Original Article

Noncardiac thoracic surgery in Abidjan, from 1977 to 2015

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Background: To report and analyze noncardiac thoracic operations performed at the Cardiology Institute of Abidjan (Institut de Cardiologie d'Abidjan) from 1977 to 2015.

Methods: This is a retrospective and descriptive study covering 39 years, from 1977 to 2015. This study period was divided into three periods of 13 years each: P1 from 1977 to 1989, P2 from 1990 to 2002 and P3 from 2003 to 2015. Medical records of 2014 operated patients were analyzed: 414 patients for P1, 464 patients for P2, 1,136 patients for P3. The records destroyed in a fire in 1997 were not included in the study. The age, sex, pathologies, types of operations, post-operative complications and mortality were analyzed with usual statistical tests.

Results: The average age varied from 35 years in P1 to 31.6 years in P3. Men predominate in all periods. Distribution of important groups of pathologies observed varies significantly over the three periods; In particular, we note an increase in trauma cases (tripling between P1 and P2, 140% between P2 and P3), and a decrease in tumors percentages, and infections and pulmonary sequelae of tuberculosis. Surgical management of thoracic trauma has increased (56.9% in P3) followed by the pleural surgery (21.3%) and pulmonary resections (13.9%). Persistent air leak >7 days was the predominant complication over the three periods. Postoperative empyema increased in P3 (14.7%). Close chest drainage-irrigation is the most frequent procedure performed to sterilize a major complication like postoperative empyema without bronchopleural fistula. Overall mortality decreased from 5.3% in P1 to 3.4% in P3.

Conclusions: Noncardiac thoracic surgery operations still concern infections, pulmonary sequelae of tuberculosis, thoracic tumors and many more thoracic trauma caused by current armed conflicts and terrorist attacks. But access to thoracic surgical care remains difficult for our population secondary to low economic status, and lack of a health insurance system. Therefore surgical consultation is often obtained at a very advanced stage of the disease. Nevertheless overall mortality observed in the practice of this surgery is reasonable.

Keywords: Chest trauma; pulmonary sequelae of tuberculosis; empyema; bronchopleural fistula; drainage-irrigation

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Introduction

Activities related to noncardiac thoracic surgery began in 1977 in Abidjan at the Cardiology Institute (Institut de Cardiologie d'Abidjan, Côte d'Ivoire) along with the first open heart operation under the guidance of professors Dominique Métras, Andre Ouezzin-Coulibaly and Alexandre Ouattara Kouame (*Figure 1*). At the beginning, pulmonary resections for pulmonary sequelae of tuberculosis were predominant activities. But to date the operations are more varied with a share of increasing importance given to the surgical management of thoracic trauma.

In this paper, the authors reviewed the activities of noncardiac thoracic surgery since the beginning and analyzed the results.

Methods

This was a retrospective and descriptive study concerning 39 years from 1977 to 2015. This study period was divided into three periods of 13 years each: P1 from 1977 to 1989, P2 from 1990 to 2002 and P3 from 2003 to 2015. Medical records of 2014 operated patients were analyzed: 414 patients in P1, 464 patients in P2, 1,136 patients in P3. The records destroyed in a fire in 1997 were not included in the study. The age, sex, pathologies, types of operations, post-operative complications and mortality were analyzed. Distributions of the main groups of pathologies were compared on the three periods using the fitting χ^2. The percentages of death of patients in each of the disease groups, as well as for all pathologies were compared on the three periods using the test for the compliance of χ^2. The level of significance of statistical tests was set at 0.05.

Figure 1 The three pioneers of thoracic and cardiovascular surgery in Abidjan, Côte d'Ivoire [1980]. We can see from left to right: professor Alexandre Kouamé Ouattara, professor Dominique Métras, professor André Ouezzin-Coulibaly.

Results

Age and sex

The average age was 35 years in P1 (range 11 months to 71 years), 36.2 years in P2 (range 1 year to 71 years) and 31.6 years in P3 (range 1 month to 78 years). Men predominated in all periods. However the distribution of patients by sex varied significantly over the three periods; In particular, we noted an increase in the proportion of women, resulting in a decrease in the sex ratio (*Table 1*).

Pathologies observed

Distribution of important groups of pathologies observed varied significantly over the three periods; in particular, we noted an increase in trauma cases (tripling between P1 and P2, 140% between P2 and P3), and a decrease in tumors percentages, and infections and pulmonary sequelae of tuberculosis (*Table 2*).

Infections and pulmonary sequelae of tuberculosis

Pathologies such as symptomatic bronchiectasis,

Table 1 Distribution of patients according sex in the three periods indicated

Sex	N (%)			
	P1	P2	P3	Total
Male	336 (81.2)	352 (75.8)	829 (73.0)	1,517 (75.3)
Female	78 (18.8)	112 (24.2)	307 (27.0)	497 (24.7)
Total	414 (100.0)	464 (100.0)	1,136 (100.0)	2,014 (100.0)
Sex ratio	4.31	3.14	2.70	3.05

χ^2=11.03; degree of freedom =2; P value =0.004; P1, from 1977 to 1989; P2, from 1990 to 2002; P3, from 2003 to 2015.

Table 2 Distribution of different groups of pathologies according to the three periods indicated

Pathologies	N (%)			
	P1	P2	P3	Total
Infections and pulmonary sequelae of tuberculosis	223 (53.9)	164 (35.6)	372 (32.2)	759 (37.3)
Tumors	123 (29.7)	81 (17.6)	134 (11.6)	338 (16.6)
Trauma	43 (10.4)	159 (34.4)	556 (48.2)	758 (37.3)
Miscellanous	25 (6.0)	60 (12.4)	93 (8.0)	178 (8.8)
Total	414 (100.0)	464 (100.0)	1,155 (100.0)	2,033 (100.0)

χ^2=230.6; degree of freedom =6; P value ≤0.0000001; P1, from 1977 to 1989; P2, from 1990 to 2002; P3, from 2003 to 2015.

Table 3 Distribution of infections and pulmonary sequelae of tuberculosis according to the three periods indicated

Infections and pulmonary sequelae of tuberculosis	N (%)			
	P1	P2	P3	Total
Pulmonary sequelae of tuberculosis	156 (69.6)	38 (23.0)	103 (27.7)	297 (39.0)
Bronchiectasies	66	18	11	95
Aspergilloma	59	12	25	96
Destroyed lung	31	8	67	106
Tuberculoma	2 (0.9)	1 (0.6)	–	3 (0.4)
Active tuberculosis	3 (1.3)	2 (1.2)	–	5 (0.7)
MultiResistant tuberculosis	1 (0.5)	1 (0.6)	2 (0.5)	4 (0.5)
Tuberculous pleurisy	–	18 (10.9)	18 (4.8)	36 (4.7)
Empyema	8 (3.6)	64 (38.8)	137 (36.7)	209 (27.5)
Fibrothorax	7 (3.1)	20 (12.2)	85 (22.9)	112 (14.7)
Post-staphylococcal lung bulla	5 (2.2)	1 (0.6)	5 (1.4)	11 (1.5)
Mediastinal adenopathies	28 (12.5)	11 (6.7)	9 (2.4)	48 (6.3)
Sternal dehiscence	1 (0.5)	1 (0.6)	5 (1.4)	7 (0.9)
Rib osteitis	1 (0.5)	4 (2.4)	7 (1.9)	12 (1.6)
Hydatid cyst	3 (1.3)	–	1 (0.3)	4 (0.5)
Lung abscess	11 (4.9)	5 (3.0)	–	16 (2.1)
Total	224 (100.0)	165 (100.0)	372 (100.0)	761 (100.0)

aspergilloma, "destroyed lungs" secondarily developed on pulmonary sequelae of treated and cured tuberculosis dominated pathologies over the periods. But non tuberculous empyema occupied the first place in the last period (*Table 3*).

Tumors

The distribution of major types of tumors varied significantly over the three periods. In particular, we noted a tripling of the proportion of mediastinal tumors between P1 and P2 followed by a stagnation between P2 and P3, an increase chest wall and pleural tumors between P2 and P3, and a decrease lung tumors between P1 and P3 (*Table 4*). However the primary or secondary malignant tumors were predominant.

Chest trauma

The increase in cases was very important over the three periods. The distribution of the three periods of the

Table 4 Distribution of different types of tumors according to the three periods indicated

Tumors	N (%)			
	P1	P2	P3	Total
Pulmonary tumors	104 (84.6)	37 (45.7)	38 (28.4)	179 (52.9)
Benign	28	13	2	43
Primary malignant	76	24	28	128
Undeterminated	–	–	8	8
Pleural tumors	–	8 (9.9)	22 (16.4)	30 (8.9)
Benign	–	–	1	1
Secondary malignant	–	8	21	29
Chest wall tumors	3 (2.4)	2 (2.4)	20 (14.9)	25 (7.4)
Benign	–	1	6	7
Primary malignant	3	1	7	11
Secondary malignant	–	–	2	2
Undeterminated	–	–	5	5
Mediastinal tumors	16 (13.0)	34 (42.0)	54 (40.3)	104 (30.8)
Benign	10	25	33	68
Primary malignant	6	9	10	25
Undeterminated	–	–	11	11
Total	123 (100.0)	81 (100.0)	134 (100.0)	338 (100.0)

χ^2=95.79; degree of freedom =6; P value ≤0.0000001; P1, from 1977 to 1989; P2, from 1990 to 2002; P3, from 2003 to 2015.

types of trauma revealed a particular increase in blunt trauma between P2 and P3. The variation was statistically significant. The number of penetrating chest trauma remained higher (*Table 5*).

Miscellaneous

They were dominated by the spontaneous pneumothorax cases (*Table 6*). No case of congenital disease has been reported in the last period.

Surgical procedures

The surgical management of thoracic trauma is on the increase (56.9% in P3) followed by the pleural surgery (21.3%) and pulmonary resections (13.9%) (*Table 7*).

Postoperative complications (≤30 days)

Major postoperative complications

Persistent air leak >7 days was the predominant complication over the three periods. Postoperative empyema increased in P3 (14.7%). While the wound dehiscence by local sepsis was down (3.7% in P3 *vs.* 30.4% in P2 and 25% in P1) (*Table 8*).

Treatment of major postoperative complications

Close chest drainage-irrigation was the most frequent procedure performed to control a serious infection like postoperative empyema without bronchopleural fistula or after the closure of a bronchopleural fistula (*Table 9*).

Mortality

Overall mortality decreases from 5% in P1 to 3.4% in P3. The mortality in the group of tumors was the most important; the highest value being observed in period P3 (P=0.0015). However, this increase was offset by the increase of trauma with low mortality, resulting in a non-significant reduction in mortality across all diseases (*Table 10*).

Postoperative stay

The distribution showed an average of 12 days with a

Table 5 Distribution of types of thoracic trauma according to the three periods indicated

Trauma	N (%)			
	P1	P2	P3	Total
Penetrating	30 (69.8)	115 (72.3)	298 (53.6)	443 (58.5)
Blunt	13 (30.2)	44 (27.7)	258 (46.4)	315 (41.5)
Total	43 (100.0)	159 (100.0)	556 (100.0)	758 (100.0)

χ^2=20.27; degree of freedom =2; P value =0.00003974; P1, from 1977 to 1989; P2, from 1990 to 2002; P3, from 2003 to 2015.

Table 6 Distribution of miscellaneous pathologies according to the three periods indicated

Miscellaneous pathologies	N (%)			
	P1	P2	P3	Total
Congenital diseases	7 (28.0)	6 (10.0)	–	13 (7.3)
Pulmonary sequestrations	5			5
Polycystic lungs	1	3		4
Hypoplasia of the pulmonary artery		2		2
Esophagobronchial fistula	1			1
Persistent sternal defect		1		1
Spontaneous pneumothorax	14 (56.0)	36 (60.0)	59 (63.5)	109 (61.2)
Thoracic foreign bodies	4 (16.0)	18 (30.0)	22 (23.7)	44 (24.7)
Intrabronchial foreign bodies	4	10	16	30
Intrapleural foreign bodies		3	1	4
Chest wall foreign bodies		5	5	10
Subclavicular adenopathies	–	–	5 (5.4)	5 (2.8)
Mediastinitis	–	–	3 (3.2)	3 (1.7)
Diaphragmatic eventration	–	–	3 (3.2)	3 (1.7)
Esophagopleural fistula	–	–	1 (1.0)	1 (0.6)
Total	25 (100.0)	60 (100.0)	93 (100.0)	178 (100.0)

P1, from 1977 to 1989; P2, from 1990 to 2002; P3, from 2003 to 2015.

maximum of 9 months in P1; 8.5 days with a maximum in 3 months to P2; 8 days with a maximum of 3 months in P3.

Comments

Our relatively low number of patients can be explained by limited access to thoracic surgical care secondary to poverty of the population, the lack of a health insurance system, inefficient medical infrastructure, and the high cost of thoracic surgery (1).

Surgery of pulmonary sequelae of tuberculosis was frequently performed during the initial two periods (P1 and P2), the decrease in the last period (P3) can be explained by wider access to early, free pharmacologic treatment for tuberculous patients. Surgery for chest trauma has increased with military-political crisis since 1999. Violence and firearms use explain our high number of thoracic injuries (2).

Postoperative empyema with or without bronchopleural fistula remains a frequent complication. It frequently occurs after surgery of pulmonary sequelae of tuberculosis (3). It can be minimized by a careful preoperative preparation (4). The treatment of the empyema without bronchopleural

Table 7 Distribution of different procedures according to the three periods indicated

Surgical procedures	N (%)			
	P1	P2	P3	Total
Pulmonary resection	226 (61.6)	65 (18.0)	115 (13.9)	406 (26.0)
Partial	126	37	71	234
Total	100	28	44	172
Resection of pulmonary bullae	–	–	6 (0.8)	6 (0.4)
Resection of mediastinal tumors	9 (2.5)	26 (7.2)	34 (4.0)	69 (4.4)
Resection of hydadid cysts	3 (0.8)	–	–	3 (0.2)
Resection of tracheal stenosis	2 (0.5)	2 (0.6)	–	4 (0.3)
Bronchotomy for foreign bodies removal	5 (1.4)	5 (1.4)	8 (1.0)	18 (1.2)
Pleural surgery	24 (6.5)	64 (17.8)	177 (21.3)	265 (17.0)
Decortication	10	46	83	139
Pleurodesis	14	18	22	54
Chest tube placement			72	72
Mediastinoscopy	18 (4.9)	12 (3.3)	–	30 (1.9)
Thoracic exploration only	33 (9.0)	9 (2.5)	–	42 (2.7)
Open lung biopsy	4 (1.1)	19 (5.2)	18 (2.1)	41 (2.6)
Trauma surgery	43 (11.7)	159 (44.0)	472 (56.9)	674 (43.3)
Chest tube placement only	24	126	421	571
Thoracotomy for specific repair	19	33	51	103
Suture of cardiac wound	4	9	3	16
Suture of large pulmonary laceration	10	11	8	29
Suture of diaphragmatic wound or defect	1	4	5	10
Suture of esophageal wound		2		2
Removal of loculated hemothorax	10	10	7	27
Empyemectomy and decortication for infected hemothorax			2	2
Direct closure of chest wall wound	4	8	23	35
Ligation of intercostal artery		2	2	4
Fixation of sternal fracture		4	9	13
Surgical stabilization of flail chest	4	8	8	20
Total	367 (100.0)	361 (100.0)	830 (100.0)	1,558 (100.0)

P1, from 1977 to 1989; P2, from 1990 to 2002; P3, from 2003 to 2015.

fistula by close chest drainage-irrigation procedure (5) is our treatment of choice since 1995. Before, we have performed Clagett procedure (6,7), but because of its highly negative psychological impact on the patient's family and the difficulties of home care, the Clagett procedure is now reserved for cases of failure of continue close chest drainage-irrigation procedure. Concerning the treatment of the bronchopleural fistula, we perform the procedure initially described by Abruzzini (8) or variations (9,10) through a transmediastinal approach for control of bronchopleural fistula in an aseptic region.

The higher mortality observed in the group of malignant tumors is secondary to presentation in late, advanced stages of disease. In addition to pulmonary tumors, mediastinal

Table 8 Distribution of postoperative complications (≤30 days) according to the three periods indicated

Complications	N (%)			
	P1	P2	P3	Total
Empyema	3 (4.2)	2 (3.5)	16 (14.7)	21 (8.9)
Empyema with bronchopleural fistula	8 (11.1)	4 (7.1)	4 (3.7)	16 (6.8)
Wound dehiscence by local sepsis	18 (25.0)	17 (30.4)	8 (7.3)	43 (18.1)
Bleeding	9 (12.6)	4 (7.1)	2 (1.8)	15 (6.3)
Persistent air leak	16 (22.2)	12 (21.4)	51 (46.8)	79 (33.3)
Persistent of pleural space	5 (6.9)	7(12.5)	15 (13.8)	27 (11.4)
Hemidiaphragmatic paralysis	2 (2.8)	3 (5.4)	–	5 (2.1)
Rib osteitis	0	2 (3.6)	1 (0.9)	3 (1.3)
Rapid accumulation of fluid in the empty pleural space	5 (6.9)	2 (3.6)	8 (7.3)	15 (6.3)
Respiratory failure	6 (8.3)	3 (5.4)	4 (3.7)	13 (5.5)
Total	72 (100.0)	56 (100.0)	109 (100.0)	237 (100.0)

P1, from 1977 to 1989; P2, from 1990 to 2002; P3, from 2003 to 2015.

Table 9 Distribution of types of procedures in postoperative complications

Procedures in postoperative complications	N			
	P1	P2	P3	Total
Clagett procedure	8	2	1	11
Abruzzini procedure	3	2	3	8
Close chest drainage-irrigation	–	2	17	19
Thoracotomy for hemostasis	9	4	2	15
Repair wound dehiscence	–	–	8	8
Completion thoracoplasty	2	–	–	2
Completion pneumonectomy	2	1	1	4
Total	24	11	32	67

P1, from 1977 to 1989; P2, from 1990 to 2002; P3, from 2003 to 2015.

Table 10 Distribution of the deaths according to the groups of pathologies

Groups of pathologies	P1		P2		P3		Total		P
	Pathology, N	Death, N (%)	Pathology, N	Death, N (%)	Pathology, N	Death, N (%)	Pathology, N	Death, N (%)	
Infections and pulmonary sequelae of tuberculosis	223	7 (3.1)	164	8 (4.8)	372	9 (2.4)	759	24 (3.1)	0.33
Tumors	123	13 (10.5)	81	5 (6.1)	134	30 (0.2)	338	48 (14.2)	0.0015
Trauma	43	2 (4.6)	159	8 (5.0)	556	1 (0.1)	758	11 (1.4)	–
Miscellaneous	25	0	60	2 (3.3)	93	0	178	2 (1.1)	–
Total	414	22 (5.3)	464	23 (4.9)	1,155	40 (3.46)	2,033	85 (4.1)	0.17

P1, from 1977 to 1989; P2, from 1990 to 2002; P3, from 2003 to 2015.

tumors are more frequently diagnosed since the advent of computed tomography. Unfortunately, comprehensive oncological care is still limited in our country. Further investment in hospital infrastructure is necessary including establishment of a radiotherapy center.

Conclusions

Noncardiac thoracic surgery operations are still dominated by infections, pulmonary sequelae of tuberculosis, thoracic tumors and thoracic trauma caused by current armed conflicts and terrorist attacks. Access to thoracic surgical care remains difficult for our population with low economic status, and because of the lack of a health insurance system. Therefore consultation is often obtained in very advanced stage of the disease. Nevertheless overall mortality observed in the practice of this surgery is reasonable and can be further improved.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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