

# Laparoscopic Transmediastinal Drainage: A Simple and Effective Procedure for Reverting an Accidental Pneumothorax During Laparoscopic Antireflux Surgery

## Drenagem transmediastinal laparoscópica: Um procedimento simples e eficaz para reverter um pneumotórax acidental durante uma cirurgia laparoscópica antirefluxo

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### ABSTRACT

**Introduction:** Pneumothorax (PTX) secondary to pleural injury is an uncommon accident in laparoscopic antireflux surgery (LARS). Its frequency is approximately 2–6%. The current therapy for transoperative PTX is thoracic intercostal drainage. **AIM:** To evaluate the treatment of accidental transoperative PTX using a new procedure: laparoscopic transmediastinal drainage (LTD). **Materials and Methods:** From January 2000 to September 2010, 400 patients underwent LARS and 18 patients presented accidental pleural injuries. All 18 were treated using LTD. LTD was performed by the insertion of an 8 to 12 French silicone drain between the diaphragmatic pillars, leaving all the holes of the drain in the pleural cavity. The drain's exit was made through a 3 to 5 mm trocar hole inserted below the 5 mm work-trocar. The patients were kept on high-pressure mechanical ventilation (PEEP) by the anesthesiologist. The drains were removed 15 min on average after the end of the surgery and a chest radiograph was performed to confirm the absence of PTX. **Results:** No significant complication was observed when this technique was used for the treatment of PTX. Radiographic confirmation of the absence of PTX was obtained in all the patients. **Conclusions:** The treatment of PTX by LTD is a safe, simple, and effective method and should be considered the procedure of choice for this complication during LARS. By avoiding traditional intercostal drainage LTD maintains a minimally invasive surgery and preserves the desired esthetic outcomes.

**Key words:** Pneumothorax. Intraoperative complications. Laparoscopy. Laparoscopy transmediastinal drainage. Antireflux procedure. Gastroesophageal reflux disease.

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## 1. INTRODUCTION

Laparoscopic antireflux surgery (LARS) is an effective alternative to lifelong antireflux medical therapy and has become the standard approach to hiatal hernia repair and surgical treatment of gastroesophageal reflux disease (GERD).<sup>1-3</sup>

Numerous studies have shown that LARS is a safe and effective treatment with excellent intermediate and long term functional outcomes, which results in high patient satisfaction, and significantly improves patients' long term quality of life.<sup>4,5</sup>

Although laparoscopic fundoplication surgery is a safe and effective procedure, it is not free of

complications. One complication of laparoscopic surgery is accidental pneumothorax (PTX). It occurs more often during laparoscopic reoperations for antireflux procedures which failed to resolve symptoms. In published studies, Nissen fundoplication surgery has a 2% to 6% rate of accidental PTX.<sup>6</sup>

The association of Nissen fundoplication with PTX is usually the result of the complexity of the surgical procedure, leading to a pleural injury, an otherwise uncommon accident in LARS. This occurrence is higher at a reoperation procedure. The current therapy for transoperative PTX is thoracic intercostal drainage. Such an intervention would be viewed as parting from what was a minimal access surgery.

This study reports and evaluates the treatment of accidental PTX – occurring as a result of antireflux surgical therapy – employing a novel, simpler, safer, and effective procedure, the laparoscopic transmediastinal drainage (LTD).

## 2. PATIENTS AND METHODS

From January 2000 to September 2010, 400 patients underwent LARS; 18 patients presented

pleural injuries (Figure 1). There were 5 left-sided pleural injuries among 351 primary antireflux procedures and 13 pleural injuries (10 left-sided and 3 right-sided pleural injuries) among 49 redo procedures (Table 1). All 18 pneumothorax were successfully treated using LTD.

### 2.1. Surgical Technique

LTD was performed by the insertion of an 8F silicone drain between the diaphragmatic pillars, if the patient did not present a simultaneous hemothorax, with all of the holes of the drain within the pleural cavity (Figure 2A). In more complex cases, such as reoperations with bleeding, the insertion of a larger diameter (12F) drain, better drains a simultaneous hemothorax. The drain's exit was made through a 3 mm (8F) or 5 mm (12F) trocar hole inserted below the 5 mm work-trocar (Figure 2B).

All patients underwent Nissen laparoscopic fundoplication; no conversion to open surgery was required. The positioning of the surgical team, patient, and trocars is summarized in figure 3.

The patients were maintained on Positive End-Expiratory Pressure (PEEP) at 5 to 10 cm H<sub>2</sub>O by the anesthesiologist during the surgery. The drains

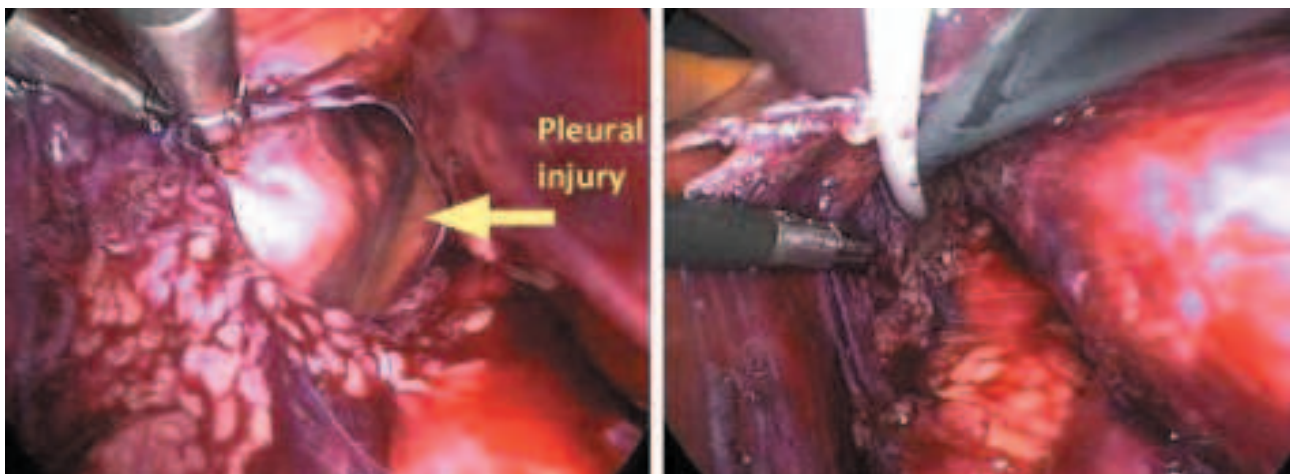
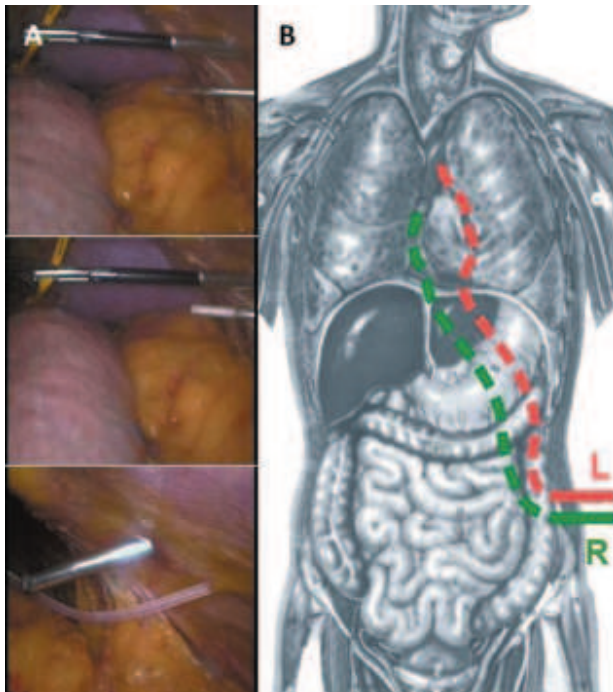


Figure 1 - Right pleural injury and drain positioning.

Table 1 - Frequency of pleural lesions by primary operations and reoperations.

|                       | Primary Operations<br>(n = 351) | Reoperations<br>(n = 49) | Total<br>(N = 372) |
|-----------------------|---------------------------------|--------------------------|--------------------|
| Left pleural lesions  | 5 (1.4)                         | 10 (20.4)                | 15 (4.0)           |
| Right pleural lesions | 0                               | 3 (6.1)                  | 3 (0.8)            |



**Figure 2** - A - Sequence of drain insertion into the peritoneal cavity. B - Path and exit of drain below the left 5 mm trocar.

were removed, on average, 15 minutes after the end of the surgery and a chest radiograph was obtained to confirm the absence of PTX.

### 3. RESULTS

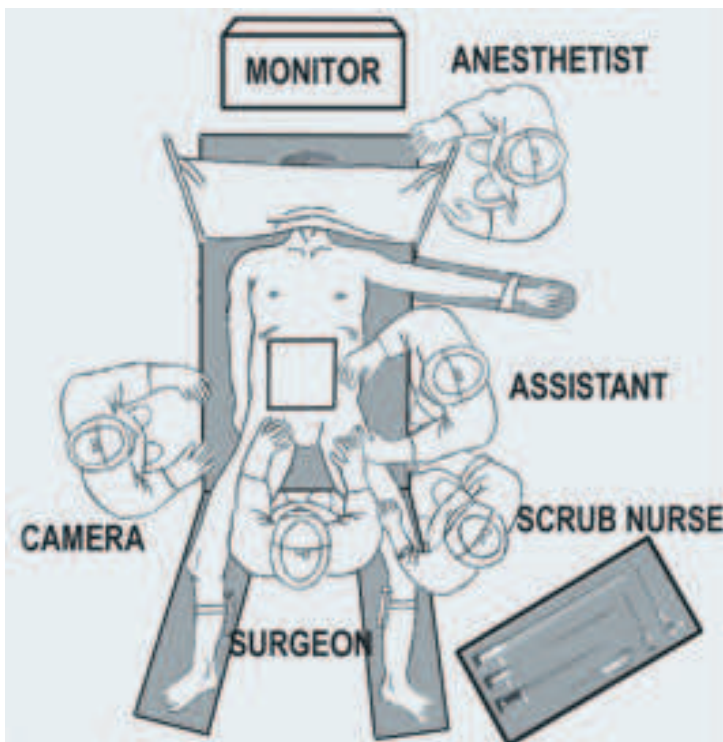
No significant complication was observed in this technique used for the treatment of PTX. Radiography confirmed the absence of PTX in all the patients.

The patients were asked about their satisfaction with the outcome after surgery. In a subjective evaluation of the patient satisfaction, all were satisfied with the outcome of the surgery.

### 4. DISCUSSION

PTX does not normally constitute a problem in open surgery because the intrapleural pressure is equal to the operating room pressure (atmospheric or zero pressure) and application of a minimal PEEP will force the lungs to inflate fully. In contrast, the intrapleural pressure of a PTX (or, to be precise, a capnothorax) created during laparoscopy may equalize the positive intraperitoneal insufflation pressure and thereby prevent full inflation of the lung during inspiration. Such an event may impair gas exchange.<sup>7</sup> Moreover, the PTX may reduce the operative space.

If the PTX is recognized during the beginning or in the middle of surgery, the prevailing treatment



**Figure 3** - Positioning of the patient and surgical team: patient in the middle at a cephalus upward angle of 30° with the legs bent.



consists of deflating the abdomen, performing a thoracic intercostal drainage, and then proceeding with the surgery if the patient remains hemodynamically stable.<sup>8</sup> LTD, not only avoids thoracostomy, but the intended esthetic results are maintained; only a minimal additional incision, usually 3 mm trocar hole in the abdomen, for 8F drainage, is required.

The psychological benefits for the patient are relevant. Thoracostomy may be viewed as an unexpected complication of the surgery, while an additional small abdominal incision probably won't. Transmediastinal pneumothorax drainage preserves the main goal of laparoscopic procedure: minimal postoperative morbidity.

Since 2000 the LTD technique described in this report has been the remedy of choice in our institution to treat all patients who experience an accidental PTX during antireflux surgical therapy.

## 5. CONCLUSIONS

Treatment of PTX by LTD is a safe, simple, and effective method and it should be considered the procedure of choice for this complication during LARS. LTD maintains the minimally invasive nature of the surgery, and preserves the desired esthetic outcomes.

This technique merits wide dissemination among surgeons, so that it benefits more patients.

## 6. ACKNOWLEDGMENTS

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## RESUMO

**Introdução:** Pneumotórax secundário a lesão pleural é um acidente incomum em cirurgia laparoscópica antirrefluxo. Sua frequência é aproximadamente 2-6%. A terapia atual para o pneumotórax transoperatório é a drenagem torácica intercostal. **Objetivo:** Avaliar o tratamento de um pneumotórax acidental transoperatório usando um novo procedimento, a drenagem laparoscópica transmediastinal. **Materiais e Métodos:** De janeiro de 2000 a setembro de 2010, 400 pacientes foram submetidos à cirurgia laparoscópica antirrefluxo dos quais 18 apresentaram lesões pleurais acidentais. Todos foram tratados usando a drenagem laparoscópica transmediastinal. Ela é realizada pela inserção de um dreno de silicone 8F-12F entre as bordas do pilar diafragmático, deixando todos os orifícios do dreno na cavidade pleural. A saída do dreno foi criada através de uma incisão feita por um trocar de 3-5 mm inserido abaixo do trocar de 5 mm. Os pacientes foram mantidos em ventilação mecânica de alta pressão pelo anestesista. Os drenos foram removidos em uma média de 15 minutos após o final da cirurgia e uma radiografia de tórax foi realizada para confirmar a ausência de pneumotórax. **Resultados:** Nenhuma complicação foi observada por essa técnica usada para o tratamento do pneumotórax. Radiografia confirmou a ausência de pneumotórax em todos os pacientes. **Conclusões:** O tratamento por Drenagem Laparoscópica transmediastinal é um método seguro, simples e efetivo e deve ser considerado um procedimento de escolha para essa complicação durante a cirurgia laparoscópica antirrefluxo e cirurgia minimamente invasiva, além de manter o resultado estético, evitando a drenagem intercostal tradicional.

**Descritores:** Pneumotórax. Complicações intraoperatórias. Laparoscopia. Drenagem transmediastinal laparoscópica. Procedimento antirrefluxo. Doença do refluxo gastroesofageal.

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