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ABSTRACT

Introduction: Primary pulmonary resection is defined as the surgical ablating or endoscopic of an entire lobe called lobectomy or an entire lung called pneumonectomy. Our objective is to describe the indication for a primary pulmonary resection and to research the morbidity and mortality factors of primary pulmonary resection at the Joseph Ravoahangy Andrianavalona Antananarivo University Hospital.

Method: This is a retrospective descriptive and analytical study of 216 patients hospitalized in the thoracic surgery department at the Joseph Ravoahangy Andrianavalona Antananarivo University Hospital (CHU-JRA), from January 1, 2015, to December 31, 2023, who underwent primary pulmonary resection.

Keywords: aspergillome, empyema, lobectomy; pneumonectomy; surgery; tuberculosis.

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Results: We collected 216 patients with a male predominance (73,6%) and a median age of 33. Post-tuberculosis pulmonary destruction is the main indication for resection in 53,24% cases, followed by a cavernous lesion of pulmonary aspergillosis in 24,07% cases then tumor mass in 18,06% and the nodular lesion in 4,63% cases.

We realized a lobectomy in 71,29% of cases and a pneumonectomy in 28,71%. The complications found are dominated by pneumothorax, prolonged bubbling, pleural empyema, bronchopleural fistula, bleeding, recurrent paralysis, septic shock and cardiac rhythm disorder. The mortality rate is 8,33% cases. severe factors were found notably: undernutrition with IMC ≤ 18 kg/m² (RR= 5[2,1-11,7]), hemorrhagic shock (RR=9,3 [3,7-13,3]), septic shock (RR=13,3 [4,6-28,4]), cardiogenic shock (RR=8,5[3,7-12,3]), pleural empyema (RR=8,5 [3,8 -13,6], bronchopleural fistula (RR=6,7[2,9-15,3]).

Conclusion: Post-tuberculous pulmonary destruction is the main indication for primary pulmonary resection in Madagascar, the complications are numerous and severe, profound factors have been involved leading to a relatively high mortality rate.

Keywords: aspergillome, empyema, lobectomy, pneumonectomy, surgery, tuberculosis.

I. INTRODUCTION

Primary pulmonary resection is defined as the surgical ablating or endoscopic of an entire lobe called lobectomy or an entire lung called pneumonectomy. It is called minor when it is ablating an anatomical or atypical segment [1]. Pulmonary resection surgery contributes to the management of pathology, notably tumours and infection [2]. Our objective is to describe the indication for significant pulmonary resection and to research the morbidity and mortality factors of primary pulmonary resection at the Joseph Ravoahangy Andrianavalona Antananarivo University Hospital (CHU-JRA).

II. PATIENTS AND METHOD

This is a retrospective descriptive and analytical study of 216 patients hospitalized in the thoracic surgery department at CHU-JRA, from January 1, 2015, to December 31, 2023, who underwent significant pulmonary resection. We included in this study, all patients hospitalized in the thoracic surgery département for primary pulmonary resection during this period, we excluded all patients who underwent unsettled surgery (atypical resection, segmentectomy and nodulectomy).

III. RESULTS

We had collected 216 patients with a male predominance of 159 men or 73,6% for 57 women or 26,4%. The sex ratio was 2,8 in favour of men. The median age was 33 years, of which the most represented age group was between 20 and 40 years representing 58,33% (figure 1). Under-nutrition with body mass index ≤ 18kg/m² was found in 16,67% cases (table I). Obstructive syndrome accounted for 8,8% of cases (table II). Post-tuberculosis lung destruction is the main indication for resection in 53,24% cases, followed by a cavernous lesion of pulmonary aspergillosis in 24,07% cases then the tumor mass in 18,06% and the nodular lesion in 4,63% cases (table III). We realized a lobectomy in 71,29% cases and a pneumonectomy in 28,71% cases (Table IV).

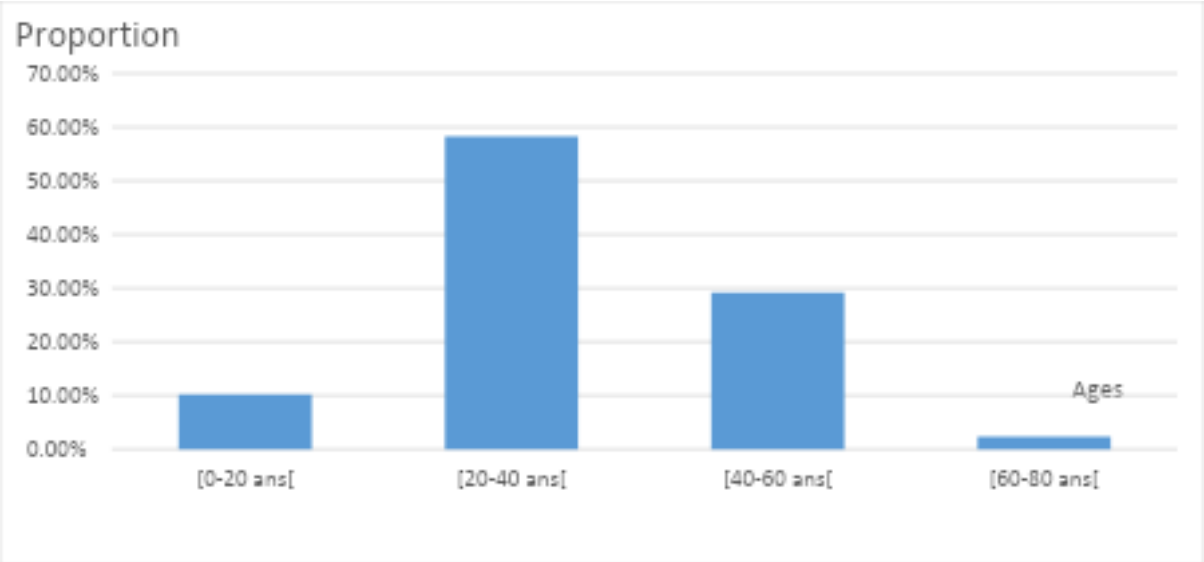

Figure 1: Distribution of Patients According to Age Group

Table I: Distribution of Patients According to Body Mass Index

Body mass index	Effective (N=216)	Percentage (%)
<18	36	16,67
18-25	177	81,94
25	03	1,39

Table II: Distribution of Patients According to Results EFR

VEMS	Effective (N=216)	Percentage (%)
Superior 1,5L	197	91,20
Lower 1,5 L	19	8,80

Table III: Distribution of Patients According to Surgical Indication

Surgical indication	Effective (N=216)	Percentage (%)
Sequelae pulmonary destruction	115	53,24
Cavernous lesion	52	24,07
Tumor mass	39	18,06
Nodular lesion	10	04,63

Table IV: Distribution of Patients According to the Type of Surgical Intervention

Type of surgical intervention	Effective (N=216)	Percentage (%)
Lobectomy	154	71,29
Pneumectomy	62	28,71

We found intraoperative complication in 53,7% cases, of which septic shock in 32,87% cases and hemorrhagic shock in 17,59% cases (Table V). Post operative medical complication were represented by pneumonia in 23,14% de case and heart rhythm disorder in 3,7 % cases (Table VI). Pneumothorax and parietal infection are frequent post-operative complication. Bronchopleural fistulas and pleural empyema represented respectively 6,9% et 5,56% cases (Table VII).

Table V: Distribution of Patients According to Post Operative Complication

Intraopérative complication	Effective (N=216)	Percentage (%)
Hemorrhagic shock	38	17,59
Septic shock	45	32,87
Cardiogneic shock	07	3,24
No complication	100	46,29

Table VI: Distribution of Patients According to Post Operative Medical Complication

Post-operative complication		Effective (n)	Percentage (%)	
Pulmonary	Pneumonia	50	23,14	
	SDRA	31	14,35	
	Bronchospasm	12	5,56	
	Acute lung edema	5	2,31	
	Atelectasis	10	4,62	
	Pulmonary embolism	05	2,31	
Cardio-vascular	Stroke	2	0,92	
	Heart rhythm disorder	08	3,70	
	Acute coronary syndrom	03	1,39	

Table VII: Distribution of Patients According to Post Operative Surgical Complication

Surgical Complication	Effective (N=124)	Percentage (%)
Pleural empyema	12	5,56
Pneumothorax	35	16,20
Post operative bleeding	18	8,33
Recurrent paralysis	5	2,31
Prolonged bubbling	17	7,88
Parietal infection	22	10,19
Bronchopleural fistula	15	6,94

We analyzed several factors; we showed that undernutrition ≤ 18kg/m² increases the mortality risk with a relative risk of 5 (Table VIII). The intraoperative complication, particularly septic shock and hemorrhagic shock, increases the risk of morbidity and mortality (tableau IX). The post-operative pleural empyema increases the risk of mortality to 8,5 times and bronchopleural fistula increases the mortality risk to 6,5 times compared to patients who have undergone major pulmonary resection without post-operative complication here (Table X et XI).

Table VIII: Correlation Between Body Mass Index and Post Operative Surgical Complication

Body mass index	Deceased n (%)	Alive n (%)	RR [IC à 95%]
BMI ≤ 18 Kg/m2 Oui Non	9(25) 9(5)	27(75) 171(95)	5 [2,1-11,7]

Tableau IX: Correlation between Patients with Intraoperative Complication and Risk of Death

Intraoperative complication	Deceased n (%)	Alive n (%)	RR [IC à 95%]	p-value
Hemorrhagic shock Yes No	12(31,6) 6 (3,4)	26(68,4) 172(96,6)	9,3 [3,7-13,3]	0,7.10-6 S
Septic shock Yes No	14(31,1) 4 (2,3)	31(68,9) 167(97,7)	13,3 [4,6-18,5]	0,4.10-7 S
Cardiogenic shock Oui Non	4(57,1) 14(6,7)	3(42,9) 195(93,3)	8,5 [3,7-12,3]	0,5.10-3 S

S: significant

Tableau X: Correlation between Patients with Surgical Complication and Risk of Death

Post-operative complication	Deceased n (%)	Alive n (%)	RR [IC à 95%]	p-value
Pneumothorax Oui Non	8(8,6) 15(8,3)	32(91,4) 166(91,7)	1,3	0,4 NS
Empyème pleural Oui Non	6(50) 12(5,9)	6(50) 192(94,4)	8,5 [3,8-13,6]	0,5.10-4 S
Bullage prolongé Oui Non	2(11,8) 16(8)	15(88,2) 183(92)	1,2	0,2 NS

S: significant

NS: Non significant

Table XI: Correlation between Patients with Surgical Complication and Risk of Death

Post-operative Complication	Deceased n (%)	Alive n (%)	RR [IC à 95%]	p-value
Broncho-pleural fistula yes No	 6(40) 12(6)	 9(60) 189(94)	 6,7 [2,9-15,3]	 0,2.10-4 S
Recurrent paralisis Oui Non	 0(0) 18(8,5)	 5(100) 193(91,5)	 0	 0,3 NS

S: Significant
NS: Non significant

IV. DISCUSSION

In our study, we collected 216 patients, the median age is 33 years, our study is similar to the survey carried out by Bazongo et al. In sub-Saharan Africa and Morrocco represented respectively 35,5 years et de 36 years [3,4]. Our population is young compared to the survey in Europe, with your median age is 63 years [5] and 59 years in the United States [5]. This difference is due to a different indication of a primary pulmonary resection in developing countries, compared to developed countries whose main indication is bronchopulmonary cancer [5]. The literature said that primary pulmonary resection affects both sexes in a variable manner, we noted a male predominance representing 73,6% cases with a sex ratio of 2,8. Our survey was relayed by Bouchikh et al. [4]. This difference is due to a high prevalence of pulmonary aspergillosis and pulmonary tuberculosis in men compared to women [6].

In our study, post-tuberculous pulmonary destruction is the main indication for primary pulmonary resection, represented 53,24% cases, which was identical to the survey carried out by Bazongo et al. In sub-Saharan Africa and Tanauh Y et al. In Ivory coast [3,7]. This resection can be deferred or urgently during septic shock due to encysted pyopneumothorax or associated parenchymal necrosis or severe hemoptysis [8]. In regions with a high tuberculosis endemic, pneumonectomy is a reference for posttuberculosis pulmonary destruction [1-3].

Our survey is different from that reported by Lele E et al. where the indication for pneumonectomy is due to damage to the hilar pedicle of mass which encompasses the pulmonary hilum [5].

Pulmonary aspergillosis is the second cause of primary pulmonary resection in our country. The literature said, surgical treatment is the reference treatment for pulmonary aspergillosis [5], it must be systematically offered even in asymptomatic people apart from operative contraindication, since surgery offers three advantages, it allows the symptoms to be controlled, prevents the recurrence of hemoptysis and increase patient survival [9]. This surgical intervention consists of resecting the nose and the residual cavity, this type of resection carries a hemorrhagic risk due to the density of the richly vascularized pleural adhesion and the richness of neovascularization, this resection can be carried out either a lobectomy or a pneumonectomy [10]. Finally, pulmonary resection for bronchopulmonary cancer was low in our study, represented 18,06% case, similar to the survey carried out by Bazongo et al. In sub-Saharan Africa represented 11,8% cases, unlike the studies carried out by Lele E et al. In Europe, for which bronchopulmonary cancer is the main indication represented 63% cases [5], this difference is due to heavy smoking in developed countries mainly in Europe, and also linked to the delay in diagnosis of cancer in the country in development pathway where the cancerous is found at the metastatic disease stage in the majority of cases and becomes inaccessible to surgery.

In our study, conventional thoracotomy constitutes the most used approach, we realized a lobectomy in 71,29% cases and a pneumonectomy in 28,71% cases, identical with the survey reported in the literature [11]. Shiraishi Y et al. said, totalization pneumonectomy is not exceptional, it is a last resort procedure, whose indications are limited essentially to hemostasis procedures in emergency and lesions extended over several lobes [12]. In our context, it is indicated that lobectomy was feasible in complex firms because it is burdened with significant mortality and morbidity, particularly decompensation of respiratory insufficiency and infection of the pneumonectomy cavity [12].

The literature said, the incidence of post-operative complications was of the order of 30% following lung resection procedures, the non-fatal complication of which is mainly represented by arrhythmia (5—25 %), atelectasis (3—10 %), pneumonia (3—6 %), bronchospasms (1—5 %), acute respiratory distress syndrome (1 à 5 %) and bronchopleural fistula (1—3 %) [5]. Post-operative complication after primary pulmonary resection is frequent. The complications encountered in our study represented 17,59%. The intraoperative complication by septic shock and hemorrhagic shock represented respectively 32,87% and 17,59%. It is a high incidence in comparison to the survey carried out by Hidetaka et al. in Japan which found bleeding as a post operative complication in 1,3% cases. This difference is explained by comorbidities predisposing to bleeding from pulmonary aspergillosis. Infectious complication generally represents 31% of the post-operative complication [14]. Pleural empyema during our study represented 5,56% carried out by Fernandes et al. (8,9 %) [14]. Simeone et al. found a higher frequency of 11% in patients undergoing chemotherapy and radiotherapy [15]. Wall infections accounted for 3,40 %. Sok. M et al. in Slovenia found 1% [16]. This difference is explained by the infectious indications for pulmonary resection in our series.

Pulmonary resection remains burdened by significant operative morbidity and mortality despite substantial progress in preoperative development, anesthesia, surgical technic and post-operative care [5]. This morbidity depends mainly on the extent of pulmonary resection, the need for resection of the carina, the age and pre-existing comorbidities of the patient. In our study, severe factors were involved in the high morbidity and mortality of a primary pulmonary resection, notably undernutrition ≤ 18 kg/m², septic and hemorrhagic shock and post-operative complication such as pleural empyema, bronchopleural fistula. Undernutrition increases the mortality risk five times compared to a patient who underwent pulmonary resection and whose nutritional status was normal. Our result is identical to that reported by Vita O et al. [17]. This undernutrition promotes poor healing and increases the risk of a parenchymal or bronchial suture coming loose, causing a bronchopleural fistula. It Also causes respiratory muscle weakness postoperatively, which reduceronchial evacuation causing bronchial congestion.

In our study, the state of septic shock in intraoperative remains high. It represented 32,87% of cases, it increases the risk of mortality by 13,3 with IC 95% [4,6-28,4] p=0,4.10-7 compared to patients without septic shock in intraoperative, Our study is different from that reported by Fernandes E O et al. [14] and survey by Lebedeva R N et al. who found an incidence respectively 5,68 % et 0,2% [18]. This marked difference is explained by the precocity of antibiotic prophylaxis adapted in developed countries, and our patients were already infected before the intervention like the cases of patients presenting aspergillary infections.

In our study, pleural empyema is a primary morbidity and mortality factor, because it increases the mortality risk by 8,5% of cases, which is identical to the survey carried out by Bazongo et al. [3]. Pleural empyema is favored by the late discovery of this infection, or due to poor postoperative analgesic management leading to bronchial congestion or a failure of pulmonary re-expansion. Finally bronchopleural fistula increases the mortality risk by 6,7 times in our study. It is favored by undernutrition; it is a most formidable complication because the pneumonectomy cavity remains a residual space

of large volume without the possibility of filling. This fistula increases mortality 50%.

The literature said, supraventricular cardiac arrhythmias with a predominance of atrial fibrillation are extremely common in thoracic surgery (20 à 25%) [20]. Surgery adds its risk factors: hypoxia, pericardial irritation, especially if pericardial approach or pericardial resection, intra and preoperative filling as well, as trauma to the sympathetic nervous system the pulmonary procedure but also lymph node dissection [19].

V. CONCLUSIONS

Primary pulmonary resection is a standard surgical procedure in thoracic surgery. The main indication is dominated by post-tuberculous parenchymal destruction, followed by pulmonary aspergillosis in developing countries like Madagascar. Severe factors have been implicated in the high mortality rate including undernutrition, septic shock, hemorrhage shock, pleural empyema and bronchopleural fistula.

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