage group (n = 31)

| Post-operative complications | Groups | | p-value |
|------------------------------|--|---|---------|
| | Enucleation of cyst with closure of bronchial opening (n = 17) | Enucleation of cyst with capitonnage (n = 14) | |
| Cough | 00 | 00 | |
| Haemoptysis | 00 | 00 | |
| Empyema | 00 | 00 | |
| Recurrence | 00 | 1(7.14) | 0.21 |

*Figures in the parentheses denote corresponding %. Chi-square (x2) test and Student's 't' test were done to analyze the data and the level of significance was 0.05.

Discussion

Pulmonary hydatid cyst is frequently encountered in sheep and cattle raising regions of the world and has been observed most often in Australia, New Zealand, South Africa and Mediterranean countries. Human act as accidental intermediate hosts and harbor cysts, which are most commonly found in the liver and lung but can be discovered in nearly any organ⁵. Bangladesh is also among cattle raising regions. Cows, goats are our common domestic animals. Pulmonary hydatid disease is not uncommon in our country. Surgery is the primary mode of treatment for patients with pulmonary hydatid disease.

In our series, 43 patients having pulmonary hydatid cyst were studied, with the mean age of 25 ± 1.4 years. This is consistent with findings of other studies. Turna et al. (2002)⁵ reviewed 75 patients and showed average age 30.2 ± 17.4 years, in their observation. In this study, 65% of the patients were female and 35% was male. However in other studies there is male dominance. Hacubrahimoglu et al. (2003)⁶ in his series shown 93 patient, 48 was male and 43 was female. Ahsan et al. (1997)⁷ reviewed 137 patients and showed in male incidence 57% and female 43% respectively.

Nearly one quarter 23.2% of the patients were asymptomatic. They were suspected to have hydatid disease of lung when they attended there physicians with other complaints and subsequently had routine chest x-ray and diagnosed pulmonary hydatid cyst. The most predominant complaints of the patients were chest pain 76.7% followed by cough without sputum 46.5%, haemoptysis 30.2%, respiratory distress 27.9%, fever 23.2% and cough with sputum 11.6%. Dakak et al. (2002)³ in their study of 422 patients showed the presenting complaints of chest pain 32%, fever 34%, cough without sputum 56%, cough with sputum 26%, haemoptysis 14%, respiratory distress 11% and 20% were asymptomatic. Our observation was more or less similar to their series.

A simple chest roentgenogram is enough to make a diagnosis in most cases of pulmonary hydatid cyst. Round homogenous opacities in the lung parenchyma are characteristics of

simple uncomplicated cyst. The water lily or camelot sign is characteristics of perforated cyst and crescent sign is characteristic of air in the cystic cavity. In our study 27 of our cases 62.79% were diagnosed with a simple roentgenogram. Computerized tomography was required in 27.90% and the diagnosis was established intraoperatively in 9.30%. Dakak et al. (2002)³ in his study of 422 patients showed chest roentgenogram lead to correct diagnosis in 82.2% and CT scan 13.27% cases and MRI in 3.55% and intraoperatively 0.95% cases. For diagnosis of pulmonary hydatid cyst our study was similar to this series. However, serological test e.g. the indirect hemagglutination test (IHA) was also used for diagnosis of pulmonary hydatids.

We used standard posterolateral thoracotomy in cases of pulmonary hydatid cyst surgery. In our series 65.1% patients had right lung involvement, 23.3% left lung involvement and the rest 11.6% both lungs involvement. Ahsan et al. (1997)⁷ showed in their series of 137 patients, cyst located in the right lung in 57.06% left lung 31.06% and bilaterally 6.05%⁷. Morar and Feldman (2003)² in their study showed pulmonary hydatid cyst affects right lung in 60% of the cases. Our study was similar to the above series.

In our study, in the right lung 18.2% had upper lobe affected, 15.1% had middle lobe affected and 66.7% lower lobe affected. In the left lung 73.3% had lower lobe involvement, while the rest 26.7% had upper lobe involvement. Dakak et al. (2002)³ in their series 422 patients, number of cyst located in right upper lobe was 58, right middle lobe 46 and right lower lobe 105 cases and in left upper lobe 66, left lower lobe 87. Hacubrahimoglu et al. (2003)⁶ in their study 96 patients, right upper lobe 19, middle lobe 11, lower lobe 24 and left upper lobe 21, left lower lobe 21. The location of the pulmonary hydatid cyst predominance of right lower lobe involvement had been shown in above series. We had also observed same trend of the disease.

It has been shown that majority 95.3% of the patients had single cyst and rest 4.7% had 2 cyst. Dakak et al. (2002)³ in his 422 patients 296 cases presented solitary pulmonary cyst

and other cases had multiple cyst in 1 or 2 lobes. In our series we did not found >2 cyst in 1 or 2 lobes.

In this study 53.4% underwent enucleation of the cyst with closure of the bronchial opening without capitonnage and rest 46.6% underwent enucleation of cyst with capitonnage. The operation was done by almost same group of surgeons. Almost 100% of the patients had immediate cure. No major fatality like death was observed. Among the 23 patients who were enucleated with closure of bronchial opening, 3 of them developed air leakage, 1 developed wound infection and non of the patient in this group had to stay in the hospital >15 days. Of the 20 patients who were subjected to enucleation of cyst with capitonnage, 4 of them developed air leakage followed by 1 haemorrhage, 1 empyema, 2 of this group had to stay in hospital for >15 days and 1 developed recurrence. Turna et al. (2002)⁵ showed 71 patients 32 were performed enucleation of the cyst and closure of bronchial openings without capitonnage and 39 patients were performed enucleation with capitonnage. Of the 32 patients who were subjected to enucleation without capitonnage, 4 of them develop air leakage, 1 empyema and none of them developed haemorrhage. Of 39 patients, who were subjected to enucleation of the cyst with capitonnage, 5 of them developed air leakage and 3 of them developed recurrence. Our complication rates were similar to this above series. Ahsan et al. (1997)⁷ and Turna et al. (2002)⁵ reported best operative method is enucleation of cyst without capitonnage. The above procedure was adopted in 23 cases of our group and the results are satisfactory.

Regarding the management of the residual cavity of the pulmonary hydatid cyst, the results of Kuzucu et al. (2003)¹, Hacubrachimoglu et al. (2003)⁶, Kanat et al. (2004)⁸ favoured the capitonnage method, where residual cavity was obliterated with separate purse string sutures that were placed into the cavity from the deepest level to the surface, as it shorten the postoperative chest tube drainage period and reduce morbidity compared with non capitonnage. It is generally agreed, however

that the most important point in the management of the residual pericystic cavity is closure of patent bronchial openings. In both of our study groups, surgical intervention primarily consisted of closing all bronchial openings after removal of the membrane of the cyst. Turna et al. (2002)⁵ stated that approximating and suturing cavity edges is not necessary because the pulmonary parenchyma obliterates the space and the surface of the lung at the site of cavity is covered by pleura. Capitonnage provides complete of obliteration of the pericystic cavity to prevent air leak from residual bronchial openings. Without capitonnage, the wall the pericystic cavity is supposed to be covered by epithelial cells for an uncertain length of time. Capitonnage prolongs the operation time and increases the risk of haemorrhage. Enucleation is the preferred method in our institution but is not favoured by others⁹.

In resection surgery, lobectomy was done in two cases due to advanced parenchymal destruction resulting from compression of the cyst, but these two cases were not included in the study. Because our aim was to compare the enucleation of the cyst with closure of bronchial opening and enucleation of the cyst with capitonnage on the basis of surgical outcome.

All patients were discharged with chemoprophylaxis. Albendazole 10 mg/kg/day for 30 days. 12 patients were lost to follow up. During follow up recurrence developed 1 patient after 6 months of operation in opposite lung in the enucleation with capitonnage group. The patient who had recurrent pulmonary hydatid cyst had a second thoracotomy. Turna et al. 2002 in his series of capitonnage group of 39 patients only 3 developed recurrence⁵. So long term study to see any recurrence is warranted.

Conclusion

In conclusion, although surgical treatment is effective in patient with ruptured as well as intact cyst for treatment of pulmonary hydatidosis, surgical intervention before rupture of cyst is essential. Regardless of whether symptoms are present, all pulmonary hydatid cysts should be surgically treated as

soon as they are diagnosed in order to avoid complication.

Our study suggests that each of the surgical methods in the hands of us yielded good results. Capitonnage had no beneficial effect on the surgical management of pulmonary hydatid cysts in terms of postoperative variables and short and long term surgical complication. Management of the bronchial opening is of major importance, whereas capitonnage can be omitted to shorten the operative time.

Recommendations

1. Enucleation of pulmonary hydatid cyst with closure of bronchial opening should become standard surgical technique for management of pulmonary hydatid cyst.
2. Further long term studies with adequate sample size are required to detect best method of surgical treatment of pulmonary hydatid disease.

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