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ORIGINAL ARTICLE

Clinical characteristics and post-surgical outcomes in patients with spontaneous pneumothorax: Analysis in a high complexity hospital

Características clínicas y desenlaces postquirúrgicos en pacientes con neumotórax espontáneo: Análisis en un hospital de alta complejidad

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Abstract

Introduction. Spontaneous pneumothorax is a rare pathology that affects both young and old people. It can have a high recurrence rate, resulting in morbidity and sometimes mortality of the patients. In our environment we do not have epidemiological data on the disease, which motivated this study to be carried out.

Methods. Retrospective study of a prospective database, which included patients over 14 years of age, with a diagnosis of spontaneous pneumothorax who underwent surgery at the Hospital Pablo Tobón Uribe, Medellín, Colombia, between January 2018 and December 2023. Sociodemographic, clinical variables and postoperative outcomes 30 days after the intervention were analyzed.

Results. Males were the most affected (68.2%), secondary spontaneous pneumothorax predominated (56.8%) and the right hemithorax was the most common location (63.6%). A similar incidence was found between smokers and non-smokers (45.4% vs. 52.3%, respectively). Wedge resection was the definitive treatment in 50% of patients and wedge resection associated with mechanical pleurodesis in 31.8%. The most common complication was persistent air leak. A recurrence of pneumothorax was recorded in a patient who had undergone wedge resection. At the end of the study, five patients died; three had been treated only with thoracostomy and two had been taken to surgery.

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Conclusions. Spontaneous pneumothorax is a rare pathology. The causes and the affected population vary according to the classification. In our environment, tuberculosis has greater relevance because it is an endemic disease.

Keywords: pneumothorax; thoracostomy; thoracoscopy; thoracic surgical procedures; pleurodesis; postoperative complications.

Resumen

Introducción. El neumotórax espontáneo es una patología infrecuente, que afecta tanto a jóvenes como a personas mayores. Puede tener tasa alta de recurrencia, generando morbilidad y, en ocasiones, mortalidad a los pacientes. En nuestro medio no disponemos de datos epidemiológicos de la enfermedad, lo que motivó la realización de este estudio.

Métodos. Estudio retrospectivo de una base de datos prospectiva, que incluyó pacientes mayores de 14 años con diagnóstico de neumotórax espontáneo intervenidos quirúrgicamente en el Hospital Pablo Tobón Uribe, de Medellín, Colombia, entre enero de 2018 y diciembre de 2023. Se analizaron variables sociodemográficas, clínicas y desenlaces postquirúrgicos a 30 días de la intervención.

Resultados. El sexo masculino fue el más afectado (68,2 %), el neumotórax espontáneo secundario predominó (56,8 %) y el hemitórax derecho fue la localización más común (63,6 %). Se encontró una incidencia similar entre fumadores (45,4 %) y no fumadores (52,3 %). La resección en cuña fue el tratamiento definitivo en el 50 % de los pacientes y la resección en cuña asociada a pleurodesis mecánica en el 31,8 %. La complicación más frecuente fue la fuga persistente de aire. Se registró una recurrencia de neumotórax en un paciente que había sido sometido a resección en cuña. Al final del estudio, cinco pacientes fallecieron; tres habían sido tratados únicamente con toracostomía y dos habían sido llevados a cirugía.

Conclusiones. El neumotórax espontáneo es una patología infrecuente. Las causas y la población afectada varían de acuerdo con su clasificación. En nuestro medio, la tuberculosis tiene mayor relevancia por ser una enfermedad endémica.

Palabras clave: neumotórax; toracostomía; toracoscopia; procedimientos quirúrgicos torácicos; pleurodesis; complicaciones posoperatorias.

Introduction

Pneumothorax is defined as the presence of air in the pleural cavity. It can be of traumatic or spontaneous origin. Spontaneous pneumothorax (SP) is broadly classified as primary (PSP), when there is no obvious lung disease, and secondary (SSP), when there is underlying lung disease. PSP usually occurs in young, tall and thin patients, with unilateral chest pain, in whom there is no history of previous diseases or underlying conditions; however, abnormalities such as subpleural blisters or emphysema-like changes are subsequently identified; it has frequently been associated with smoking. SSP occurs in patients with any pulmonary comorbidity; the most common is chronic obstructive pulmonary disease (COPD). Among the causes of SSP is also catamenial pneumothorax, which occurs in women during menstruation. SSP generally manifests with dyspnea, since these patients already have deterioration in lung function [1].

Spontaneous pneumothorax has an incidence of 7 to 18 cases per 100,000 inhabitants per year in men and 1.2 to 6 cases per 100,000 inhabitants per year in women [1]. In other words, it is three to six times more common in men than in women [2]. The distribution is bimodal [1]; PSP is observed more frequently in patients between 15 and 34 years of age and SSP in patients over 55 years of age [1]. Recurrences occur in approximately 30% of patients,

and each new episode increases the probability of a new recurrence, reaching 60-70% after the third episode. They occur more frequently in SSP and in women [1].

The diagnosis is usually made by associating the patient's symptoms with a chest x-ray. In some specific cases, computed tomography (CT) may be useful. Treatment is focused on identifying the cause to correct it, achieving rapid lung reexpansion and preventing recurrences. Closed thoracostomy is usually indicated initially, although in most cases, surgical management through thoracoscopy is necessary for pleurodesis and/or resection of the lung parenchyma [3].

The general objective of this study was to describe the clinical characteristics, surgical results and postoperative outcomes of patients with spontaneous pneumothorax treated at the Pablo Tobón Uribe Hospital, a fourth level complexity institution in the city of Medellín, Colombia.

Methods

Type of study and population

Observational retrospective cohort study of a prospective database, which included patients over 14 years of age with a diagnosis of SP, who were taken to a surgical procedure in a fourth level of complexity hospital in Medellín, Colombia, between January 2018 and December 2023. Patients who had an incomplete or unavailable surgical description in the medical record were excluded.

Variables

Patient variables were first evaluated, such as age, sex, place of origin (urban or rural), body mass index (BMI), smoking, comorbidities, personal and family history of SP. In addition, variables related to the patient's clinical condition were included, such as vital signs upon admission, oxygen requirement, symptoms, results of diagnostic images (laterality, size and classification), whether tension pneumothorax was present and what was the indication for surgery. Likewise, management variables such as insertion of a chest tube or multipurpose catheter, type of surgery performed, and biopsy collection were reviewed.

Finally, the outcomes that were evaluated were hospital stay, duration in days of pleural drainage, 30-day mortality, and early postoperative complications. Patients who met all study entry criteria were analyzed based on the information found in their respective electronic medical records. Data recorded in the first 30 days after surgery were considered for the collection of clinical history data.

Statistical analysis

The qualitative variables were described with absolute and relative frequencies. For continuous quantitative variables, the assumption of normality was verified using the Shapiro France test. Variables with a normal distribution were expressed with the mean and standard deviation, while variables that did not meet this assumption were expressed descriptively with the median and interquartile range (IQR). Statistical analysis was performed with the STATA program (Stata Statistical Software. College Station, TX: StataCorp LLC) version 15.0.

Results

In the period between 2018 and 2023, a total of 2932 surgical procedures were performed by the Thoracic Surgery Service. Of the patients who underwent surgery, 44 had a diagnosis of spontaneous pneumothorax and met the inclusion criteria. A predominance was observed in the male gender (68.2%) and the median age was 50.7 years (Table 1). 47.7% of patients had no personal history of lung disease. In our study, SSP predominated with 59% and three patients were diagnosed with catamenial pneumothorax. In the SSP, COPD was the most frequent history, which occurred in 11 of the 12 patients with this disease; the second most common comorbidity was having a history or active diagnosis of pulmonary tuberculosis (11.4%). A similar proportion of patients who were active smokers (20 cases; 45.4%) versus non-smokers (23 cases; 52.3%) was found.

Table 1. Clinical characteristics of patients with spontaneous pneumothorax. Pablo Tobón Uribe Hospital, Medellín, Colombia. January 2018 to December 2023. (n=44)

Characteristic	Frecuency	%
Sex		
Male	30	68.2
Female	14	31.8
Age (years), median (IQR)	50.7 (27.0-67.5)	
Residence area		
Rural	10	22.7
Urban	33	75.0
No information	1	2.3
Smoking		
Yes	20	45.4
No	23	52.3
No information	1	2.3
Package/year index		
<15	3	6.8
>15	6	13.6
Not applicable	23	52.3
No information	12	27.3
Comorbidities		
None	21	47.7
COPD	12	25.0
History of tuberculosis	5	11
Pneumonia	2	4.5
Active tuberculosis	1	2.3
Catamenial pneumothorax	1	2.3
Metastasis	2	4.5
Asthma	1	2.3
History of COVID-19	3	2.3
Pulmonary fibrosis	1	2.3
Pulmonary emphysema	1	2.3
Personal history of pneumothorax		
Yes	16	36.4
No	27	61.4
No information	1	2.3
Family history of pneumothorax		
Yes	1	2.3
No	40	90.9
No information	3	6.8

* IQR: Interquartile range; COPD: chronic obstructive pulmonary disease.

Source: prepared by the authors.

Five patients (11.4%) were admitted in unstable condition and were diagnosed with tension pneumothorax (Table 2). Twenty-five patients (56.8%) required supplemental oxygen on admission. The most frequent symptoms were chest or pleuritic pain (88.6%), followed in almost the same proportion by dyspnea (84.1%) and, cough in half of the patients. Involvement in the right hemithorax was more frequent (63.6%). The most used initial diagnostic method was chest x-ray (90.9%). Chest CT was used in 37 patients (84.1%), while chest ultrasound was only used in two patients (4.5%).

On admission, 41 patients (93.2%) received closed thoracostomy, 18 with a multipurpose catheter and 23 with a chest tube. In total, 39 of the 44 patients underwent surgery. The main cause was SSP (n=16; 41.0%), followed by treatment failure with closed thoracostomy (n=13; 33.3%) (Figure 1). The most frequently performed surgical procedures were wedge resection (n=22; 56.4% of patients taken to surgery), for 50% of all patients, and wedge resection plus mechanical pleurodesis (n=14; 35.9% of patients taken to surgery); wedge resection plus mechanical and chemical pleurodesis, mechanical pleurodesis alone, and chemical pleurodesis alone were also performed, each procedure in one patient (2.5%).

The 39 patients were approached by thoracoscopy, and a sample was taken for pathology in all of them, although it was not described in the results because they were very different findings (emphysematous changes, subpleural blisters, eosinophilic pleuritis, chronic inflammation, cicatricial fibrosis, among others).

The hospital stay ranged between 5 and 15 days, with a median of 8 days, and the duration of thoracostomy (multipurpose catheter or chest tube) was between 5 and 14 days, with a median of 9.5 days.

Postoperative complications occurred in eight patients (18.2%) in the following 30 days (Table 3). The main complication was persistent air leak (defined as a prolonged air leak for more than 72 hours) in six patients, four with wedge resection

Table 2. Characteristics related to the clinical presentation of pneumothorax on admission. (n=44)

Variables	
Vital signs upon admission	
Heart rate (bpm), media (± SD)	90 (±22)
Respiratory rate (bpm), median (IQR)	19 (17-23)
Mean blood pressure (mmHg), media (± SD)	89.8 (±18.9)
Oxygen saturation (%), median (IQR)	92 (87.5-95.5)
Oxygen requirement, n (%)	25 (56.8)
Symptoms, n (%)	
Chest or pleuritic pain	39 (88.6)
Dyspnoea	37 (84.1)
Cough	22 (50.0)
Tension pneumothorax, n (%)	5 (11.4)
Laterality, n (%)	
Right	28 (63.6)
Left	15 (34.1)
Bilateral	1 (2.3)
Size (%), median (IQR)	45 (30-80)
Classification, n (%)	
Primary	18 (40.9)
Secondary	26 (59)
Diagnostic method, n (%)	
Radiography	40 (90.9)
Tomography	37 (84.1)
Ultrasound	2 (4.5)

* SD: standard deviation; IQR: Interquartile range; bpm: beats per minute; bpm: breaths per minute; mmHg: millimeters of mercury.

Source: prepared by the authors.

(n=4), one with mechanical pleurodesis (n=1) and one with only closed thoracostomy (n=1). The recurrence of pneumothorax occurred in one patient, who had a diagnosis of osteosarcoma with lung metastases.

Mortality was 11.4% (five patients). A 64-year-old woman with a history of COPD and chronic eosinophilic pneumonia, who presented respiratory failure 28 days after admission; a 79-year-old man with angiosarcoma, with multiple lung metastases, who was managed palliatively; a 55-year-old man, an active smoker, with COPD and an API greater than 15, with decreased pulmonary reserve, who underwent left lung volume reduction and subsequently presented respiratory failure, which he did not recover from; a 73-year-old woman with COPD, who was hospitalized with severe COVID-19 infection and who presented with a ruptured bulla, necrotizing pneumonia, and abscess, and died 69 days after admission due to respiratory failure; and lastly, a 17-year-old patient with spastic cerebral palsy, with severe neurodevelopmental delay, who was admitted with respiratory failure due to multilobar pneumonia, in whom invasive maneuvers were not performed due to his comorbidities.

Discussion

In our study, the frequency of spontaneous pneumothorax was 1.5% of all procedures performed by the Thoracic Surgery Service at the institution, demonstrating that it is a rare pathology. As could be seen in the results, spontaneous pneumothorax is more common in men than in women.

Precipitating factors may be changes in atmospheric pressure [1] and exposure to loud music [4] and, contrary to popular belief, PSP usually occurs at rest, therefore avoiding exercise is not recommended to prevent recurrences [1]. Smoking is a major risk factor for PSP; up to 88% of patients are smokers in large-scale observational studies [2]. A smoker, compared to non-smokers, has a 9-fold risk in women and a 22-fold risk in men of developing PSP, with a strong dose-response link with the number of cigarettes smoked [2,5]. However, in our study a very similar proportion of smoking and non-smoking patients was found. Similarly, smoking cannabis also increases the risk of developing spontaneous pneumothorax [6] and is associated with the development of emphysematous changes and bullous lung disease [2].

The exact pathophysiology of the spontaneous appearance of communication between the alveolar spaces and the pleura is unknown [2]. Most authors believe that spontaneous rupture of a subpleural bleb or bulla is always a cause of PSP, but alternative explanations exist [1]. Only a minority of blisters are ruptured at the time of surgery, while there are often other lesions such as pleural porosity, areas of altered mesothelial cells in the visceral pleura, replaced by an inflammatory elastofibrotic layer with increased porosity, allowing air to leak into the pleural

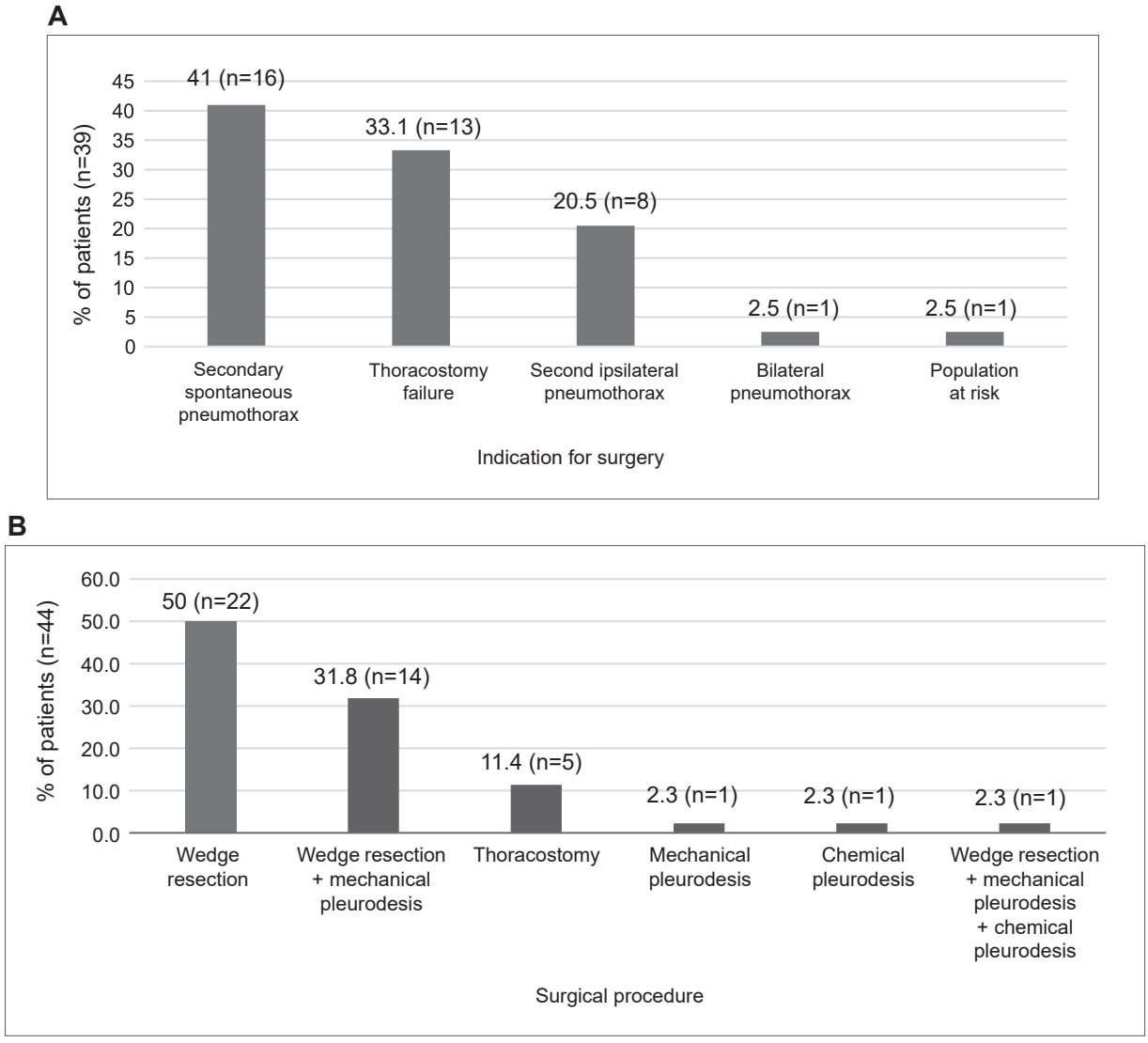

Figure 1. Indications and surgical procedures performed in patients with spontaneous pneumothorax. A. Indication for surgery. B. Type of surgical procedure.

Source: prepared by the authors.

Table 3. Post-surgical complications and clinical outcomes. (n=44)

Complications	Frecuency	%
Postoperative complication	8	
Persistent air leak	6	18.2
Pneumonia	1	
Recurrence of pneumothorax	1	
Hospital stay (days), median (IQR)	8 (5.0-15.5)	
Tube duration (days), median (IQR)	9.5 (5.0-14.5)	
Mortality	5	11.4

* IQR: Interquartile range.

Source: prepared by the authors.

space. This latter phenomenon may explain the high recurrence rates, which reach up to 20% in bullectomy alone (without associated pleurodesis) as therapy [1].

The development of blisters and areas of pleural porosity may be related to a variety of factors, including inflammation of the distal airways, hereditary predisposition, anatomical abnormalities of the bronchial tree, ectomorphic physiognomy with more negative intrapleural pressures and apical ischemia at the apices, abnormal connective tissue [1], low BMI, and caloric restriction [7]. The recurrence rate is 32% within one year [8]; it is three times higher in women and it has been described that quitting smoking reduces the risk of recurrence four times [2].

Almost all patients with PSP present with sudden ipsilateral chest pain, which usually resolves spontaneously within 24 hours [1]. Dyspnea may occur but it is usually mild. Physical examination may be normal in small pneumothoraces. In large ones, respiratory sounds are usually decreased or absent and percussion is hyperresonant. Rapidly evolving hypotension, tachycardia, tachypnea, and cyanosis should raise suspicion of tension pneumothorax, which, however, is extremely rare in PSP [1]. In this group of patients, the most common symptom was chest or pleuritic pain and there were five cases in which the patient presented hemodynamic instability.

A multitude of respiratory disorders have been described as a cause of SSP. The most common underlying disorders are COPD [9], as seen in this study, as well as cystic fibrosis, tuberculosis, lung cancer, and human immunodeficiency virus (HIV)-associated Pneumocystis jirovecii pneumonia, followed by less common but "typical" disorders such as lymphangioleiomyomatosis and histiocytosis X [1]. The most common mechanism for the development of SP in patients with COPD is the rupture of emphysematous bullae and blisters [2].

In SSP, dyspnea is the most prominent clinical feature (45-93%); there may also be chest pain, cyanosis, hypoxemia, and hypercapnia, sometimes leading to acute respiratory failure [1]. Because lung function in these patients is already compromised, SSP often presents as a life-threatening disease, requiring immediate action, in contrast to PSP [1]. Recurrence rates are usually higher compared to those of PSP, reaching up to 80% of cases [1]; it usually occurs within 6 months of the initial episode [2].

According to the clinical and pathological findings, pneumothorax in women of childbearing age is classified into three groups: catamenial pneumothorax (with or without endometriosis), non-catamenial pneumothorax related to endometriosis (pneumothorax that occurs outside the menstrual period, but with pathological findings of endometriosis) and idiopathic pneumothorax (non-catamenial and non-endometriosis, without identified underlying cause) [2,10]. Catamenial pneumothorax is associated with the menstrual cycle and usually occurs within 72 hours before or after the start of the menstrual period [2]. It is usually unilateral, predominantly right, and associated with thoracic or extrathoracic endometriosis. In this study there were three cases of catamenial pneumothorax; all underwent surgery with good results.

The diagnosis of pneumothorax can be made with ultrasound as a first-line imaging modality. It is sensitive (91%) and highly specific (99%) among trained professionals. The absence of lung sliding, known as the "bar code" or "stratosphere sign," is the most sensitive finding, while a lung point (visualization of the point where the visceral pleura separates from the parietal pleura) is the most specific finding [11]. Upright posteroanterior chest x-ray is not sensitive (44%) but highly specific (100%) for pneumothorax [1,11]. It is important to realize that contralateral displacement of the trachea and mediastinum is a completely normal phenomenon in spontaneous pneumothorax and does not suggest a tension pneumothorax [1]. Chest CT requires more radiation, time, and healthcare costs. It can be considered when there is diagnostic uncertainty regarding a bulla versus a pneumothorax [11], to assess size [12], to plan surgery, and to differentiate between PSP and SSP.

Treatment should always begin by assessing the patient's stability, looking for respiratory distress and hemodynamic instability, which may suggest tension pneumothorax, because this

requires immediate intervention and should not be delayed while awaiting radiological results [11]. Although needle decompression in the second intercostal space with midclavicular line has traditionally been recommended, multiple studies have shown that this location has a greater depth (4.3 cm vs 3.4 cm) and a higher failure rate (38% vs 13%) compared with needle thoracostomy in the fourth/fifth intercostal space with anterior axillary line [11,13]. Regardless of the technique, these should be followed by the insertion of a chest tube when the patient has stabilized [11].

The treatment of PSP can be conservative using needle aspiration, drainage with a chest tube or multipurpose or surgical catheter [12]. Patients with pneumothorax and oxygen saturation less than 92% should initially receive supplemental oxygen [11]. If the patient is stable and has minimal symptoms, conservative management can be started, which lasts 3 to 6 hours; subsequently, imaging control is requested, and if there is no progression or there is improvement in size, the patient could be discharged, but if there is worsening, thoracostomy with a catheter or chest tube must be performed [11].

Likewise, if the patient is symptomatic, needle aspiration can be considered; if the procedure is successful (reduction > 2 cm) on post-procedure radiography (4 hours after insertion) and improvement in symptoms, it would be reasonable for the patient to be discharged, while if unsuccessful, a thoracostomy (multipurpose catheter or chest tube) should be performed [11]. In daily clinical practice, conservative management of SP is rarely performed since most patients are usually symptomatic and the process of resolution of the clinical condition is also accelerated.

In patients requiring surgical management, pleurodesis or bullectomy is recommended after the second episode of PSP (ipsi or contralateral), regardless of the management method used for the first episode [12]. Furthermore, it is recommended that patients with hemopneumothorax, simultaneous bilateral pneumothorax, presence of signs of severity, air leak or persistent pneumothorax despite suction drainage, occupation or risky activity (pilot, isolated workplace, diver) be taken to surgery in the first episode of PSP [12,14]. In this study, the most frequent surgical indications were the presence of PSP, failure of treatment with closed thoracostomy, and a second PSP.

Patients with SSP should be hospitalized due to their high morbidity and mortality. The goals of treatment are to ensure lung reexpansion, minimize morbidity and prevent recurrence, relieve symptoms, and treat the underlying disease. Although the options, as in PSP, vary from simple observation, due to their condition, the majority will require surgical intervention [9].

Currently, surgical treatment options include open thoracotomy (OT) and video-assisted thoracoscopic surgery (VATS). It is still controversial whether OT or VATS is the optimal access to the chest for the surgical treatment of SSP. Although OT has the lowest recurrence rate, the obvious advantages of VATS are less pain, better postoperative respiratory therapy, and shorter hospital stay, as well as a superior cosmetic outcome [9]. OT and VATS have a recurrence rate of 1% and 5%, respectively [9,15]. Furthermore, the lowest recurrence rate has been shown in the wedge resection and pleurodesis groups [9]. In this study, most patients were approached by VATS (88.6%).

The postoperative complication rate ranges from 0% to 37.5% in the literature [9,16]. In this study it was 18.2%, mainly due to persistent leakage (n=6). SSP-related mortality has been documented at a rate of up to 18% in the literature [9]; overall mortality in this study was 11.4%.

The strengths of this study include the characterization of patients with a rare pathology, being in our setting one of the only studies of its type [17-20]. As limitations, it is a single-center retrospective study, of a cohort with a low number of patients and without a comparison group, although it was carried out in a highly complex hospital, with a high patient occupancy and which is a reference center for referrals of patients from many specialties, including thoracic surgery, not only from the city of Medellín but from the department of Antioquia, which may better reflect the local and regional epidemiology.

Conclusions

Spontaneous pneumothorax (SP) is a rare pathology, as demonstrated by world literature and this study. This work describes the characteristics of patients with SP and its frequency (1.5%). In general, the results coincide with those described in the literature from other countries, except in the presence of smoking as a risk factor, which was lower (45.4%). We observe that the second cause of SSP, after COPD, is tuberculosis, which represents a public health problem in our country. It is interesting to highlight the presence of three cases of spontaneous pneumothorax secondary to SARS-CoV-2 infection, which occurred during the years of the pandemic, and three cases of catamenial pneumothorax, a very rare pathology. In general, good post-surgical results were obtained, with an acceptable complication rate and low mortality. This study should promote research into this pathology in other areas of our country to better understand our epidemiology, which will allow us to take measures to improve patient outcomes.

Compliance with ethical standards

Informed consent: This study was approved by the Ethics Committee of the Hospital from which the patients were taken, as well as by the Health Research Ethics Committee of the Universidad Pontificia Bolivariana in minute No. 9 of 2024. In addition, it is framed in the Political Constitution of Colombia and in the Scientific, Technical and Administrative Standards for Health Research established in Resolution No. 8430 of 1993 of the Ministry of Social Protection, respecting the principles of autonomy, confidentiality, freedom and protection of life, with a "risk-free" classification. Therefore, informed consent was not required for the development of the research since the source of information is secondary and was collected retrospectively.

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Use of Artificial Intelligence: The authors declared that no artificial intelligence-assisted technologies were used to conduct the study, analyze the results, and write the manuscript.

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Author's contribution:

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- Acquisition of data: Santiago Barrantes-Moreno, Carolina Sánchez-Castro, Sofía Bernal-Sierra.
- Literature search and analysis: Santiago Barrantes-Moreno, Carolina Sánchez-Castro, Sofía Bernal-Sierra.
- Data analysis: Johanna Marcela Vanegas.
- Drafting the manuscript: Santiago Barrantes- Moreno, Carolina Sánchez-Castro, Sofía Bernal-Sierra, Andrés Zerrate-Misas, Willfredy Castaño-Ruiz, Lina Velásquez-Gómez.
- Critical review: Andrés Zerrate-Misas, Willfredy Castaño-Ruiz, Johanna Marcela Vanegas, Lina Velásquez-Gómez.

References

1 Noppen M. Spontaneous pneumothorax: Epidemiology, pathophysiology and cause. Eur Respir Rev. 2010;19:217-9. https://doi.org/10.1183/09059180.00005310

2 Huan NC, Sidhu C, Thomas R. Pneumothorax: Classification and etiology. Clin Chest Med. 2021;42:711-27. https://doi.org/10.1016/j.ccm.2021.08.007

3 Baumann MH, Strange C, Heffner JE, Light R, Kirby TJ, Klein J, et al; for the ACCP Pneumothorax Consensus Group. Management of spontaneous pneumothorax. An American College of Chest Physicians Delphi Consensus Statement. Chest. 2001;119:590-602. https://doi.org/10.1378/chest.119.2.590

4 Noppen M, Verbanck S, Harvey J, van Herreweghe R, Meysman M, Vincken W, Paiva M. Music: A new cause of primary spontaneous pneumothorax. Thorax. 2004;59:722-4. https://doi.org/10.1136/thx.2003.007385

5 Bense L, Eklund G, Wiman LG. Smoking and the increased risk of contracting spontaneous pneumothorax. Chest. 1987;92:1009-12. https://doi.org/10.1378/chest.92.6.1009

6 Tschopp JM, Bintcliffe O, Astoul P, Canalis E, Driesen P, Janssen J, et al. ERS task force statement: Diagnosis and treatment of primary spontaneous pneumothorax. Eur Respir J. 2015;46:321-35. https://doi.org/10.1183/09031936.00219214

7 Amjadi K, Alvarez GG, Vanderhelst E, Velkeniers B, Lam M, Noppen M. The prevalence of blebs or bullae among young healthy adults. Chest. 2007;132:1140-5. https://doi.org/10.1378/chest.07-0029

8 Walker SP, Bibby AC, Halford P, Stadon L, White P, Maskell NA. Recurrence rates in primary spontaneous pneumothorax: A systematic review and meta-analysis. Eur Respir J. 2018;52:1800864. https://doi.org/10.1183/13993003.00864-2018

9 Değirmenci M. Morbidity, mortality, and surgical treatment of secondary spontaneous pneumothorax. Ulus Travma Acil Cerrahi Derg. 2023;29:909-19. https://doi.org/10.14744/tjtes.2023.20566

10 Legras A, Mansuet-Lupo A, Rousset-Jablonski C, Bobbio A, Magdeleinat P, Roche N, et al. Pneumothorax in women of child-bearing age. An update classification based on clinical and pathologic findings. Chest. 2014;145:354-60. https://doi.org/10.1378/chest.13-1284

11 Gottlieb M, Long B. Managing spontaneous pneumothorax. Ann Emerg Med. 2023;81:568-76. https://doi.org/10.1016/j.annemergmed.2022.08.447

12 Jouneau S, Ricard JD, Seguin-Givelet A, Bigé N, Contou D, Desmettre T, et al. SPLF/SMFU/SRLF/SFAR/SFCTCV Guidelines for the management of patients with primary spontaneous pneumothorax. Ann Intensive Care. 2023;13:88. https://doi.org/10.1186/s13613-023-01181-2

13 Laan DV, Vu TDN, Thiels CA, Pandian TK, Schiller HJ, Murad MH, et al. Chest wall thickness and decompression failure: A systematic review and meta-analysis comparing anatomic locations in needle thoracostomy. Injury. 2016;47:797-804. https://doi.org/10.1016/j.injury.2015.11.045

14 Roberts ME, Rahman NM, Maskell NA, Bibby AC, Blyth KG, Corcoran JP, et al. British Thoracic Society Guideline for pleural disease. Thorax. 2023;78(Suppl 3):s1-42. https://doi.org/10.1136/thorax-2022-219784

15 Barker A, Maratos EC, Edmonds L, Lim E. Recurrence rates of video-assisted thoracoscopic versus open surgery in the prevention of recurrent pneumothoraces: A systematic review of randomised and non-randomised trials. Lancet. 2007;370:329-35. https://doi.org/10.1016/S0140-6736(07)61163-5

16 Isaka M, Asai K, Urabe N. Surgery for secondary spontaneous pneumothorax: Risk factors for recurrence and morbidity. Interact Cardiovasc Thorac Surg. 2013;17:247-52. https://doi.org/10.1093/icvts/ivt221

17 López R, Azuero R, Camacho F, Ramírez J, Russi H, Brieva J. Cirugía torácica videoasistida. Experiencia preliminar y revisión del tema. Rev Colomb Cir. 1993;8:227-34.

18 Cañas-Arboleda A, Puentes-Leal GA. Neumotórax espontáneo recurrente Reporte de un caso. Rev Colomb Neumol. 2009;21:161-7.

19 Álvarez-Barreneche MF, Mejía SA, Ramírez-Quintero JD. Neumonía y neumotórax espontáneo por tuberculosis, reporte de casos. Acta Med Colomb. 2016;41:62-6. https://doi.org/10.36104/amc.2016.584

20 Vergara-Dagobeth E, Cáceres-Sepúlveda JF, Gamarra-Acosta D. Características clínico-epidemiológicas del neumotórax espontáneo en el Hospital Universitario de Sincelejo entre 2003-2013. Rev Navar Med. 2016;2:6-10. https://doi.org/10.61182/rnavmed.v2n1a1