
PULMONARY RESECTION IN BASRAH: PERSONAL EXPERIENCE

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Summary

Pulmonary resection is the operation that defines the thoracic surgeon. It represents the appropriate surgical treatment for many pulmonary lesions. This is the first study on pulmonary resection in Basrah, south of Iraq. The study is conducted in the Section of Thoracic and Cardiovascular Surgery in Basrah Teaching Hospital over a 5-year period (August 1996 to July 2001). The aim of the study is to present the personal experience of the author in lung resection, analyze the indications, surgical and anaesthetic management and outcome including morbidity and mortality in view of the literature. Thirty patients (17 males and 13 females) underwent pulmonary resection for different indications were retrospectively analyzed. The results of this study indicate that despite the small number of patients and the difficulties in anaesthetic management, pulmonary resection is practiced safely in Basrah, south of Iraq.

Introduction

Although the five patients operated on by Block (1883), Kronlein (1884) and Ruggi (1885) died following attempted partial resection of their tuberculous lungs, Tuffier successfully resected the apex of the right lung of a 25 years old man in 1891. The use of the individual ligation technique as proposed by Blades and Kent made pulmonary resection a safe procedure in general¹. In 1933, both Graham and

Rienhoff, independently performed successful pneumonectomy using this technique². The following decades have been refinements of surgical techniques and anaesthetic management in the field of thoracic surgery. The efforts of surgeons of the 1930s and 1940s culminated in the perfection of pulmonary resectional techniques currently practiced³. In Iraq, pulmonary resection started in the treatment of pulmonary tuberculosis in early 1950s⁴.

Types of pulmonary resection include simple and radical pneumonectomy, simple and radical lobectomy, bilobectomy, sleeve lobectomy, extended resec-

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tions, segmentectomy, wedge resection and palliative resections⁵.

Through preoperative evaluation and preparation of the patient reduces the morbidity and mortality of thoracotomy and pulmonary resection. Pulmonary function tests and analysis of arterial blood gases help determine the feasibility of pulmonary resection. Postoperative pulmonary function is estimated by calculating the preoperative function and projected resection of pulmonary parenchyma. Patients are excluded from surgical therapy if estimated postoperative pulmonary function falls below minimum acceptable values.

The technique of pulmonary resection had dramatically changed from mass ligation of pulmonary hilum to individual ligation of hilar structures and recently to video-assisted thoracoscopic pulmonary resection. However, the safe performance of lung resection requires a perfect knowledge of hilar anatomy and a technique with which the surgeon is familiar.

Complications after lobectomy include persistent air space, bronchopleural fistula, empyaema, pulmonary insufficiency, cardiac arrhythmias and death. Pneumonectomy, on the other hand, can be complicated by bronchopleural fistula, empyaema, haemothorax, respiratory insufficiency, arrhythmias and death⁶.

Patients and Methods

This is a retrospective analysis of 30 cases (17 males and 13 females) with different pulmonary lesions treated by pulmonary resection by one surgeon in Basrah, Iraq/ complete history and physical examination were performed. The presenting symptom(s) and the most probable diagnosis were recorded. Investigations to confirm the diagnosis included plain chest radiography (PA and lateral projection). Bronchoscopy was performed in 20 patients for

different indications while it was unnecessary in most cases of pulmonary hydatid cysts and in 4 infants with congenital lobar emphysema. The decision to resect was either taken preoperatively (the majority of patients) was anticipated but confirmed intraoperatively. Therefore, all patients were adequately prepared for this sort of surgery. The pulmonary function was assessed clinically and by spirometry in most patients especially when pneumonectomy was anticipated. Adequate amount of blood was prepared. Adult patients had one lung ventilation through double-lumen endotracheal tube unless such intubation proved difficult. The approach was via standard posterolateral 5th space thoractomy with rib resection in some cases. Pulmonary vessel first technique was used. Pulmonary vessels were ligated by silk (00 for segmental and 0 for lobar and main vessels). Additionally, the proximal ends of the main pulmonary artery and veins were clamped and sutured by continuous 4-0 prolene. The divided bronchi were sutured by interrupted 00 silk sutures. After meticulous haemostasis and airtightness 2 chest tubes were used in lobectomized patients and left until blood drainage and air leak ceased. One chest tube was used after pneumonectomy and was kept clamped to prevent mediastinal shift. The intraoperative events as well as the postoperative complications were recorded.

Results

Table I shows the age and sex distribution of patients. The youngest patient was a one-month-old girl with congenital lobar emphysema and the eldest was a 61-year-old man with life threatening haemoptysis secondary to pulmonary tuberculosis. The mean age is 26 years.

Table I. Age and sex distribution of patients.

Age	M	F	Total	%
1d-1 y	2	2	4	13.3
1-9 y	0	2	2	6.6
10-13y	2	0	2	6.6
14-19y	3	2	5	16.6
20-29y	4	2	6	20
30-39y	1	1	2	6.6
40-49y	2	1	3	10
50-59y	3	2	5	16.6
60-69y	0	1	1	3.3
Total	17 (56.6%)	13 (43.3%)	30	100

The indications for lung resection are listed in Table II. The commonest indication was pulmonary hydatid cyst (13 cases) followed by suppurative lung disease (7 patients). Five cases had lung tumours (4 bronchogenic carcinoma and one bronchial carcinoma), 3 patients with bronchogenic carcinoma was treated by pneumonectomy while the fourth, a lady of 50 years, had right upper lobectomy for squamous cell carcinoma (op. on March 3, 1998 and she is disease free since then, about 6 years). The fifth case was a man of 50 treated by left upper lobectomy for bronchial carcinoid on January 1997; he is alive and well at present.

Table II. Indication for pulmonary resections

Indication	No. of pats	%
Pulmonary hydatid disease (PHD)	13	43.3
Pulmonary tuberculosis	4	13.3
Lung abscess	2	6.6
Broncheictasis	1	3.3
Tumours	5	16.6
Bronchogenic carcinoma	4	13.3
Bronchial carcinoid	1	3.3
Congenital labour	4	13.3
Emphysema		
Haemoptysis	1	3.3
Total	30	100

Almost all anatomical types of pulmonary resections are represented in this study and shown in Table III. Sixteen patients had left-sided resections versus fourteen patients with right-sided resec-

tions. The commonest operation was left upper lobectomy (9 cases). One patients had resection of left upper lobe proper with preservation of lingula for a huge simple hydatid cyst destroying the left upper lobe proper but saving the lingula. Pneumonectomy was done in 7 cases for indications shown in Table IV.

Table III. Types of pulmonary resections

Type	No.	%
Left-sided	16	53.3
Right-sided	14	46.6
R-pleuropneumonectomy	1	3.3
R-pneumonectomy	3	9.9
L-pleuropneumonectomy	1	3.3
L-pneumonectomy	2	6.6
Middle lobectomy	2	6.6
R.upper lobectomy	2	6.6
R.lower lobectomy	3	9.9
Bilobectomy (middle & lower)	2	6.6
Bilobectomy (upper & middle)	1	3.3
L.upper lobectomy	9	30
L.lower lobectomy	1	3.3
Segmentectomy (LUL proper resection with preservation of lingula)	1	3.3
Total	30	100

Table IV. Indications for pneumonectomy

Indication	No. of patients
Bronchogenic carcinoma	3
Pulmonary tuberculosis	2
Inadvertent injury to main pulmonary artery during left upper lobectomy for PHD.	1
Complicated pulmonary hydatid cyst	1
Total	7

All pneumonectomized patients were extubated in the theatre without the need for assisted respiration. There was no hospital mortality. Two patients were lost for follow up. Four patients

developed empyema with or without bronchopleural fistula.

Table V displays the indications for lung resection in pulmonary hydatid cyst. Six patients had infected ruptured cysts while five had huge simple cysts causing lobe destruction.

Table V. Indications for resection in pulmonary hydatid disease.

Indication	No. of patients	%
Huge simple cyst causing lobe destruction	5	38.4
Suspicion of a tumour	1	7.6
Infected ruptured cyst	5	38.4
Hydatid broncheictasis	1	7.6
Life-threatening haemoptysis secondary to central eroding pulmonary vessel	1	7.6
Total	13	100

Four tuberculous patients had lung resections. Two of them had pleuro-pneumectomy for empyema and totally destroyed underlying lung. One case had left lower lobectomy for life threatening haemoptysis while the last had right positive smear and drug resistant mycobacteria.

Eight patients were children. Half of them (4) had resection for infective or parasitic causes [broncheictasis and pulmonary hydatid cyst (PHC)].

Bronchoscopy was done prior to resection in 20 patients mainly for haemoptysis. It was not necessary in 6 patients with pulmonary hydatid cysts and in 4 patients with congenital lobar emphysema.

The complications are shown in Table VI. There was one intraoperative death due to asphyxiation with blood (3.3%). Bronchopleural fistula with empyema complicated four cases [3 following pneumonectomy (42.8%) and one after lobectomy (4.3%)]. Three fistulae responded to conservative treatment but one persisted.

Table VI. Complications of pulmonary resection.

Complication	No. of pats	Comment
Intraoperative		
1- Death due to asphyxiation with blood	1	
2- Slipped ligature of main pulmonary artery	1	Fortunately could be controlled
3-Cardiac standstill	2	Responded to resuscitation
Postoperative		
1-Wound infection	8	100
2-BPF with empyema	4	
After pneumonectomy	3	Two closed spontaneously One persisted
After lobectomy	1	Closed after conservative treatment
3-Empyema without BDF	1	

All surviving patients in this study except 2 are seen at regular follow up visits and they are in a good health.

Discussion

The number of patients in this study is relatively small. Elhassani reported 50 cases of paediatric pulmonary resections over a period of 2½ year at the Thoracic Surgical Department of Medical City Teaching Hospital, Baghdad⁴. Faisal Haba reported 36 cases of pulmonary resection for pulmonary hydatid cyst over 2 years in Ibn Al-Nafis Hospital, Baghdad⁸. Elhassani, in another study, reported 88 lung resections for various causes over a 2-year period⁶. This is not surprising, as these are the major centers of thoracic surgery in our country to which cases are referred from all governorates. This study, however, is the first about pulmonary resection in Basrah, south of Iraq. The relatively small number of patients treated by lung resection in this study is partly explained

by the high percentage of inoperable bronchogenic carcinoma in Basrah (95.8%)⁹. The study included only four patients with bronchogenic carcinoma treated by lung resection. Thus it is hoped that with early detection of lung malignancies, more patients with operable bronchogenic carcinoma would present to us and benefit from resection which offers the best chance for cure in patients with stage 1 or 2 non-small cell lung cancer (NSCLC)³.

The age of patients in this study from one month to 61 year. Thus pulmonary resection is feasible at any age, or in other words, age is not a contraindication for lung resection, provided the patient has a good pulmonary reserve to tolerate the removal of lung parenchyma¹⁰⁻¹².

The decision to do lung resection in the patients under study was made preoperatively in most cases (ILE, PTB, tumours, broncheictasis, lung abscess and life threatening haemoptysis). In cases of PHC, it was possible to anticipate the need for lung resection in most of them due to huge size of the cyst but in 4 cases the decision was taken during operation when the lobe was found destroyed.

Children constituted almost quarter of cases in this series. Half of them had resection for parasitic and infective causes (pulmonary hydatid cyst and broncheictasis). In Elhassani series, 62% of pulmonary resection children were for infective and parasitic diseases; both of which are preventable⁴. The most common indication for paediatric pulmonary resection in developed countries is congenital malformations. It is regrettable to notice that pulmonary resection in such age group in Iraq was performed in the majority of cases for preventable diseases⁴.

Four children had lung resection for infantile lobar emphysema (ILE). Their ages ranged from 1 month to 1 year. All had left upper lobe involvement and

were treated by left upper lobectomy with uneventful recovery. Alhassani reported 16 cases of ILE out of 50 paediatric cases, 11 cases were in left upper lobe⁴. Lobar emphysema is a common cause of respiratory distress in infants accounting for approximately 50% of congenital lung malformations^{13,14}.

Pulmonary resectional procedures still represent the appropriate treatment for many pulmonary lesions. Neoplasms of the lung, mainly malignant, are the most common indications for pulmonary resection⁶. However, in this study, tumours constituted only a small group mainly due to delayed presentation and diagnosis, so most cases are beyond the scope of resection when first seen⁶.

Pulmonary hydatid cyst is endemic in our country. It is responsible for most of the thoracotomies in our practice. In Faisal Haba's series, surgery for pulmonary hydatid cyst constituted 25-35% of thoracotomies⁸. Parasitic infestation by hydatid cyst when complicated is a common indication for resection in Iraq⁴. Elhassani reported 28% of cases treated by pulmonary hydatid disease required resection in Faisal Haba series⁸.

The treatment for hydatid disease is surgical removal of the cyst and its contents with preservation of lung parenchyma. Every trial should be done to remove as little as possible of functioning lung tissue in order not to affect pulmonary functions^{8,15-17}. Pulmonary resection is reserved for the simple giant cyst that causes permanent and irreversible changes in the affected part of the lung and for the complicated cyst where infection has caused lung abscess. Resection is also indicated when there are multiple daughter cysts within the mother cyst. In patients with massive haemoptysis or recurrent suppuration following the removal of the cyst, resection of the involved part of the lung is advisable^{4,15}. Bronchobiliary fistula is

another indication for lung resection in PHC^{8,15}.

The commonest indication for pulmonary resection in this series is pulmonary hydatid cyst (13 cases; 34.3%). All of them were treated by lobectomy except 2 patients who had pneumonectomy. In one case, exploration was done for suspicion of tumour, however, there was a complicated hydatid cyst requiring left upper lobectomy. During the course of lobectomy, the left main pulmonary artery was injured inadvertently; thus pneumonectomy was necessary to save the patient. The patient did well postoperatively. The second patient had ruptured infected hydatid cyst of the middle lobe. He was managed initially by removal of the cyst contents and preservation of the lung. Unfortunately, the patient had persistent larger air leak postoperatively which required reoperation and pneumonectomy. In retrospect, middle lobectomy was necessary from the start rather than lung preservation. This proves the fact that when the surgeon is reluctant to do pulmonary resection for any reason in the presence of a strong indication, then the price, i.e. the morbidity, will be high.

There was one death in this series. The patient died intraoperatively due to asphyxiation with blood. He was a man of 49 who presented with recurrent massive haemoptysis from bilateral central pulmonary hydatid cysts. Fiberoptic bronchoscopy showed the bleeding to arise from the left lower lobe. He was intubated by a double-lumen endotracheal tube (DLT), but unfortunately, it seems that it did not provide adequate bronchial blockade. During left lower lobectomy, profuse bleeding through the endotracheal tube occurred. The patient died due to pooling of blood to the opposite side. Asphyxiation, rather than hypovolemia, is the usual cause of death from haemoptysis¹⁵. Pulmonary haemorrhage is a well-known absolute indication for one lung ventilation (OLV)¹⁸⁻²⁰

in order to isolate the bleeding lung from the normal dependent lung. Many authorities advocate the routine use of a DLT in all adult patients requiring thoractomy not only for reasons related to the pure indication for OLV, but also for training purposes. Gaining adequate training by routinely practicing OLV enables the anaesthesiologist to provide this service to the patient with absolute indication like lung resection for life threatening haemorrhage.

In regard to preoperative evaluation, assessment of pulmonary function is essential prior to lung resection especially when pneumonectomy is considered. In this study, non of the patients had postoperative pulmonary insufficiency. On the contrary, it was possible to extubate the patients with pneumonectomy in the theatre with very good values of Oxygen saturation. This indicates that the clinical and spirometric assessment of pulmonary function of these patients was good.

Most patients were bronchoscoped preoperatively. The main indication was haemoptysis, which was severe in at least 6 patients. Bronchoscopy was essential in choosing the side for resection when haemoptysis occurred in a patient with bilateral lesion. It is noteworthy that lung resection provided complete cure for patients with life threatening haemoptysis except the unfortunate patient who died intraoperatively.

The surgical treatment for pulmonary tuberculosis has changed from "collapsing therapy" years ago to pulmonary resection. Compared with thoracoplasty, pulmonary resection has the advantage of achieving prompt conversion to sputum-negative status in a single stage without creating any chest-wall deformity or severe limitation of ventilatory capacity^{18,21}. The indication for resection include cavities (especially an open cavity) with positive sputum, thick-walled cavity, a cavity containing

mycetoma, tuberculomas, bronchial stenosis, bronchiectasis, destroyed lung, massive persistent or recurrent haemoptysis in a localized disease and failure of chemotherapy due to infection with atypical mycobacteria^{6,15}. In this study, 4 tuberculous patients were subjected to resectional therapy. All of them received anti-tuberculous drugs for adequate periods. In 3 patients decortication was combined with lung resection. The outcome of surgery was good. The patient with life-threatening haemoptysis has been cured by left lower lobectomy. Two patients had pleuropneumonectomy for totally destroyed lungs, one developed persistent pleural space due to inadequate expansion of the remaining right lower lobe. Thus he was referred to another thoracic surgical centre where he had tailoring thoracoplasty in 2 stages. Two specific complications of resection for mycobacterial disease are particularly worrisome, empyaema with or without bronchopleural fistula, and bronchogenic spread of mycobacterial disease. These complications occur more frequently when the patient is sputum positive at the time of operation^{12,22-24}.

The technique of resection adopted in this series is the standard one. Isolation of pulmonary vessels was followed by bronchial dissection. The safety dictates using a technique with which the surgeon is familiar. One patient had slipping of a ligature of the pulmonary artery; fortunately, this happened intraoperatively and therefore, the bleeding was controlled. Ligature is thus the least safe procedure. It is better to apply a vascular clamp, divide and then suture the vessel by a vascular suture or apply

an additional transfixing ligature proximally. The use of pedicled pleura in the closure of bronchial stump is very much recommended to minimize the incidence of bronchopleural fistula²⁵. Moreover, the use of automated stapling device is also recommended to be used routinely in all pulmonary resections for the same purpose¹⁸. However, no matter what technique or suture material is used in closing the bronchus, the most important factor that guards against the occurrence of this complications is the preservation of blood supply of the bronchial stump by avoiding excessive peribronchial dissection and denudation.

In this study, no mortality was reported after pneumonectomy. There was one death following lobectomy (4.3%) due to anaesthetic cause. This is considered low in comparison with other studies (8% and 11.4%)^{4,6}.

In conclusion, the results of this study indicate that despite the small number of patients and the difficulties in anesthetic management, pulmonary resection is being practiced safely in Basrah, south of Iraq. It is hoped that in the future more patients with benefit from lung resection by early diagnosis of cases of lung tumours. The thoracic surgeon needs to master the technique of lung resection as any pulmonary operation can change into lung resection. Reluctance to do pulmonary resection when it is really indicated will cost the patient a lot in term of morbidity and mortality. There is an urgent need to increase the skill of our anaesthesiologists in the field or thoracic anaesthesia specially in lung isolation techniques.

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