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## Abstract

Background: Retroperitoneoscopic lumbar sympathectomy is the standard surgical treatment for plantar hyperhidrosis. However, it is rarely performed due to the technical complexity of the procedure. This study aimed to describe a modified video-assisted lumbar sympathectomy technique, the superselective transperitoneal lumbar sympathectomy. Methods: This is a retrospective study of 32 sympathectomies (16 patients) for plantar hyperhidrosis. The procedure is performed with the patient in the supine position and under general anesthesia. A video camera is introduced through the umbilical trocar, and the dissection forceps are introduced through trocars in the suprapubic area and right-and left-iliac fossa. The patient is placed in the Trendelenburg position at the level of the L3 vertebral body.

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*Index terms*— hyperhidrosis, excessive plantar sweating, lumbar sympathectomy, laparoscopic surgery.

## 1 Introduction

Plantar hyperhidrosis is characterized by excessive sweating of the feet mediated by sympathetic stimulation. In severe cases, patients may have gait disturbances, skin lesions, and cold feet. The prevalence of plantar hyperhidrosis is estimated to be from 2.9% to 9% [1][2]. Retroperitoneoscopic lumbar sympathectomy is the standard surgical treatment. This procedure has been performed with a low rate of complications [3][4][5] and has improved the quality of life of patients affected by plantar hyperhidrosis [6]. However, the surgery requires that the patient be in a semi-lateral position with elevation of the flank and the use of intraabdominal and retroperitoneal pneumoperitoneum [3], in addition to, sometimes, being performed in two stages. Some authors perform bilateral sympathectomy which uses a single-sided access and lasts just over an hour [7]. Compensatory hyperhidrosis is the most frequent adverse event and, although infrequent, sexual dysfunction may also occur [8].

This study aims to describe a modified video-assisted lumbar sympathectomy technique, called superselective transperitoneal lumbar sympathectomy, which allows the performance of the procedure using a single access with an easy abdominal approach.

## 2 II.

## 3 Materials and Methods

This is a retrospective study of 32 sympathectomies performed in 16 patients with plantar hyperhidrosis treated by laparoscopic superselective transperitoneal lumbar sympathectomy.

## 4 III.

## 5 Technical Description

For better anatomical orientation, considering that the surgery is performed with the patient in the supine position, a simple preoperative abdominal x-ray is performed. The x-ray imaging is done with the patient in the supine position and with the umbilicus marked with a metallic disk, which can be a coin. Thus, the location of the L4 vertebral body can be confirmed in a straight direction from the umbilicus. The anatomy must be confirmed because there may be anatomical variations or umbilical deviation due to previous abdominal surgery.

The surgery is performed under general anesthesia with the patient in the supine position. A thermometer is placed on each plantar foot surface of the patient. Before anesthetic induction, the temperature of the feet is approximately 25 °C, while after anesthesia, it rises to 32 °C on average.

44 Pneumoperitoneum with carbon dioxide and pressure of 12 mm of mercury is established and four 5mm trocars  
45 are inserted. The video camera is introduced through the first one placed in the umbilicus. The dissection forceps  
46 are introduced through the suprapubic area and right-and left-iliac fossa trocars (Figure 3). The patient is placed  
47 in the Trendelenburg position, exposing the root of the mesentery, which is at the level of the L3 vertebral body.

48 Under the direct view of the endoscope and with the aid of dissection forceps, a small opening of the posterior  
49 peritoneum is made close to the third portion of the duodenum after cranial mobilization of the mesentery and  
50 intestines (Figure 4).

51 With the forceps inserted through the umbilical trocar, a lumbar spine projection is made to identify the L3-L4  
52 vertebrae using a C-arm radioscopy to help locate the level of the vertebrae. Thus, consequently, locating the  
53 sympathetic chain, which allows for the approach to the sympathetic plexuses on the right and left sides.

54 Subsequently, the vena cava is bluntly dissected and medially displaced so that the sympathetic chain, usually  
55 found behind the vein, can be visualized. The level of the sympathetic resection is confirmed with intraoperative  
56 radioscopy at L3-L4 on the right. Thus, the section of the sympathetic chain is carried out.

57 Similarly, the para-aortic lymph nodes are dissected in order that the right sympathetic chain is reached  
58 (Figure 7 and 8). Under intraoperative radioscopy, the right sympathetic chain is sectioned after its level is  
59 confirmed at L3-L4. The opening that gives access to the retroperitoneum, which is soon after closed, can be  
60 seen in Figure 9.

61 When the sympathetic section is performed, there is an increase of approximately 2 °C in temperature and  
62 significant vasodilation of the lower limbs. Thus, the section of the sympathetic chain can be confirmed.

63 The surgery lasts approximately one hour and does not require a hospital stay longer than 24 hours.  
64 Prophylactic antibiotics are used in surgery and common analgesics are given to the patient postoperatively.  
65 After the removal of the stitches, which usually takes 10 days, the patient can resume normal activities. Figure  
66 10 shows the excellent aesthetic result achieved after the procedure.

67 IV.

## 68 6 Results

69 The cases of 16 patients who underwent laparoscopic superselective transperitoneal lumbar sympathectomy were  
70 analyzed. Most of them were women (n=12) and had a higher education degree. Ages ranged from 19 to 36 years,  
71 with a mean of 28.3±4.5 years. Three women had already undergone surgical treatment of plantar hyperhidrosis.  
72 Before the procedure, patients mentioned wearing from one to four pairs of socks per day. Women reported  
73 wearing two or three different pairs (mean 2.8±1.1), while men, one or two (mean 1.6±0.5; p = 0.039).

74 Fifty patients were treated over 18 years; however, only 16 were contacted. These underwent the procedure  
75 from 1 to 15 years ago. In a telephone interview, 15 patients reported improvement in both feet, while 1 patient  
76 described seeing improvement in only one foot and undergoing a second surgery. Patient satisfaction with the  
77 treatment was assessed using a five-point Likert scale in which 1 would be dissatisfied; 2, somewhat satisfied; 3,  
78 satisfied; 4, very satisfied; and 5, extremely satisfied. Two patients reported being somewhat satisfied (2 points);  
79 two were satisfied (3 points); and the other 14 were very or extremely satisfied (4 and 5 points). Among both  
80 men and women, 75% of patients declared being very or extremely satisfied. There was no association between  
81 the degree of satisfaction and the number of pairs of socks changed before treatment (p=0.78).

82 Three patients reported improvement in sweating, in addition to the feet, in another region of the body. Most  
83 patients (n=13) developed compensatory sweating with the most affected region being the trunk, but with less  
84 intense sweating. There were no surgical complications in the case series reported in this study; however, one  
85 case required reintervention because the first procedure failed to control the symptoms on one side.

86 V.

## 87 7 Discussion

88 This study presented cases of plantar hyperhidrosis treated with the laparoscopic superselective transperitoneal  
89 lumbar sympathectomy technique and the vast majority of patients were satisfied with the treatment.

90 The extraperitoneal lumbar sympathectomy is a technique little used because of the difficulty of its performance  
91 and the lack of trained surgeons. Despite the clear improvement in the quality of life of treated patients 6 , the  
92 number of patients with the pathology who have delayed surgical treatment is still difficult to assess. As it is  
93 performed with a commonly used positioning, the technique described allows for accessing the retroperitoneal  
94 space through anterior approaches to the spine, thus, facilitating the procedure.

## 95 8 I

96 For having anatomical support, this procedure can be safe pre-and trans-operatively, achieving high levels of  
97 satisfaction among patients, as reported after a retroperitoneoscopic lumbar sympathectomy ?? . In this study,  
98 there was one unsuccessful case due to the difficulty of dissecting the right-sided nerve; however, during a  
99 second intervention, the right lumbar sympathetic chain was sectioned without complications. Compensatory  
100 hyperhidrosis was the adverse effect observed in most patients submitted to laparoscopic superselective  
101 transperitoneal lumbar sympathectomy. Nonetheless, as it was less intense, it did not negatively affect satisfaction  
102 with the surgery. Several studies report that, despite compensatory sweating, the overall quality of life of these

103 patients improves 5,6, ??0 . No cases of retrograde ejaculation, hemorrhage, visceral injury, infection, or death  
104 were recorded.

105 Compensatory hyperhidrosis occurs in up to two-thirds of cases according to the literature 9-11 and can be  
106 exacerbated by the use of a surgical clip to interrupt the sympathetic chain. In these cases, the performance of a  
107 new procedure is recommended to remove the clip and section the sympathetic chain 12 . Reinnervation, although  
108 less frequent than after thoracic sympathectomy 12 , may also occur and require a new surgical intervention.

109 The body anatomy in the supine position, the insertion of trocars, and camera positioning are well known  
110 by surgeons, making this approach advantageous. Moreover, the location of the lumbar sympathetic chain is  
111 anatomically constant and, in rare cases, it is not anatomically favorable. Extraperitoneal lumbar sympathectomy,  
112 on the other hand, is a technique that has a longer learning curve as it is not the most common route used by  
113 surgeons. Furthermore, it requires longer anesthetic time, as well as greater preparation of the team as a whole  
114 for the positioning of the patient 4,7 . For being performed with the patient in a commonly used position, the  
115 technique described in this study allows for access to the retroperitoneal cavity through an anterior approach to  
116 the spine.

117 The main limitations of this study were the small number of cases, the difficulty in locating all patients, and  
118 the long time elapsed between the surgery and telephone interview in some cases. In contrast, this investigation  
119 provides data on long-term evolution cases. There seems to have been no preferential selection of women since  
120 the number of women is also higher in several other studies in the literature 5, ??0, ??3, ??4 .

## 121 9 VI.

## 122 10 Conclusion

123 The treatment of plantar hyperhidrosis using the laparoscopic superselective transperitoneal lumbar sympa-  
124 thectomy technique proved to be effective and safe. In addition to sympathectomy, this direct approach to  
125 the retroperitoneum could also be used in difficult-to-access laparoscopic oncologic resections and treat anterior  
126 lumbar spine pathologies. Using a robot for this surgical approach is a possibility.

## 127 11 Conflicts of Interest and Source of Funding

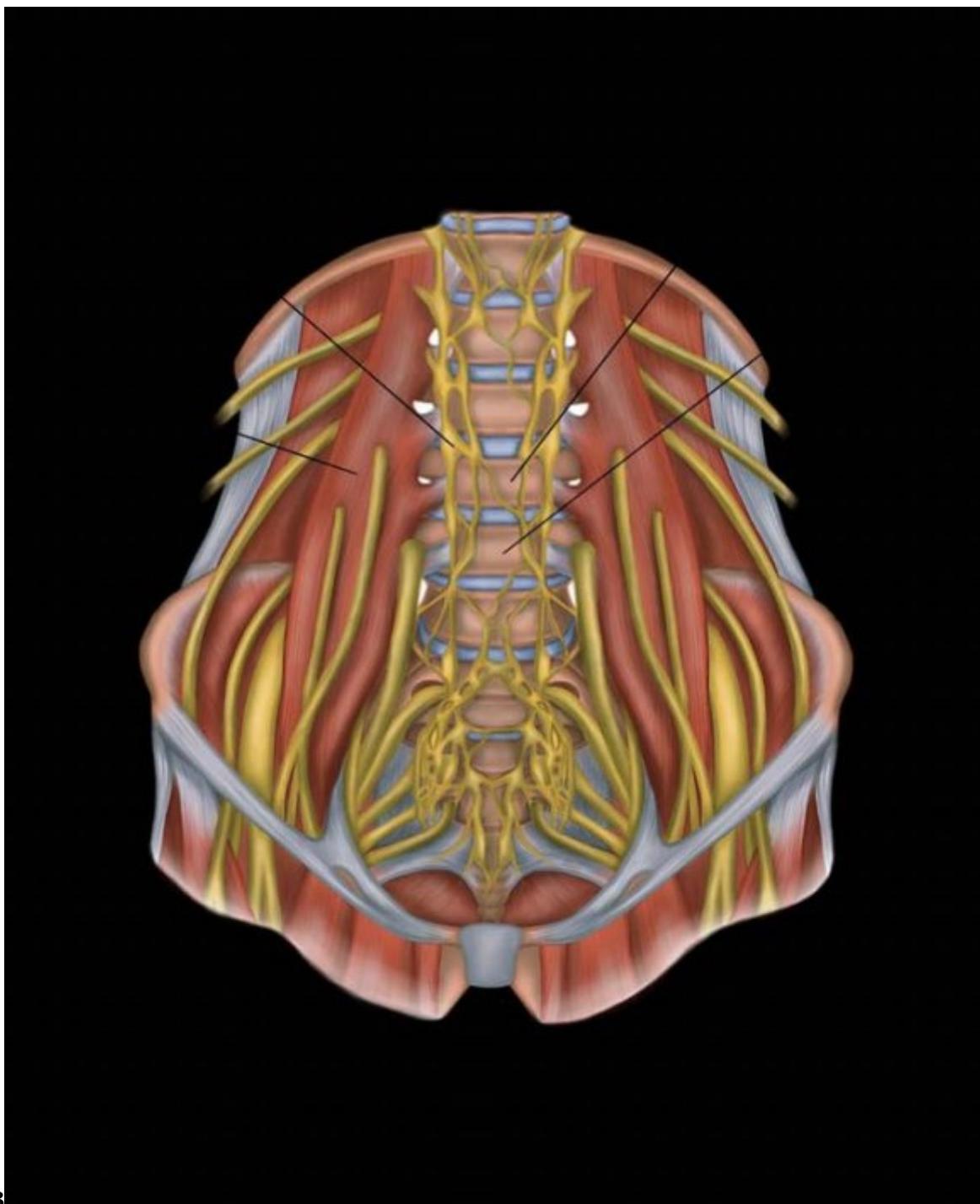
The authors declare that there is no conflict of interest or funding sources. <sup>1</sup>



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Figure 1: Figure 1 and 2 :

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Figure 2: Figure 3 :

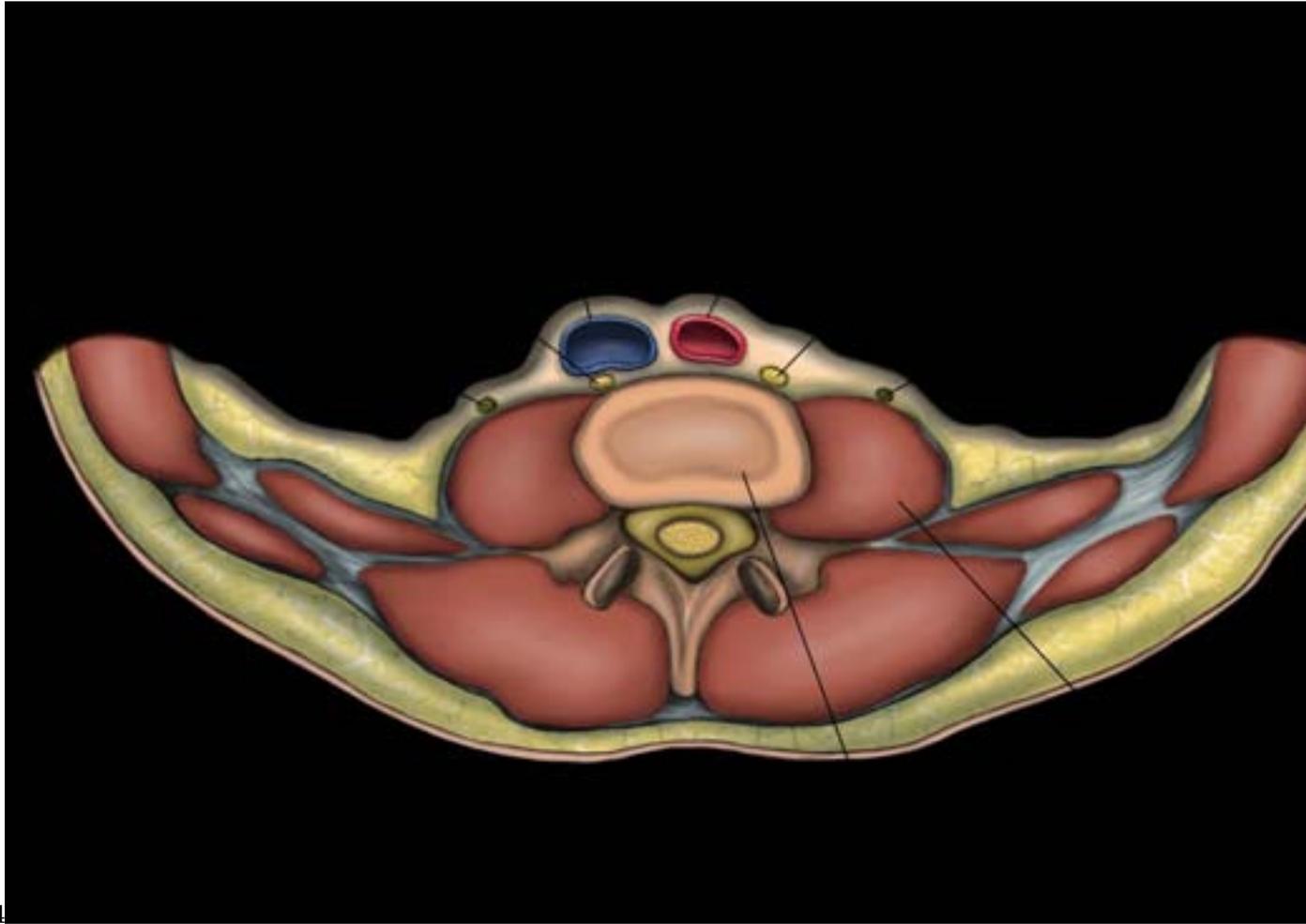


Figure 3: Figure 4 :

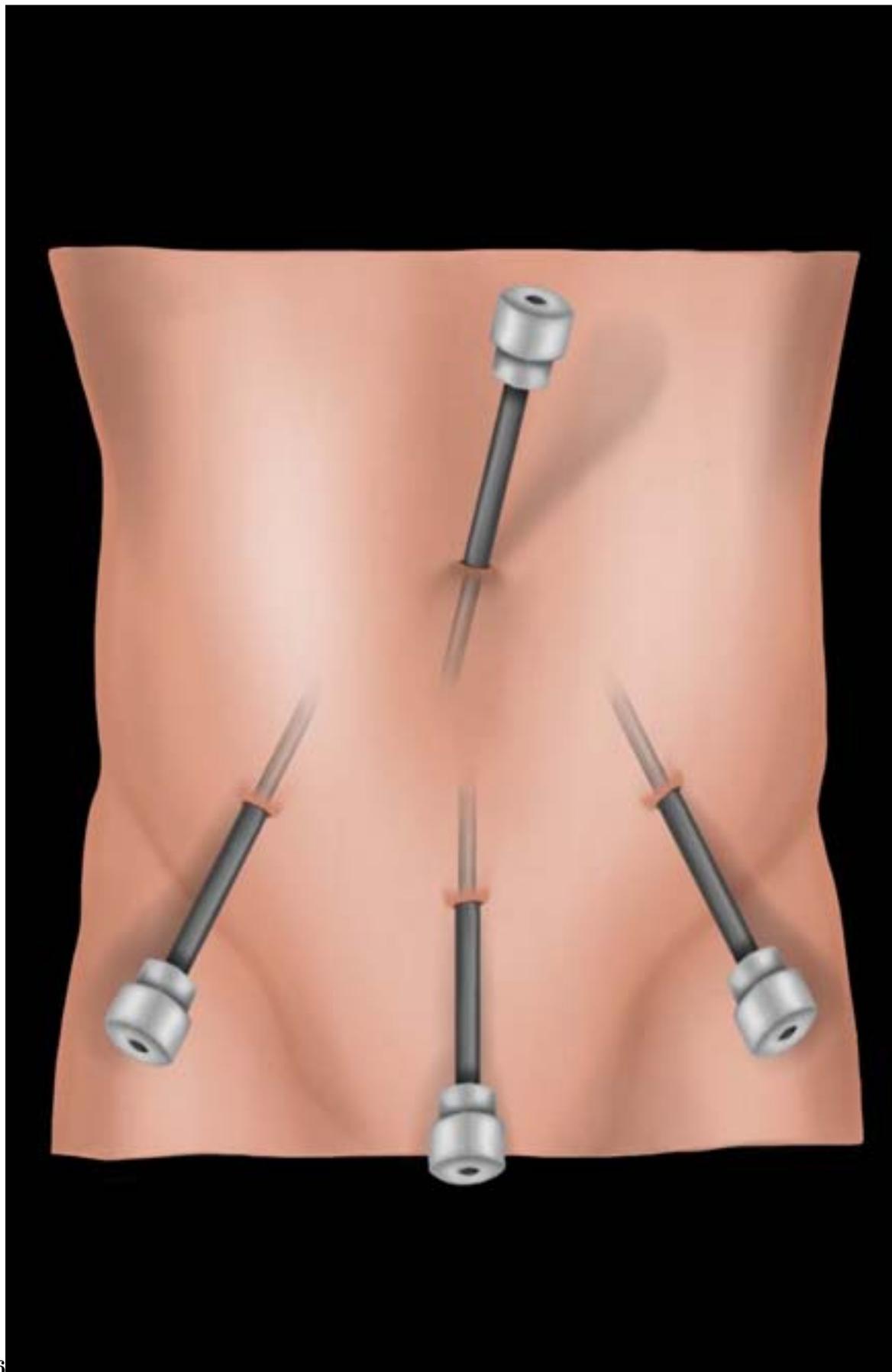
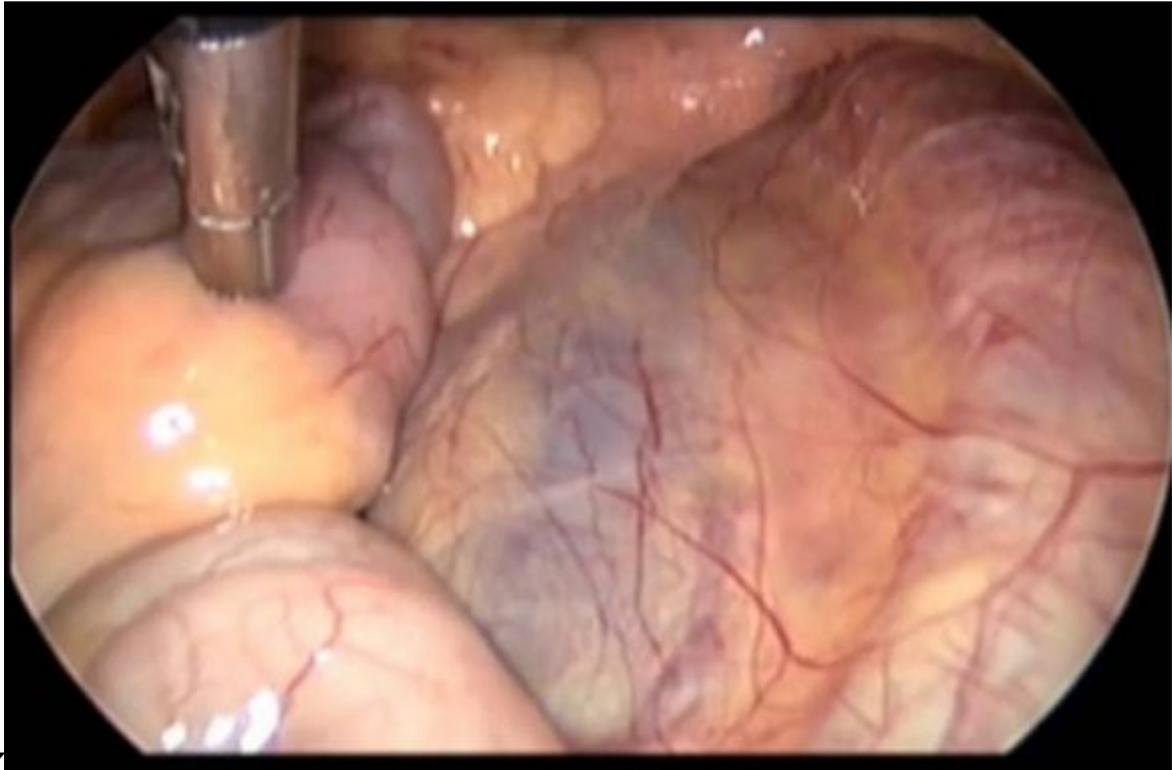
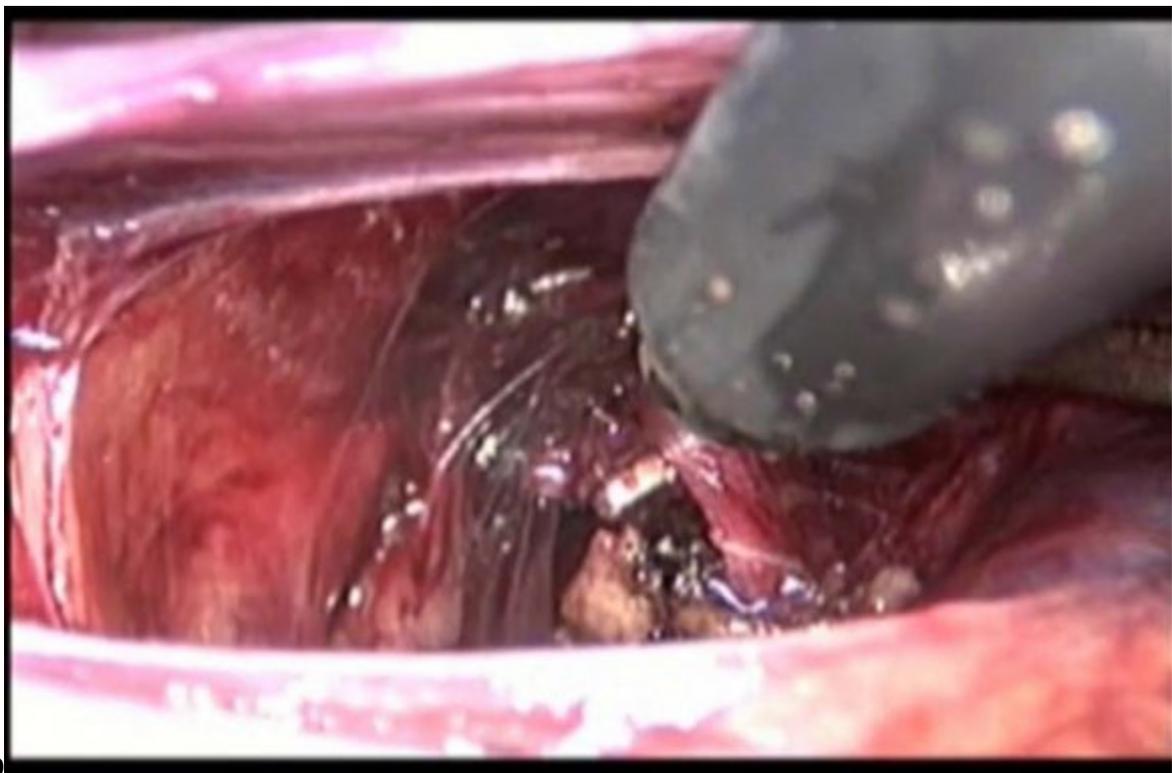


Figure 4: Figure 5 and 6 :



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Figure 5: Figure 7



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Figure 6: Figure 9 :

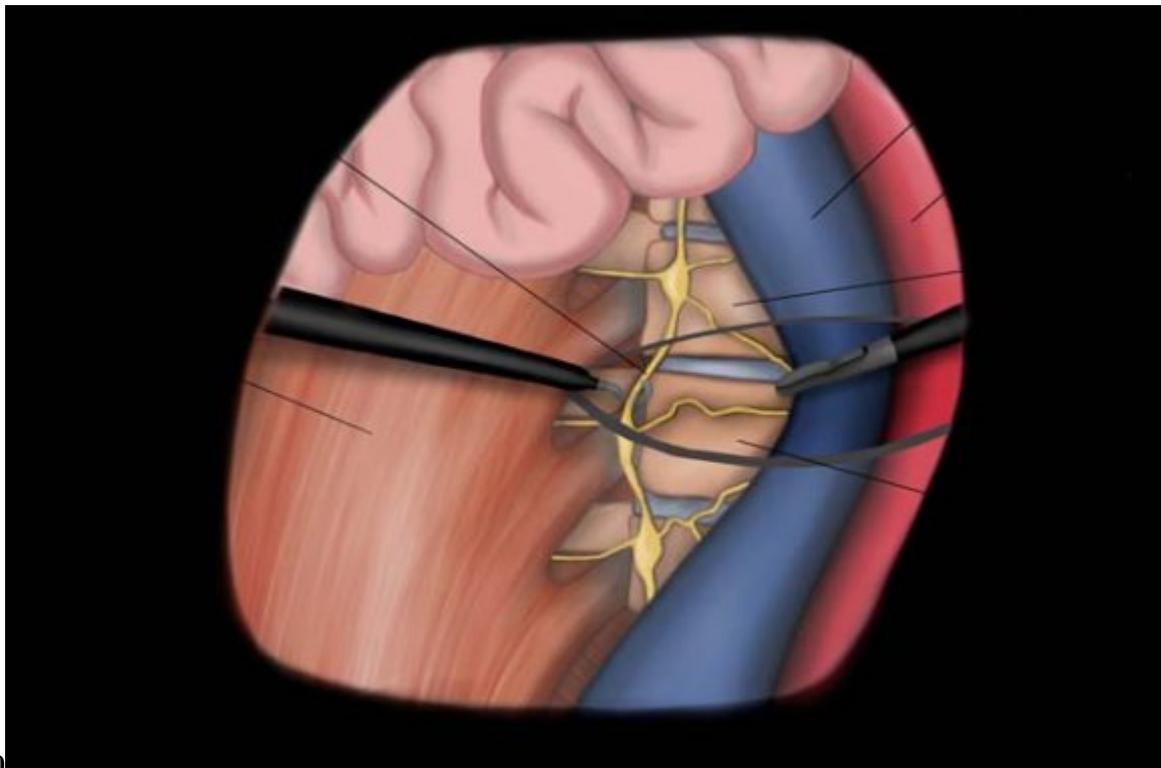


Figure 7: Figure 10 :

Laparoscopic Superselective Transperitoneal  
Lumbar Sympathectomy for Treating Plantar  
Hyperhidrosis  
Lumbar Sympathectomy for or Treating Plantar Hyperhidrosis  
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[Note: Rodrigo]

Figure 8:

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Complications of lumbar sympathectomy.  
Retrospective study 791 patients  
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Figure 9:



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