

# Progressive preoperative pneumoperitoneum in abdominal wall hernias

## *Neumoperitoneo progresivo preoperatorio en hernias de pared abdominal*

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### Keywords:

Pneumoperitoneum,  
loss of dominion,  
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### Palabras clave:

Neumoperitoneo,  
pérdida de dominio,  
hernias gigantes,  
malla retromuscular.

### ABSTRACT

**Introduction:** In 1940, the progressive preoperative pneumoperitoneum was described to increase abdominal cavity volume progressively in patients with hernias and loss of dominion, before visceral reintroduction, thus decreasing complications in the immediate postoperative period. **Material and methods:** We evaluated patients with giant incisional hernias or with loss of dominion in whom a double-lumen intraperitoneal catheter was placed for insufflation of ambient air during a period of seven to 17 days before hernia repair, over an 18 month period. Pre-, trans- and postoperative variables were analyzed. **Results:** Nine patients (eight females, one male) were gathered. On average, a volume of 800 cm<sup>3</sup> ambient air was insufflated. We had a loss of pneumoperitoneum due to leakage in one case, but closure was ensured thereafter. Pneumoperitoneum allowed the further reduction of the viscera to the cavity in all cases. **Conclusions:** The use of pneumoperitoneum allowed adequate closure of hernias, none had a compartmental syndrome. It was possible for us to achieve a new alternative to the preoperative management of hernia pathologies, such as the loss of dominion in giant defects of the abdominal wall.

### RESUMEN

**Introducción:** En 1940 se describió el neumoperitoneo progresivo preoperatorio para permitir el aumento de volumen de la cavidad abdominal de forma progresiva y la reintroducción visceral herniada, disminuyendo complicaciones en el postoperatorio inmediato en los pacientes con hernias con pérdida de dominio. **Material y métodos:** Se valoraron pacientes durante un periodo de 18 meses con hernias incisionales gigantes o con pérdida de dominio a los que se colocó un catéter de doble lumen intraperitoneal para insuflación de aire ambiente y realizar el neumoperitoneo preoperatorio durante un lapso de siete a 17 días; se programaron para hernioplastia analizando variables preoperatorias, transoperatorias y postoperatorias. **Resultados:** Se reunieron nueve pacientes (ocho mujeres y un hombre). En promedio se insuflaron 800 cm<sup>3</sup> aire ambiente. Hubo una pérdida del neumoperitoneo por fuga; sin embargo, se logró el cierre. El neumoperitoneo permitió la reducción de las vísceras a la cavidad en todos los casos. **Conclusiones:** El uso del neumoperitoneo permitió el adecuado cierre de los defectos herniarios, en ningún caso se tuvieron datos de síndrome compartimental. Fue posible obtener una nueva alternativa al manejo preoperatorio de la patología herniaria como en el caso de la pérdida de dominio y defectos gigantes de pared abdominal.

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## INTRODUCTION

A definition of hernia with loss of dominion is that in which the sac content exceeds the capacity (volume) of the abdominal cavity, making a complete reduction of the viscera impossible.<sup>1</sup> More than 70 years have passed since Goñi Moreno's technique was presented to achieve a progressive increase in the size

and volume of the abdominal cavity to the reduction of the hernia content with less risk of creating a compartment syndrome.

When handling hernias of disproportionate unusual size, the surgeon is required to know about the anatomical and physiological changes in a patient, to avoid trans- and postoperative complications which very frequently arise, compromising the patient's life.<sup>2,3</sup>

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A series of cases with giant hernias and loss of dominion is presented, using the preoperative progressive pneumoperitoneum to show its safety and benefits in the closure of the abdominal wall.<sup>4</sup>

### MATERIAL AND METHODS

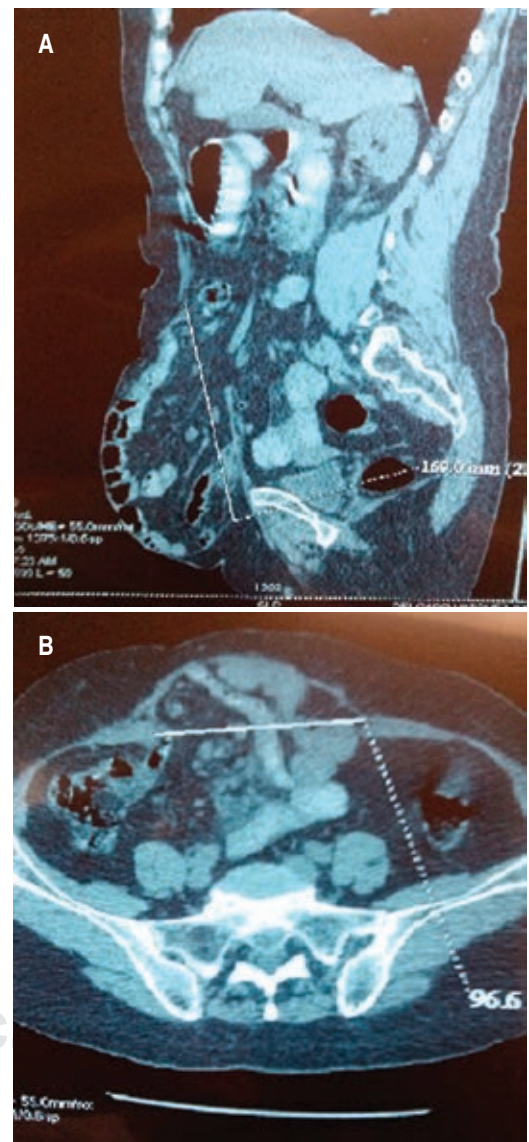
A retrospective, cross-sectional study was carried out between August 2016 and January 2018 in two public hospitals; the General Hospital of Durango, and the IMSS General Hospital of in Torreón. The following criteria were considered: patients over 18 years of age, of both sexes, with ventral or inguinal hernias with giant-sized sacs (*Figure 1*) classified as loss of dominion establishing this criterion as those hernias greater than 10 cm in diameter (Chevre<sup>5</sup>) in which content exceeds the capacity of the abdominal cavity.<sup>6</sup>

The variables analyzed were: the patient's tolerance to the procedure, in which we assessed the presence or absence of symptoms during the puncture and the time the air was blown (days), among which we considered abdominal pain, nausea, and dyspnea; the volume of air breathed (in cubic centimeters), from the first session, the time to achieve an increase in the size of the abdominal cavity, indirectly assessed by measuring the increase of the abdominal perimeter, the presence of complications secondary to insufflation and the puncture itself, puncture site infection, subcutaneous emphysema, acute abdomen due to intestinal injury or strangulation of the hernia. The follow-up was three months.

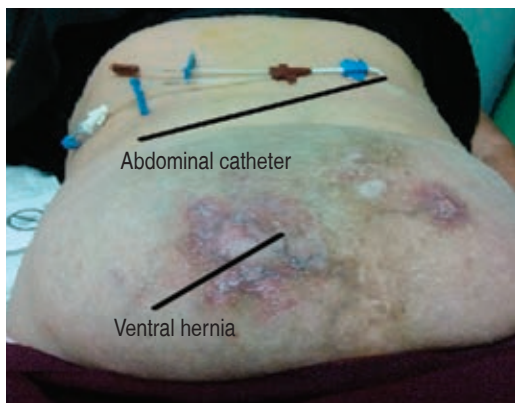
### Punction technique

All patients were previously informed about the procedure, risks, and benefits of the puncture, placement of the catheter, and insufflation. They all signed their informed consent. Sterile technique was used in all cases. If there was no contraindication, the puncture was done on Palmer's point. Local anesthesia with 2% lidocaine was infiltrated. A double catheter (*Figure 2*) or triple lumen (central venous catheter 7 Fr) was inserted for insufflation with Seldinger's technique.<sup>7</sup> Punctures were done with a Veress needle, corroboration of access to

the abdominal cavity by instillation and suction of saline solution. The usual steps were followed by passing a metal guide through the lumen of the needle, then removed leaving the guide, a dilator was used, and finally, the catheter was placed through the same guide, removed after insertion of the catheter. Ambient air with a 60 cm<sup>3</sup> syringe was used to insufflate. After the first 100 cm<sup>3</sup> insufflation, X-ray controls



**Figure 1: A and B.** Tomographic image of a patient with a giant hernia without loss of domain. The measures of the hernial defect are seen.



**Figure 2:** Double lumen catheter placed in the left hypochondrium. Patient with skin changes secondary to giant hernia.

were taken to check for subdiaphragmatic free air. After confirming the proper placement of the catheter, a volume up to 1,000 cm<sup>3</sup> was supplemented, on a patient-dependent basis. The entire procedure was performed as an outpatient procedure. For daily insufflations, a direct relative was trained in the technique of insufflation, to keep track of the volume and discomfort of the patient, and to report any complication.

**RESULTS**

Eleven patients with giant hernias recruited during the period were analyzed. Six cases were

obtained from the surgery consultation of the General Hospital of Durango, and five from the General Hospital of Torreón.

Of the 11 cases, two were excluded due to technical difficulty in placing the intraperitoneal catheter, due to a large adipose tissue that did not allow the introduction of the Veress needle. Of the remaining, 8 were females and 1 male, with an age average of 56 years (ranges 35 to 79). One of the cases without surgical history and a primary umbilical hernia (11.1%), 8 with a previous surgery (88.8%); 2 with laparotomy for acute abdomen (25%), and 6 with recurrence after previous repairs (75%). Of these, 4 had cesarean sections and previous repair (66.6%), 1 with recurrence after repair (16.6%), and 1 with double recurrence (16.6%). Five patients had a loss of dominion (55.5%) and 4 had giant hernias (44.4%) with an average defect of 16.5 cm (range from 10 to 20 cm (Table 1).

For the daily sessions, only 2 patients (22.2%) were hospitalized due to the remoteness of their homes and the refusal of relatives to perform the procedure at home. For the remaining 77.7% (seven patients), the procedure was ambulatory.

In our series, patients with loss of dominion presented giant sacs, with cutaneous changes such as thinning of the skin, change of color and ulcers<sup>8</sup> (Figure 3). The reduction of the hernia content was impossible. The size of the abdominal cavity and the hernia contents were measured and compared using CT images,

**Table 1:** Ages and surgical history.

Case	Male	Female	Age	History of C-section	Hernia	Laparotomy	Lost of dominion
1		X	64	X	Recurrent		
2		X	45	X	Recurrent		X
3		X	35			X	X
4		X	50		Recurrent		X
5		X	79	X	Recurrent		
6		X	58	X	Recurrent		X
7		X	53			X	
8	X		64		Recurrent		
9		X	57		Primary		X



**Figure 3:** Patient with a giant hernia after placement of the double lumen catheter.

confirming that content was larger than the size of the cavity.

In seven cases (77.7%) a Veress needle was used, considering that it has a lower risk of visceral injury. However, in 2 patients (22.2%) it was decided to use a Tuohy needle as an alternative to the catheter. The average time for the procedure was 20 minutes. In 4 patients, the pneumoperitoneum catheter was placed in the OR (44.4%), supported with sedation by an anesthesiologist, to reduce anxiety. Two catheters were placed in the outpatient clinic (22.2%) and the remaining three in a ward bed (33.3%).

The insufflated volumes ranged from 500 cm<sup>3</sup> to 1,200 cm<sup>3</sup> per day, with an average of 800 cm<sup>3</sup> according to tolerance. Only two patients showed symptoms (22%), in the first case, pain at the puncture site, which improved with oral analgesics (paracetamol) and in the second case a subcutaneous emphysema resolved by deferring the pneumoperitoneum for two days.<sup>9</sup>

The average number of days with pneumoperitoneum was 12.1 days with ranges from seven to 17 days (Table 2). The smallest number of days was in a patient who, after seven days of pneumoperitoneum, presented air leakage through an opened cutaneous ulcer; however, the pneumoperitoneum facilitated the separation of the intestinal loops from the hernial sac (Figure 3). We chose not to exclude her from the group, since a significant increase in the size of the hernial sac had been obtained which allowed us to partially reduce it before the operation, which was not possible at the start of the procedure. He did not have an acute abdomen, and underwent a satisfactory procedure the day after the air leak, achieving the reduction of the intestinal loops to the abdominal cavity, placement of the mesh with the Rives technique, and adequate closure of the wall.

Hernia defects had an average size of 13.6 cm (ranges 16-20 cm). All nine patients had the mesh placed in the retromuscular space.<sup>10</sup> Difficulty in achieving midline closure was found in 2 cases, in one of them despite performing a level 2 component separation.<sup>11</sup> In the second case the separation of components was of level I, complete mobilization was impossible due to a stoma; the mesh was placed "inlay".

During the dissection of the hernial sac, we had two cases of incidental intestinal perforation, both smaller than 1 cm (22.2%), repaired with primary closure with 3-0 Vicryl® (polyglactin 910) with separate stitches in a single plane without major complications. Both started per os feeding the day after surgery.

Two of our patients (22.2%) had skin necrosis. In the first case, the mesh was sutured to the aponeurotic border, so the prosthetic material was exposed. It was managed with primary closure, and later with a new skin flap. A second case in

**Table 2: Days, volumes and size of the defect.**

Case	Days of pneumoperitoneum	Insufflated volumen per day (cm <sup>3</sup> )	Tamaño Size of the defect (cm)
1	15	600	16
2	15	1,000	17
3	10	700	18
4	10	1,200	16
5	10	500	16
6	15	1,200	20
7	7	1,000	18
8	10	1,000	18
9	17	1,000	10



which abdominal repair was performed, had necrosis of the flap junction, which was resolved a week later, by resection of the affected dominion and closure of the skin.

At three-month follow-up, no case had presented recurrence data.<sup>12</sup>

## DISCUSSION

As Acevedo et al.<sup>13</sup> describe, 5 to 20% of laparotomies present some incisional hernia or eventration (Timmermans refers it after a 10-year follow-up<sup>14</sup>) as an 11-50% of laparotomies, also commented by Vargas-Flores.<sup>10</sup>

In 1940, Iván Goñi Moreno implemented the preoperative pneumoperitoneum technique in a patient with a hernia with loss of dominion. He decided to insufflate the abdominal cavity with oxygen, with the reduction of the hernia; his case was presented at the Argentine Congress of that year.<sup>15</sup> This case represents the great challenge of loss of dominion in hernias of the abdominal wall. Koontz, in the 1950s, described how Ziffren and Womack<sup>16</sup> chose to create a new controlled hernia, to allow for the reduction of content into the cavity. Finally, Koontz himself preferred to use the Goñi Moreno technique for hernias with loss of dominion due to their safety, reproduction, and low cost. Thus, in our hospital centers, we chose the use of preoperative pneumoperitoneum as part of the management of giant defects with loss of dominion, as reported in 2010 by Sabbagh,<sup>6</sup> who presented a series of 19 cases with a 21% frequency of giant midline hernias.

According to Piskin,<sup>17</sup> pneumoperitoneum reduces the pre- and postoperative risks in giant hernias, since it causes a progressive increase in the abdominal cavity with the patient's tolerance for surgery, benefits we have corroborated. The greatest benefit is a decrease in risk of compartment syndrome, dehiscence, and recurrence due to tension of the aponeurosis, as compared to no previous preparation.

Our technique is primarily based on what Martínez<sup>7</sup> describes using a double lumen catheter with a subclavian needle, is subsequently reproduced and improved by Mayagoitia<sup>18</sup> using the Veress needle, with less likelihood of visceral perforation.

The duration of the pneumoperitoneum and volume was dependent on the patient, since these were modified according to tolerance and symptoms. The greatest duration of stay in our series was 17 days, a period was mainly determined by tolerance to pneumoperitoneum during the last days. We consider this within the range suggested by Hernández and Villalobos for ventral hernias<sup>1</sup> which contrasts with data reported by Mayagoitia,<sup>11</sup> who recommends 30 to 90 days to achieve objectives, from the loosening of adherences to an increase in the volume of the abdominal cavity. Our average number of days is closer to that described by Cerasani,<sup>19</sup> Rodríguez in 2006<sup>20</sup> and Martínez in 2002.<sup>7</sup>

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