



Primary spontaneous pneumothorax (PSP): the role of VATS and a new paradigm

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Abstract: The therapeutic management of primary spontaneous pneumothorax (PSP) will include many variables, which alone anticipates difficulties of consensus and challenge to paradigms. Even the recent technological advances and the growing number of publications indicating the need for review the definitive surgical approach to PSP were not able to change the classic guideline. However, they have undoubtedly brought into question the need to add new items to the list. The increase availability of minimally invasive surgery to all surgeons is established as a method of choice in surgical treatment of these patients. The reduction in hospitalization time, impact on care costs, less postoperative pain, high therapeutic resolution by the extinction of the cause and prevention of relapse, reduction of the emotional impact considering the chances of recurrence around 30%, after the first episode and the possibility of early return to the usual activities mainly to young population. These variables support the reflection on method indication at the first episode of PSP. Why not?

Keywords: Spontaneous pneumothorax; video thoracoscopy; emphysema; blebs and bullae

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The two main objectives in the therapeutic management of patients with PSP are: restoring negative pressure of the pleural space and reducing the possibility of recurrence.

The strategy of non-invasive treatment

The strategy of non-invasive, conservative treatment with observation of evolution, will be reserved only for asymptomatic patients and with small volume pneumothorax, less than 15% (apex/dome distance <3 cm). Considering that the communication between the alveolus and the pleural space has been eliminated, in a prediction of 1.25% volume per day of reabsorption, at the end of twelve days the pneumothorax will be totally absorbed. If the patient is hospitalized, the use of supplemental oxygen may accelerate this reabsorption.

However recurrence rates, may reach 50% and approximately 40% of these patients will require pleural drainage. Although it is a non-invasive treatment, it is not simple to monitor the evolution of the pneumothorax

camera, requiring sequential radiological examinations and with no preventive action (1).

Percutaneous aspiration X tubular pleural drainage

For patients with greater volume pneumothorax, above 15–20%, it will be indicated the removal of accumulated air through drainage. This procedure can be done by pleural puncture with percutaneous aspiration or by the insertion of a thoracic drain.

The percutaneous aspiration is a less invasive and less costly treatment indicated to pneumothorax with volumes up to 15%. Similar to conservative treatment.

Aspiration does not prevent relapse in 25% of cases. When compared to tubular pleural drainage, the successful rate for complete air drainage is lower, 67% and 93%, respectively (2).

Thus, isolated pleural drainage is able to prevent recurrence of pneumothorax, in approximately 35%, similar

to methods that do not add preventive procedures, such as pleurodesis or resection of blebs (3-5).

Surgical treatment in first episode

Even the recent technological advances and the growing number of publications indicating the need for review the definitive surgical approach to PSP were not able to change the classic guideline. However, they have undoubtedly brought into question the need to add new items to the list.

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The reduction in hospitalization time, impact on care costs, less postoperative pain, high therapeutic resolution by the extinction of the cause and prevention of relapse, reduction of the emotional impact considering the chances of recurrence around 30%, after the first episode and the possibility of early return to the usual activities mainly to young population.

These variables support the reflection on method indication at the first episode of PSP. Why not? (6-11).

The first manifestations of this indication occurred in trials from the late 1990s to the early 2000s (12-14).

A panel of experts who sought consensus, about the management of PSP, 15% of them considered the discussion with the patient, to decide the timing of the intervention, in the first episode, since through video-assisted thoracoscopy (15).

Even without the use of video-surgery, the indication of treatment through axillary thoracotomy and abrasive pleurodesis in PSP first episode was effective. In a series of 23 patients who underwent to a surgery in the first episode, there was no recurrence in three years of follow-up, reduced length of pleural drainage (2 days) and hospital stay (5 days). Concluding this study, the authors consider the possibility of surgical approach in the first episode of the PSP (16).

The studies that compared the strategies for the first episode, pleural drainage *vs.* video surgery, are eloquent in showing the advantages of second one when we analyze the pleural drainage duration, hospitalization, care costs and patient satisfaction (17).

A study including 70 patients prospectively admitted with PSP and randomized to treatment with pleural drainage (group 1) *vs.* video-surgery with resection of blisters/blebs and apical pleurectomy (group 2), the main outcomes were prolonged airflow (>6 days), that occurred in 11%

vs. 5.7%; recurrence 28% *vs.* 2.8%; mean hospital time 9–12 *vs.* 4–6 days; mean care costs (hospitalization and material) \$2,750.00 per patient *vs.* \$1,925.00. In this study, the indication of definitive surgical treatment in the first episode was justified by the patients and hospital managers interests, showing that the costs of relapses in group 1, who subsequently adhered to surgery, could have been avoided if they underwent surgical treatment as the first choice (18).

The generalization of the indication for surgical intervention in the first episode, even if stimulated by the excellent results mentioned, should be viewed with some caution, without losing the enthusiasm and the prospect of being able to offer the most effective therapy for the control of the disease. The need to select, within the population of patients with PSP, those with a higher risk of recurrence is central to the change in this therapeutic paradigm, still supported by the most recent guidelines. There is currently no clinical evidence or diagnostic test that is proven to be effective and capable of identifying patients at risk of relapse (15,19,20).

Considering the consensus that bubble/bleb rupture is present in the etiology of the disease in the vast majority of cases of PSP (*Figure 1*), it is reasonable to imagine that in the analysis of this circumstance, patients with a higher probability of recurrence may be identified. In this sense, imaging studies, fundamentally high resolution computed tomography, impose themselves in the search for anatomical criteria capable of predicting the greater or lesser risk of recurrence and, in identifying them, propose that definitive treatment can be instituted already in the first episode, with undeniable benefit to the patient and to the assistance models as previously mentioned.

A recent study, led by Casali *et al.* (21), evaluated retrospectively 176 patients who had first episode of PSP and received conservative treatment: pleural drainage or resting and observation. It aimed at identifying the correlation between ipsilateral or contralateral recurrence and the presence of blebs or blisters detected through high resolution tomography. By creating a severity score based on the bullous-type changes (I) Blebs or blisters, (II) number (single or multiple) and (III) distribution (unilateral or bilateral) identifies in these patients, they were able to correlate the severity to the relapse rates. In patients who presented blebs/blisters (110/176) at the ipsilateral recurrence rate was 68.1% (75/110 patients), which depicted the positive predictive value of tomographic findings. When multiple lesions were

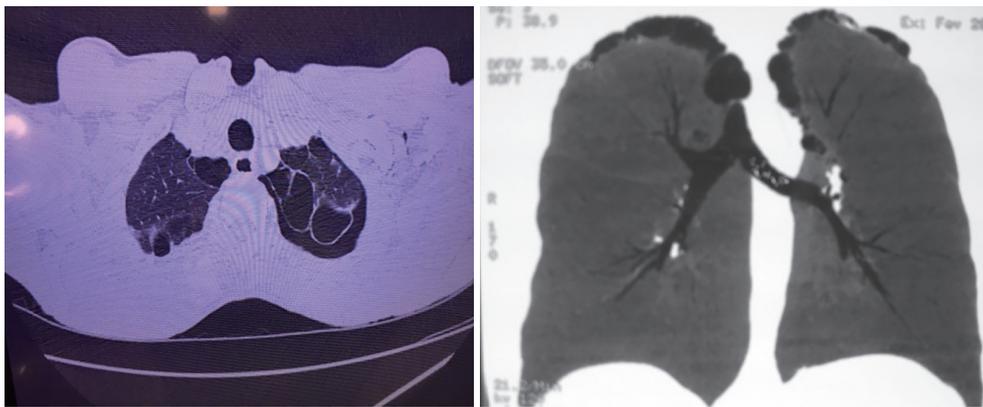


Figure 1 Tomography showing small blebs of bilateral apical subpleural emphysema.

detected, relapse rate increased to 82%. On the other hand, in patients without bleb/blister tomography findings, the recurrence rate was 6.1%, with a negative predictive value of 93.9%. The risk of contralateral recurrence was 19% in patients with positive radiological findings and absent in those with no contralateral alterations. In a multivariate analysis that included sex, age, body mass, smoking and pneumothorax, only the presence of blebs/blisters was significant for the risk of relapse ($P < 0.001$) and 18 as odds ratio.

Other similar studies established a correlation between tomographic findings and recurrence, however without the same design, follow-up and number of patients (22-24).

These studies allow us to support the higher probability of relapse according to the findings of emphysema-like alterations in high resolution computed tomography and to argue the indication of early intervention and recurrence prevention. Likewise they support the more conservative behavior in patients without evidence of these findings.

There is no doubt that other studies will be necessary and it gives certainty that the current indications for surgical treatment of primary spontaneous pneumothorax should be questioned.

Contra-lateral prophylactic surgical treatment

Whereas the excellent results of video surgery for PSP treatment, the increasing number of studies proposing surgical treatment for the first uncomplicated ipsilateral episode in the presence of emphysema-like radiological alterations, as previously mentioned, many authors are

presenting cases that denotes definitive preventive surgical treatment for patients in the first episode when the high resolution tomography showed contralateral disease. The first works that introduced this therapeutic premise were based on the rates of contralateral recurrence with the presence of tomographic changes. Sihoe *et al.* identified 26.7% of contralateral pneumothorax in 15 patients with tomographic evidence of blebs or blisters from a small series of 28 successive patients with PSP. They conclude that chest CT can be useful to identify group of patients and indicate contralateral preventive surgical treatment in specific ones (25).

The bilateral and simultaneous video-assisted intervention does not add morbidity to the procedure, keeping satisfactory results in controlling the disease (26,27).

A late prospective study attempted to answer whether there is indication for contralateral prophylactic treatment in patients with PSP.

A number of 86 patients with PSP (53.5% with bilateral disease) sharing the same demographic variables (gender, age, smoking and body mass) were divided into three groups. Group 1 (N=35) with unilateral disease, were submitted to ipsilateral video-surgery; Group 2 (N=35) bilateral disease, underwent unilateral and ipsilateral video surgery; Group 3 (N=16) bilateral disease, were submitted to bilateral video surgery at the same anesthetic time. The rates of contralateral recurrence in Groups 1, 2 and 3 were 2.8%, 17.14% and none, respectively. Except for prolonged air leakage in 7 cases, no other morbidity was identified, no recurrence on the operated side, and overall satisfaction with the aesthetic result. The surgical time was longer



Figure 2 Dorsal decubitus with elevation of 30–45°, allowing access to the unilateral or bilateral axilla for the cases of simultaneous approach, without needing to change the patient's position, similar to what we do in the sympathectomy.

($P < 0.001$) in patients submitted to simultaneous bilateral treatment. Even with a small number of patients, this study was able to demonstrate that simultaneous bilateral preventive approach did not add morbidity, relieved the anxiety of relapse risk. Prior discussion with patients and family members about informed consent for the procedure was very valued. Considering that this strategy also avoids a second hospitalization, anesthesia and another surgery the answer was yes, prophylactic treatment should be indicated for these patients (28).

Thus, definitive bilateral prophylactic surgical treatment aims to be a safe therapeutic option for patients with PSP, in the presence of bilateral measurable disease by chest computed tomography. Obviously, it will be necessary more large studies to support an unquestionable indication, to evaluate the strategy costs and to answer why a great part of patients with potential risk of relapse will never have it. However, excluding it from the therapeutic option, especially from the discussion about morbidity and relapse with the patient and his relatives, is to restrict the access to a safe method with very satisfactory results for a young and healthy population of patients, who is afraid of experiencing sudden pain, new drainage and its inherent pain, return to the hospital and activity restriction again.

Operative technique

There is no doubt that minimally invasive surgery

overcomes other alternatives for the surgical treatment of primary spontaneous pneumothorax. Conventional thoracotomies, axillary thoracotomies and sternotomy are reserved for very specific cases. The effort to offer methods that combine minimal morbidity, effective therapeutic resolution and rapid return to regular activities is consistent as a therapeutic rule and achieves a larger dimension if indicated for a benign disease affecting a young and healthy population.

Most patients undergo general anesthesia, a double lumen tube to promote selective ventilation. Instrumental entrance portals are defined according to the surgeon's choice and familiarity, ranging from uniportal access to three or four toracoportes. The possibility of surgery with the non-intubated patient is a reality in contemporary thoracic surgery (29-31).

When indicated surgery with non-intubated patients for the PSP, it showed the same technique effectiveness of the technique with general anesthesia, which can present a reduction in hospital time (31).

Other access routes such as subxiphoid or transareolar approach seek alternatives that further reduce pain and improve aesthetic effects (32,33).

The following technical routines used for bilateral approach of the Department of Thoracic Surgery of General Hospital-Foundation University of Caxias do Sul:

- ❖ Patient in dorsal decubitus with elevation of 30–45° (Figure 2).

- ❖ Abducted arms for armpit exposure (*Figure 2*).
- ❖ Two toracoporters for patients without previous drainage and three toracoporters to take advantage of the previous drainage incision (*Figure 3*).
- ❖ In men, 30° optic access is subareolar and in females in the submammary sulcus.
- ❖ A small 2 cm working incision in the axillary void allows the passage of the stapler and also of the instruments for performing abrasive pleurodesis or apical pleurectomy (*Figures 3,4*).
- ❖ If you already have drainage, the incision can be used to introduce the pleural drainage.
- ❖ Otherwise, the drain can be placed in the axillary incision in men or submammary in women.



Figure 3 Positioning of the trocars in a male patient with a previous drainage incision.

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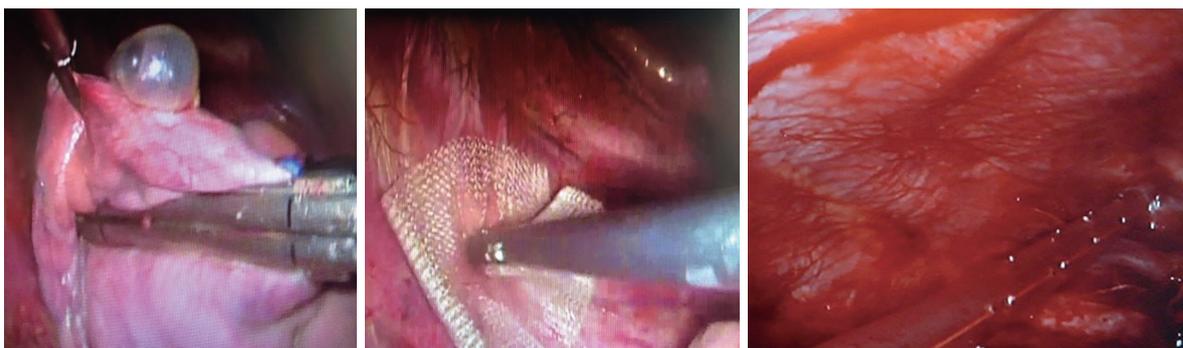


Figure 4 Videothoroscopic resection of apical blebs, abrasive pleurodesis with polypropylene mesh (Marlex®).

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