

# POSTSPLENECTOMY PULMONARY RESECTION : RISK FACTORS FOR AN AVOIDABLE COMPLICATION

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## ABSTRACT

In our locality, splenectomy is frequently done for bilharziasis and its complications. It can be done as isolated operation or in conjunction with devascularization. Over a period of 20 years ending in December 2000, fifty-three patients were submitted for left pulmonary resections due to postsplenectomy complications in the Department of Cardio-Thoracic Surgery at Mansoura University Hospitals. Thirty-two patients (60.4%) were males and 21 (39.6%) were females. Their ages range from 18 to 46 years (mean  $34.9 \pm 6.5$  years).

Splenectomy was done for all patients because of bilharziasis. All patients had postsplenectomy subphrenic collection and in 42 of them (79.2%) the abscess was improperly managed. The elapsed time between

splenectomy and start of respiratory symptoms ranged from 9 months to 13 years (mean  $4.8 \pm 2.9$  years). The main respiratory presentations were productive cough with occasional hemoptysis that occurred in 23 patients (43.4%), suppurative syndrome in 18 (34%), and recurrent hemoptysis in 12 patients (22.6%). Radiological examination revealed bronchiectatic changed affecting the left lower lobe in 34 patients (64.2%) for whom lobectomy was done. The left lower lobe with the lingulae were affected in 19 patients (35.8%), 18 of them underwent lower lobectomy and lingulectomy, and in one patient left pneumonectomy was done because of massive vascular adhesions and accidental pulmonary vascular injury. Foreign bodies were found in 20 cases (37.7%) in the form of abdominal towels in 2, corrugated rubber drain in

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one and bulk of silk sutures in 17 patients.

There were two cases of hospital mortality (3.8%) and 15 cases (28.3%) of postoperative complications. Intraoperative bleeding developed in 4 patients (7.5%), pulmonary vascular injury in one (1.9%), rethoracotomy for bleeding in 2 (3.8%), hemothorax in one (1.9%), empyema in 2 (3.8%), and significant wound infection in 5 patients (9.4%).

Comparative study was done between this group of patients and similar number of control cases. It revealed that performing splenectomy in a peripheral small hospital or clinic, development of postoperative subphrenic collection, and its delayed or improper drainage were significantly predictors of late postoperative left lung problems requiring pulmonary resection (*P* values are 0.001, 0.00001, and 0.0002 respectively).

We conclude that pulmonary resection for late postsplenectomy complication is a difficult operation and is associated with significant mortality and morbidity. This can be avoided by meticulous care during splenectomy as well as by suspecting postopera-

tive subphrenic collection and draining it properly if developed.

## INTRODUCTION

The spleen has long been an organ of interest in popular as well as medical literature. Historically, the spleen has been associated with more functions than any other organ (1). The first report of a splenectomy for disease is attributed to Quittenbaum in 1826, although the patient did not survive (1). The first successful splenectomy is attributed to Pean in 1867, performed for a large splenic cyst. By 1877, there were more than 50 case reports of splenectomy for a wide range of indications (1).

Conditions associated with hypersplenism remain the most frequent indication for elective splenectomy. These can be divided into those conditions in which the spleen is normal but increased destruction of abnormal blood elements causes hypersplenism, and those in which there is a primary disorder of the spleen that results in increased destruction of normal blood cells (2). In our locality, splenectomy is frequently done for bilharziasis and its complications. It can be done as isolated operation or in conjunction with devascularization (3).

Splenectomy is an operation with significant postoperative complications. Respiratory complications affect 10% to 48% of patients after open splenectomy in the form of atelectasis in 15%, pleural effusion in 11%, and pneumonia in 7-13% (4). Other complications include subphrenic abscess in 4-8% (5,6), wound problems in 3-6% (7,8), ileus and small bowel obstruction in 1-10% (8), fever (4), thromboembolism in 2-11% (4,6), splenosis in 48-66% (9), and overwhelming postsplenectomy infection in 4% (10). Laparoscopic splenectomy almost has the same complications (11).

One of the late complications of splenectomy is the neglected prolonged infection in the subphrenic space, which spread superiorly leading to bronchiectatic changes and destruction of the left lower lobe. As far as we know no previous studies discussed this problem except one report from our department published in the last decade (12). The aim of this study is to review the results of our experience with postsplenectomy pulmonary resection. In addition a comparative study was done between patients and control group in a trial to reveal the risk factors of developing

this problem and how to avoid it.

## PATIENTS AND METHODS

Over a period of 20 years ending in December 2000, 53 patients underwent left lung resection for destroyed lung tissue as a late complication of splenectomy in the Department of Cardio-Thoracic Surgery at Mansoura University Hospitals. Thirty-two patients were males and 21 were females. Their ages range from 18 to 46 years (mean  $34.9 \pm 6.5$  years).

All patients had previous splenectomy and all of them had postsplenectomy subphrenic collection and recurrent attacks of fever. The elapsed time between the operation and start of the respiratory symptoms was ranging from 9 months to 13 years (mean  $4.8 \pm 2.9$  years).

All patients were submitted for careful history taking regarding the previous splenectomy, postoperative fever and methods of drainage of subphrenic collection if already done. Full chest examination and preoperative investigations necessary for diagnosis of the chest problem were done. Bronchoscopy was done as a routine for all patients to exclude other causes of bronchiectasis or lobar collapse.



Sputum examination for TB bacilli was done for all patients. Bronchography or CT scan was necessary in all patients to confirm the diagnosis. Abdominal ultrasound was a routine. Sinogram was done for any patient with abdominal wall sinus.

All patients were operated upon through left posterolateral thoracotomy. Left lower lobectomy was done in 34 patients (64.2%), left lower lobectomy and lingulectomy in 18 patients (34%), and left pneumonectomy in one patient (1.9%). In all of our patients we adopted the technique of hilar dissection and ligation of pulmonary vessels first followed by bronchial division and closure leaving the diaphragmatic adhesions as the last step to be done to avoid massive bleeding from the vascular adhesions and to avoid contamination of the bronchial stump. Most of the patients had a hole in the diaphragm connecting the pleural cavity with the infected subphrenic space. In some of these patients foreign bodies were removed from the subphrenic space. The defects in the diaphragm were closed in two layers after drainage of the subphrenic space. Finally the chest was closed in layers with chest drain in place.

To assess the risk factors for developing postsplenectomy destruction of lung tissue requiring resection, we randomly selected equal number of control cases who had previous splenectomy without developing postsplenectomy significant respiratory problems. These control cases were selected from other outpatient clinics either surgical or medical at Mansoura University Hospitals. All of them had normal chest x-rays at the time of study. Comparative study was done between patients and control groups regarding age, sex, indication for splenectomy, early postsplenectomy complications, and the quality of center in which splenectomy operation was done.

All statistical data were tabulated and analysed using Statistical Package for Social Science (SPSS). Values are expressed as the mean  $\pm$  Standard Deviation (SD). Chi-square was used for analysis of categorical data. For continuous variables, statistical analysis was performed using Student's t-test. A  $P < 0.05$  was considered statistically significant.

## RESULTS

A total of 53 patients underwent left pulmonary resections for postsple-

nectomy complications over the last 20 years ending in December 2000. Thirty-two patients (60.4%) were males and 21 (39.6%) were females. Their ages range from 18 to 46 years (mean  $34.9 \pm 6.5$  years).

All patients developed respiratory symptoms after an elapsed period ranging from 9 months to 13 years (mean  $4.8 \pm 2.9$  years) after splenectomy. Respiratory symptoms include productive cough with occasional hemoptysis in 23 patients (43.4%), suppurative syndrome in 18 (34%), and hemoptysis in 12 (22.6%). The lapse period between beginning of respiratory symptoms and referral for thoracic surgery ranged from 3 months to 2 years (mean  $10 \pm 3.1$  months).

Chest x-rays in the form of posteroanterior and left lateral views were done for all patients, bronchography was done for 21 of the early cases in this study, and CT scan was done for 32 cases. Radiological examination of the chest revealed in addition to bronchiectatic changes (Fig 1&2) which was present in all patients, abscess cavities in 3 patients (5.7%), and chronic lung collapse in 15 (28.3%).

Abdominal ultrasound was done

for all patients and revealed amalgamation of the subphrenic space in 38 patients (71.7%), and subphrenic abscess (Fig. 3) in 15 patients (28.3%). Associated colonic fistula was present in 3 patients (5.7%), gastric fistula in one (1.9%) as proved by contrast studies. Barium studies proved the presence of colonic fistula in 3 (5.7%) of our patients, and gastric fistula in one (1.9%)

Sinogram was done for 7 patients (13.2%) who presented with abdominal wall sinus and revealed the presence of communication between the subphrenic space and bronchial tree of the left lower lobe in 3 patients (Fig 4), while demonstrated the presence of subphrenic abscess in 4 patients.

In 34 patients (64.2%) the bronchiectatic changes affected the left lower lobe and required left lower lobectomy, and the lingula was affected with the lower lobe in 19 patients (35.8%) who underwent left lower lobectomy and lingulectomy except one. Only in one patient (1.9%) the plane was to resect the bronchiectatic left lower lobe and lingulae but because of massive adhesions and pulmonary vascular injury the decision

was taken to proceed with left pneumonectomy to save patient's life.

All procedures were done through left posterolateral thoracotomy. Thick heavily varicose vasacular adhesions between the left lower lobe and diaphragm were characteristic for these operations. In 41 patients (77.4%) we did find a hole in the diaphragm after removal of the left lower lobe. In 20 patients (37.7%) foreign bodies were removed from the subphrenic space through the hole in the diaphragm. Theses foreign bodies were corrugated rubber drain in one patient, abdominal towel in 2, and a bulk of silk sutures in 17 patients.

Complications of pulmonary resections for these patients include intraoperative bleeding in 4 patients (7.5%), pulmonary vascular injury in one (1.9%), rethoracotomy for bleeding in 2 (3.8%), and hematemesis in one (1.9%). Other complications included in Table 1. Two patient (3.8%) died early postoperatively because of liver cell failure and then multiorgan failure.

Comparison between patients and

control revealed no difference between the two groups regarding the age, sex, indication of splenectomy (hypersplenism or devascularization), and the mean elapsed time between splenectomy and either lung resection (for patients) or the time of study (for control group) (table 2).

However, while postsplenectomy subphrenic collection developed in all patients (100%), it occurred in only 6 cases (11.3%) of the control group with a statistically significant higher incidence in the group of patients than control group ( $P=0.00001$ ). In 42 patients (79.2%) the drainage of the subphrenic collection was delayed and these patients received repeated courses of antibiotics to control their fever while no one (0%) of the control group who developed subphrenic collection was delayed for the proper management ( $p=0.0002$ ). Regarding the place in which splenectomy was done, we found that most of the patients (60.4%) were operated upon in peropheral small hospital or clinic versus 18.9% of the control group ( $p=0.001$ ) while the rest were operated upon in a higher referral center (Table 2).



**Table 1. Complications of postsplenectomy pulmonary resection.**

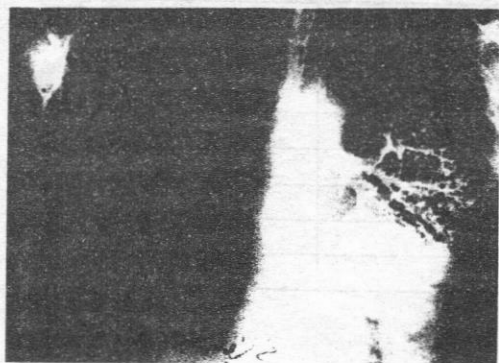
Complication	Number (15)	Percent (28.3%)
Intraoperative bleeding	4	7.5%
Pulmonary vascular injury	1	1.9%
Rethoracotomy for bleeding	2	3.8%
Hematemesis	1	1.9%
Empyema	2	3.8%
Wound infection	5	9.4%

**Table 2. Comparative study between patients and control.**

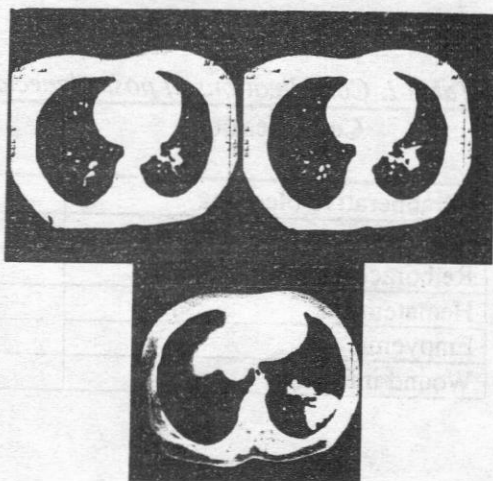
Factor	Patients (N=53)	Control (N=53)	P-value
Mean age (years)	34.9 $\pm$ 6.5	34.3 $\pm$ 4.5	N.S.
Sex (male to female ratio)	32/21	33/20	N.S.
Indication of splenectomy (hypersplenism/devascularization)	46/7	44/9	N.S.
Mean time from operation (years)	4.8 $\pm$ 2.9	4.9 $\pm$ 2.6	N.S.
Postsplenectomy subphrenic abscess (prolonged fever)	53 (100%)	6 (11.3%)	0.00001
Delayed drainage of the abscess	42 (79.2%)	0 (0%)	0.0002
Operating place (peripheral small clinic)	32 (60.4%)	10 (18.9%)	0.001

N: Number of patients,  $P < 0.05$  considered significant.

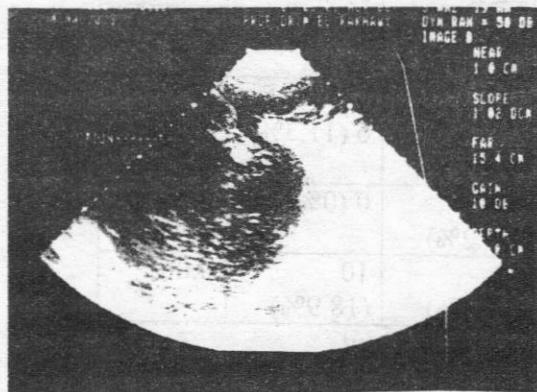
NS: Nonsignificant.



**Fig 1.** Left sided bronchogram showing bronchiectatic changes in the left lower lobe.



**Fig 2.** Postcontrast axial CT scan of the chest reveals consolidation collapse of the basal segments of the left lower lobe with associated bronchiectatic changes .



**Fig 3.** Ultrasonography of the left upper abdomen showing a large left subphrenic collection on posterior location.



**Fig 4.** Sinogram showing communication between the subphrenic space and bronchiectatic left basal bronchial tree (arrow).



## DISCUSSION

Pleural effusions often occur in response to sterile or infectious inflammation below the diaphragm (13). Postsplenectomy subphrenic abscess result from a bacterial infection below the diaphragm, but the symptomatic pleural effusion is usually sterile. The effusion becomes a thoracic empyema in only 15 to 20% of patients and is then secondary to necrosis of the diaphragm (14). Many cases with these early postsplenectomy complications were treated in our Department either by thoracocentesis or thoracostomy tube drainage with underwater seal. To avoid contamination of the pleural cavity the chest should not be entered during surgical drainage of the intraabdominal collection, and if tube thoracotomy is necessary to control the effusion, it should be placed some distance from the abdominal incision.

In this study we are presenting the problem of late postsplenectomy left lung bronchiectasis requiring left pulmonary resection. Some of the general surgeons, who did splenectomy, are not aware about this complication because patients lose contact with them by time. Moreover, most of these patients were referred to our

Department from the chest physicians because of their chest problem.

Most of the authors described the early postoperative pulmonary complications in the form of left lower lobe atelectasis and pneumonia (4). Moreover, most of those who discussed the late infection after splenectomy, concentrated their work on children who had splenectomy done for hematological disease or trauma and attributed the late infection to the underdeveloped immune mechanism. Many studies have attempted to define the immunologic role of the spleen. It is apparent that the spleen is the major site of early IgM production and is important in the production of opsonins, particularly properdin. Asplenic patients have been found to have abnormalities of cell-mediated immunity as well (15). The reported incidence of severe late postsplenectomy infection varies considerably in the literature (16,17). Also differences exist as to what constitutes late postsplenectomy infection: miliary tuberculosis (18), osteomyelitis, rheumatic fever, respiratory tract infections (19), peritonitis (20), late wound infections (21), intraabdominal abscesses, Herpes zoster (21), and pyrexia of unknown origin (23) have been included.

Recognition of the risk of overwhelming postsplenectomy infection (OPDI) has led surgeons to attempt salvage procedures in cases of splenic trauma (24-26).

In this study the situation is different in that none of our patients was a child. Moreover, all our patients underwent splenectomy because of bilharzial disease. The condition started by postsplenectomy subphrenic collection especially in bilharzial patients with huge spleen that confronted the surgeon with dense adhesions to the splenic bed and to the left copula of the diaphragm.

In our study the elapsed time between splenectomy and start of respiratory symptoms ranged from 9 months to 13 years. The sequence of events was almost the same in all patients from the time of splenectomy to the time in which the patient presented to us. The events started with splenectomy followed by fever for long time and subphrenic collection which was not drained or insufficiently drained and they received massive alternative courses of antibiotics, then after a time they started their respiratory symptoms and finally reached the full picture of bronchiectasis that

required pulmonary resection.

All patients were transferred to our Department because of respiratory symptoms in the form of productive cough with occasional hemoptysis (43.4%), manifestations of suppurative syndrome (34%), and frank hemoptysis (22.6%). Most of these patients did not correlate between the previous splenectomy and their chest troubles. This stimulated us to describe these events to make apparent the correlation between chest problems in these patients and the previous splenectomy. The correlation with the previous operation became sure after exclusion of other causes of such pulmonary diseases, and by intraoperative findings.

In order to interrupt the sequence of events it is important to remove the spleen carefully, to control hemorrhage from the splenic vessels properly, and to make sure that there is adequate haemostasis in the splenic bed. To fix a drain in the splenic bed at the end of operation, is a matter of controversy. Some believe that postoperative complications are more prevalent if the splenic bed is not drained (27). On the other hand, others concluded that prolonged prophylactic

drainage of the subphrenic space actually increases the incidence of subphrenic abscess (28).

Splenectomy performed as a single elective intraabdominal procedure should be followed by a very low incidence of subphrenic abscess of about 1% (29). If a subphrenic abscess developed the diagnosis should be suspected when there are signs and symptoms of inflammatory process in addition to tenderness either anteriorly or over the last rib posteriorly with elevation of the left hemidiaphragm in chest x-ray. Abdominal ultrasound has been the most valuable technique for early diagnosis of subphrenic abscess. CT scan of the abdomen could be done to confirm the diagnosis.

Once the diagnosis of subphrenic abscess is confirmed, the treatment is drainage. Approaches to drain the abscess include the posterior approach through the bed of the twelfth rib, lateral extraperitoneal approach, or anterior transabdominal approach. The decision concerning the proper approach depends on the localization site of the abscess cavity. In our series there was a reluctance to drain the subphrenic abscess early in 34 pa-

tients (64.2%), in whom there were no scars of previous drainage. Moreover, although there were abdominal scars of previous drainage of the abscess in 19 patients (35.8%), the sequelae of the abscess continued which may be attributed to the insufficient drainage and/or the presence of infected foreign body.

Abdominal ultrasound was done to all patients in this study and showed either loculated subphrenic collection with very thick wall in 28.3% or organized amalgamated subphrenic area in 71.7% which again assures the reluctance in early drainage of the subphrenic abscess or its insufficient drainage.

Another problem of delayed insufficient drainage of the subphrenic abscess is erosion of the adjacent structures with fistulae formation. Postsplenectomy abscess leading to gastric perforation has been reported (30,31). Barium studies proved the presence of colonic fistula in 3 (5.7%) of our patients, and gastric fistula in one (1.9%).

Pulmonary resection after splenectomy is a difficult surgery due to the extensive vascular adhesions to the



diaphragm and subphrenic area. This procedure is not free of complication especially in patients who had abnormal liver functions. Two patient died postoperatively because of liver failure. Fifteen patients (28.3%) developed postoperative complications. Massive intraoperative bleeding was encountered in 4 patients (7.5%) mostly due to the extensive varicose vascular adhesions. Pulmonary vascular injury happened in one patient (1.9%) while doing left lower lobectomy and lingulectomy and in attempt to encircle the main pulmonary artery to minimize bleeding it was injured and the operation progressed to left pneumonectomy in order to save the life of the patient. Two patients (3.8%) required rethoracotomy to control bleeding from the site of adhesions with the diaphragm. One patient developed hematemesis and required emergency injection of his varices. Two patients developed postoperative empyema and five patients developed significant wound infections.

In our comparative study between patients and control, we found that splenectomy which done in peripheral small hospital or clinic, development of subphrenic abscess and its improper drainage are considered signif-

icant predictors for the development of postsplenectomy pulmonary complications requiring lung resection. The presence of the considered number of foreign bodies in our patients led us to concentrate on the role of general surgeon to avoid this complication.

We conclude that postsplenectomy pulmonary resection is not an easy job. It is a difficult surgery due to extensive adhesions, especially when several years elapsed between splenectomy and the time of pulmonary resection. The operation is not without significant mortality and morbidity especially in these patients with chronic liver disease. Postsplenectomy destroyed left lower lobe can be avoided if meticulous care is taken in consideration during splenectomy. What is also important is the early diagnosis and proper drainage of the subphrenic abscess if developed. So we recommend that splenectomy should be done in a higher well-equipped center by a qualified surgeon.

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## عمليات الاستئصالات الرئوية بعد إستئصال الطحال العوامل المسببة لأحد المضاعفات الممكن تلافيها

د. أحمد قدرى عبد الله

قسم جراحة القلب والصدر - كلية الطب - جامعة المنصورة

يتم إجراء عمليات إستئصال الطحال بكثرة فى بلادنا وذلك نظراً لانتشار مرض البلهارسيا.

خلال فترة ٢٠ عاماً حتى ديسمبر ٢٠٠٠ تم بقسم جراحة الصدر والقلب بكلية الطب - جامعة المنصورة إجراء عمليات رئوية لعدد ٥٣ مريضاً ممن أصيبوا بمضاعفات بعد إجراء عمليات إستئصال الطحال .

وكل هؤلاء المرضى أصيبوا بتقيح تحت الحجاب الحاجز بعد استئصال الطحال وفى ٤٢ منهم (٢, ٧٩٪) لم يتم علاج هذا التقيح بطريقة جادة. وكان الوقت المنقضى بين عملية إستئصال الطحال وبداية الأعراض التنفسية ممتدة ما بين ٩ شهور و ١٣ سنة بمتوسط ٨, ٤ سنة. وكان أهم هذه الأعراض الكحة مع النفث الدموى القليل فى ٢٣ مريض (٤, ٤٣٪) وأعراض التقيح الرئوى فى ١٨ مريض (٣٤٪) ونفث دموى متكرر فى ١٢ مريض (٦, ٢٢٪). وقد أظهرت فحوصات الأشعة تمددات شعبية فى الفص الأيسر الأسفل فى ٣٤ مريض (٢, ٦٤٪) وتم إستئصال الفص لهم. كما أظهرت التمدد الشعبى فى الفص الأيسر الأسفل بالإضافة إلى الفصيص اللسانى فى ١٩ مريض (٨, ٣٥٪) أجريت لهم عمليات إستئصال للفص الأيسر الأسفل والفصيص اللسانى عدا مريض واحد تطلبت حالته إجراء إستئصال للرئة اليسرى نظراً لوجود التصاقات شديدة ونزيف من هذه الالتصاقات تسبب فى إصابة الأوعية الدموية الرئوية مما تطلب إستئصال الرئة حفاظاً على حياة المريض. وقد تم إنتشال أجسام غريبة من ٢٠ مريض (٧, ٣٧٪) وهى عبارة عن قوطة بطن من ٢ مريض ودرنقة مطاطية من مريض واحد ومجموعة من خيوط الحرير من ١٧ مريض.

وقد توفى مريضين (بنسبة ٣, ٨٪) بعد إجراء العملية الجراحية وأصيب ١٥ مريض بمضاعفات بنسبة ٢٨, ٣٪. وشملت المضاعفات على نزيف أثناء العملية فى ٤ مرضى وإصابة الأوعية الدموية فى مريض واحد وإعادة شق الصدر بسبب النزيف فى مريض وقى دموى فى مريض واحد وانصباب للورى

صديدي في مريضين والتهابات بجرح العملية في ٥ مرضى .

وتم مقارنة هؤلاء المرضى مع مجموعة مماثلة ممن أجريت لهم عمليات إستئصال الطحال مسبقاً ولم يصابوا بمشاكل رئوية للوقوف على أسباب تفاقم الحالة إلى حد الحاجة للإستئصالات الرئوية .

وأظهرت المقارنة أن إجراء إستئصال الطحال في مستشفى فرعى وظهور التقيح تحت الحجاب الحاجز بعد العملية. والتأخر أو عدم تصريف هذا التقيح على وجه السرعة كانت من أهم الأسباب التي تؤدي إلى ظهور هذه المشكلة حيث كانت هذه الأسباب ذات دلالات إحصائية مهمة .

ونستخلص من البحث أن عمليات الاستئصال الرئوية بسبب المضاعفات المتأخرة بعد عمليات إستئصال الطحال هي عمليات صعبة وترتبط بنسبة غير قليلة من المضاعفات والوفيات. ويمكن تجنب هذه المشكلة بمراعاة الدقة عند إجراء عملية إستئصال الطحال وتوقع حدوث التقيحات تحت الحجاب الحاجز بعد هذه العملية وتصريف هذا التقيح أن حدث على وجه السرعة.



و در مورد این مسئله و جزئیات آن به شرح زیر می آید:

در قسمت اول این کتاب، که به شرح و توضیح کلیه چیزها می باشد، از آن قلمرو که  
در آن کتاب بحث شده است، به شرح و توضیح کلیه چیزها می باشد.

در این کتاب به شرح و توضیح کلیه چیزها می باشد، از آن قلمرو که  
در آن کتاب بحث شده است، به شرح و توضیح کلیه چیزها می باشد.

در این کتاب به شرح و توضیح کلیه چیزها می باشد، از آن قلمرو که  
در آن کتاب بحث شده است، به شرح و توضیح کلیه چیزها می باشد.