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Long-Term Results of Expectant Management of First Episode of Primary Spontaneous Pneumothorax. Is it a Safe Therapeutic Option?

Authors: Dietrich Agustín[1], Croattini Sebastián[2], Olivera Soledad[2], Raices Micaela[1], Montagne Juan[1], Smith David[1]

[1]Thoracic Surgery Services. Hospital Italiano de Buenos Aires, Autonomous City of Buenos Aires, Argentina.
[2]General Surgery Services. Hospital Italiano de Buenos Aires. Autonomous City of Buenos Aires, Argentina.

Abstract

Introduction: Expectant treatment in clinically stable patients with small primary spontaneous pneumothorax (PSP) remains in discussion, partly due to the described increased recurrence rate compared to patients treated with pleural drainage.

Objective: To present the experience in the management of grade I PSP, comparing long- and short-term results of patients treated with pleural drainage with those treated expectantly.

Methods: We present a retrospective study of patients diagnosed with small asymptomatic or mildly symptomatic PSP.

Results: 34 out of 69 patients were treated with pleural drainage and 35 underwent expectant treatment with outpatient management. Both groups were comparable regarding sex, side, size of pneumothorax and history of tobacco smoking. As for the short-term results, there weren't any differences between groups in success therapy, but there were significant differences related to hospital stay, where patients treated with pleural drainage presented longer length of stay. Regarding long-term results, there weren't significant differences in terms of recurrence between both groups.

Conclusion: The expectant management of clinically stable patients with small primary spontaneous pneumothorax with strict ambulatory control follow-up and those who comply with treatment recommendations and can obtain prompt emergency medical care presents acceptable long- and short-term results and should be the first choice of treatment.

Key words: Pneumothorax; Expectant management; Drainage; Ambulatory care

Introduction

Since primary spontaneous pneumothorax (PSP) was described in the XIX century as a clinical entity (Itard 1803), there have been numerous publications that clarify the pathogenic mechanisms and their evolution[1]. Officially, the reported incidence of PSP is 18-28 / 100 000 cases per year in men and 1.2-6 / 100 000 in women, with estimated costs of 130 million dollars per year in the United States[2, 3]. Such incidence is not high when compared with other prevalent benign diseases, but the PSP appears basically in young adults who are the basis of the economically productive population. As for the therapeutic management, in recent years the American and British societies issued management guidelines for primary and secondary spontaneous pneumothorax with many similarities and some differences between them[4-6]. There is certain consensus about which patients with mild and asymptomatic PSP[7-9] would benefit from an expectant management, without the need to place a pleural drainage or any

Correspondence: Micaela Raíces. Hospital Italiano de Buenos Aires. Juan D. Perón 4190. C1181ACH. Buenos Aires, Argentina. e-mail: micaela.raices@hospitalitaliano.org.ar

other invasive procedure. However, this type of therapeutics is not used in some centers because it might be associated with a higher recurrence rate[10]. We present our experience in the management of grade I PSP, comparing the results of patients treated with pleural drainage with those treated with an expectant behavior.

Methods

Population and design

We conducted a retrospective cohort study with a prospective database including adult patients older than 18 years with grade I primary spontaneous pneumothorax (< 25%), in accordance with the Light index[11], all of them clinically stable[12], between January 2012 and December 2018.

Patients with grade I spontaneous pneumothorax who consulted about symptoms such as dyspnea, cough or mild thoracic pain were evaluated at the moment of the diagnosis by the surgeon on call, who then decided randomly whether to use expectant management or percutaneous or surgical pleural drainage, according to his/her own experience and previous knowledge, without consulting a thoracic surgeon. Thus, the choice of treatment depended on the clinical-surgical criterion of the surgeon on call in each case.

The pleural drainage was carried out by inserting a thin, percutaneous 8.5 or 10 FR pigtail catheter (*Nephrostomy Cook®, IN, USA),* using radiologically or CT-guided Seldinger technique, with local anesthesia. After the placement, the catheters were connected to a water-sealed continuous aspiration system (*Aquaseal®, Medtronic, MN, USA*) (**Figures 1 and 2**). The imaging guideline has the advantage of subsequently evaluating the correct position of the drainage, the lung expansion and, on the other hand, this technique allows for making an etiological diagnosis in most cases.

The patients were hospitalized and the tube was extracted after confirming lack of air leaks and correct lung expansion through control X-ray. Patients who received expectant treatment were controlled at the emergency center: they were administered analgesics and oxygen at 2 L and were told to rest for 4 hours. There aren't any randomized studies about the benefits of supplemental oxygen, but some retrospective cohort studies support it[13-15]. On the other hand, the adverse effects associated with oxygen therapy have been described in an experimental manner and are not frequent with FiO_2 of less than 70%[16]. Then a chest X-ray was made and patients without pneumothorax progression were discharged. Ambulatory radiographic control was carried out at 24 hours and 7 days after the initial diagnosis, looking for the improvement of the pneumothorax images in comparison with the initial diagnostic image. This was done until the eventual normalization of lung expansion during the first 15 days. If pneumothorax progression or persistence was seen in any of the radiographic evaluations or if there was an exacerbation of symptoms, the case was considered a therapeutic failure of the expectant management, and the patient was hospitalized to receive surgical treatment.

Persistence was defined as the absence of initial re-expansion after 7 days in patients who received expectant treatment, or the presence of air leaks and absence of complete re-expansion after 5 days in patients who received initial pleural drainage. For both groups, recurrence was defined as a new ipsilateral spontaneous pneumothorax, after the imaging resolution of the first episode of PSP in the group of patients with expectant treatment or after the extraction of the pleural drainage tube in the case of patients who received initial percutaneous surgical treatment, at some time during follow-up. Recurrence cases were treated with pleural drainage in the group who had received initial expectant treatment and with video-assisted thoracoscopic surgery (VATS), associated with bullectomy and pleural sealing with mechanical abrasion in patients who had had an initial pleural drainage.

We defined therapeutic success as the absence of pneumothorax in imaging control studies after initial re-expansion or of exacerbation of associated respiratory symptoms 30 days after diagnosis in cases of patients who received expectant treatment, and 30 days after pleural drainage extraction in patients surgically treated after the first episode of PSP.

Patients mentioned in the study have given their consent and the protocol has been approved by the Research and Ethics Committee of the Hospital Italiano (CEPI, for its acronym in Spanish).

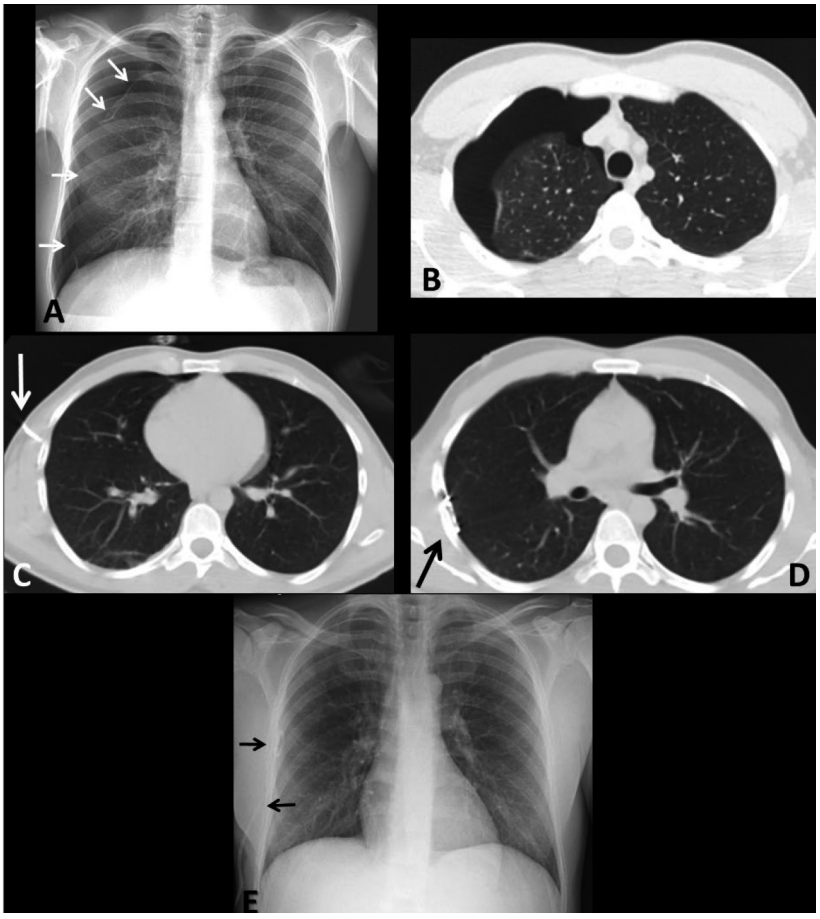

Figure 1. A. Frontal chest x-ray. Arrows: right pneumothorax line. B. Computerized axial tomography. Axial cut. Lung window. Right pneumothorax. C. Computerized axial tomography. Axial cut. Lung window. Arrow: Percutaneous drainage catheter placement. D. Computerized axial tomography. Axial cut. Lung window. Complete lung expansion. Arrow: Intrathoracic percutaneous drainage catheter with posterior cephalic orientation

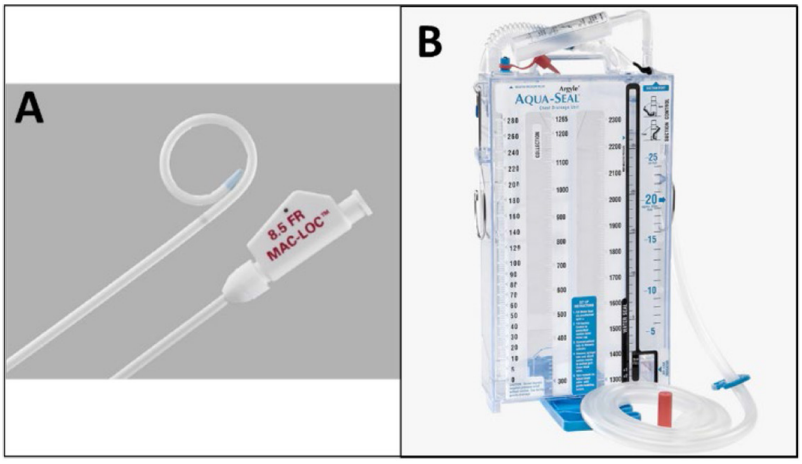

Figure 2. A. Thin, percutaneous 8.5 FR pigtail catheter (Nephrostomy Cook®, IN, USA). B. Aquaseal®, Medtronic, MN, USA.

Objectives

– To describe demographic, clinical and evolutionary characteristics of the population of patients with spontaneous pneumothorax.
– To evaluate the efficacy of the expectant management of grade I asymptomatic PSP in terms of recurrence rate, i.e. therapeutic failure.

To compare the recurrence rate in PSP patients who received initial expectant management with those who were drained after diagnosis.

Analyzed variables

Demographic variables such as age, gender, smoking habit, use of inhalation drugs, PSP laterality, pneumothorax size; and variables related to treatment: pleural drainage, expectant treatment, hospitalization, recurrence, follow-up time.

Statistical Analysis

Categorical variables are expressed in percentages. Continuous variables are expressed as mean and standard deviation (SD) for symmetrical distribution, and median and interquartile range (IQR) for data not symmetrically distributed. Variables potentially associated with the therapeutic failure of the expectant management were compared by means of the Chi Square Test. Statistical analyses were carried out with STATA version 13 (StataCorp LP, TX). A value of $p < 0.05$ was considered significant.

Results

The demographic characteristics of the sample are detailed in **Table 1**. Groups differ about the prevalence of the smoking habit, which is more frequent in the group of patients treated expectantly. As expected, the length of hospital stay was greater in patients who received a percutaneous pleural drainage, but therapeutic success at 30 days and the recurrence rate were similar in both groups: 94 and 26% in the expectant treatment group and 97 and 21% in the pleural drainage group (**Table 2**). The mean follow-up for the evaluation of recurrence was 15 months. The mean time to recurrence was 12 months.

TABLE 1. Sample characteristics

	Expectant treatment (n = 35)	Percutaneous pleural drainag (n = 34)	p
Gender, masculine[a]	26 (74)	27 (79)	0,9
Age, years[b]	37,1	34,3	0,8
Smoking[a]	31 (86)	26 (76)	0,09
Use of inhalation drugs[a]	25 (73)	28 (82)	0,7
Pneumothorax size, mm*[b]	16	21	0,1
Right side[a]	7 (20)	20 (59)	0,08

[a]n (%); [b]Median. *Light index

None of the patients of the group who had received expectant treatment showed persistent pneumothorax in the images after 7 days. Also, none of the patients who had been placed a percutaneous drainage tube required subsequent surgery for air leak persistence.

Recurrence in both groups was: mild pneumothorax (< 25%) except for one patient of the percutaneous drainage group who had initially presented an air leak that was solved 3 days after the placement of the pleural drainage tube. Five days after tube extraction, the patient had sudden dyspnea

TABLE 2. Results

	Expectant treatment (n = 35)	Percutaneous pleural drainage (n = 34)	p
Hospital length of stay, hours	6	98	0,0002
Therapeutic success (30 days)[a]	33 (94)	33 (97)	0,9
Recurrence[a]	9 (26)	7 (21)	0,6

[a]n (%); [b]Median. *Light index

and consulted with the physicians on call, and required emergency pleural drainage and eventually a videothoracoscopic surgical resolution just like the rest of the patients of the initial pleural drainage group who presented recurrence.

Patients receiving initial expectant treatment who presented recurrence (n = 9) were treated with pleural drainage. Only one of them required definitive treatment with VATS due to a new recurrence after the extraction of the drainage. Multiple lung bullae could be seen in this patient during surgery, thus requiring atypical segmental resection.

Discussion

The pathogenesis of the PSP is still unclear, and the presence of bullae/vesicles or histological modification of micro/macroscopic visceral pleura (for example, "pleural porosity") are currently the most reported causes. Also, PSP risk factors include longilineal body shape, masculine gender and smoking[17]. Without intervention, recurrence rates after the PSP are reported in a variable fashion, with some studies citing rates as low as 14%[18] or as high as 49% per year[19], up to 50% in patients monitored for 5 years[20, 21]. In the literature, recurrence after the first episode is generally observed after 6 months to 2 years[22]. However, it's worth mentioning that in most bibliographies, the reported recurrence rates do not differentiate between expectant and invasive treatment[23, 24].

The treatment of choice for recurrent or complicated spontaneous pneumothorax is clearly established[25, 26], but the treatment of patients with first episode of PSP is still open to debate. There is consensus about the fact that a definitive surgical solution has to be offered to patients with ipsilateral recurrent PSP, simultaneous bilateral PSP, PSP episode after previous episode of contralateral PSP, first episode of tension pneumothorax, significant spontaneous hemopneumothorax in the first episode, persistent air leak through pleural drainage for more than 5-7 days or failure in lung expansion despite the adequate drainage in the pleural space during the first episode. Besides, surgery in the first episode of PSP should be offered to certain patients, as for example those whose job puts them at risk of developing dangerous or complicated recurrence, such as pilots and divers, patients who live very far from the nearest hospital or in small islands and oceanic sailors[27].

Nevertheless, some authors recommend invasive surgical management of the first episode of PSP in young, healthy patients with no risk history, by means of a therapeutic VATS[28-30]. The main reasons for this recommendation are the lower recurrence rate and higher quality-adjusted life expectancy that would be associated with the initial invasive treatment. On the other hand, the invasive yet conservative management of the first episode of PSP has been described, including aspiration puncture with 16- or 18-gauge needle or placement of percutaneous pleural drainage catheter[31]. Authors who promote percutaneous pleural drainage in asymptomatic patients with first episode of PSP, regardless of pneumothorax size, maintain that this approach would present a lower PSP recurrence rate, probably associated with the intrapleural adhesions formed by the drainage catheter in the pleural space, which would complicate the occurrence of a new episode[32]. But there aren't many publications about long-term results of the expectant management of the first episode of PSP in terms of recurrence rates associated with percutaneous pleural drainage. In asymptomatic patients with a mild first episode of

PSP (< 20% of hemithorax or 2-3 cm of thoracic wall) there is evidence in favor of expectant management by means of observation, oxygen therapy and analgesics[2, 33-35].

In this study we show the similarity between PSP recurrence rates after expectant treatment (26%) and invasive treatment through placement of the percutaneous pleural drainage tube (21%). We also show the therapeutic success after 30 days, of 94% and 97%, respectively. In both cases, the differences weren't statistically significant.

Among the limitations of this study, we can mention the follow-up time, which was 15 months. Also, whereas recurrence rates are not insignificant, it is important to stress that patients who received initial expectant treatment and showed recurrence had complete resolution, except for one patient, simply with percutaneous drainage, not requiring major surgery. On the other hand, whereas recurrence in the group with initial pleural drainage was treated with VATS, adaptation with the placement of a drainage tube allowed for the performance of the VATS in a second episode within a more reduced group of patients (n = 7), with all that this entails as regards health costs for complex procedures and initial therapeutic aggressiveness. Finally, designation to one or the other arm of treatment wasn't at random, it depended on the designation bias of the surgeon on call, not a specialist.

To conclude, the expectant management of the first episode of PSP in healthy and asymptomatic patients is safe and effective, since it wouldn't show greater long-term recurrence or higher rate of therapeutic failure. New randomized studies are necessary with a larger sample of patients and longer follow-up in order to evaluate the recurrence rate of both conservative approaches and reach a consensus about the most appropriate behavior a general surgeon might adopt in such cases.

Conflict of interest: None

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