



## ORIGINAL ARTICLE

# THORACOSCOPIC SPLANCHNICECTOMY FOR PAIN CONTROL IN IRRESECTABLE PANCREATIC CANCER

By

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**Aim:** Disabling pain for many patients with irresectable pancreatic cancer is poorly managed and can remain a significant problem until their deaths. The aim of this study was to evaluate the safety and efficacy of thoracoscopic splanchnicectomy for pain control in patients with irresectable pancreatic cancer.

**Methods:** Thirteen patients suffering from intractable pain due to irresectable pancreatic cancer underwent 15 attempted thoracoscopic splanchnicectomy procedures. All patients were opiate dependent. Right-sided splanchnicectomy was performed for a dominantly right-sided pain, whereas a centralized, bilateral, or left-sided pain was managed by left splanchnicectomy. If pain recurred, patients were offered to have the procedure repeated on the contralateral side.

**Results:** Thoracoscopic splanchnicectomy procedure was a technical failure because of pleural adhesions in one patient. Fourteen (10 left- and 4 right-sided) thoracoscopic splanchnicectomies were successfully completed in 12 patients. Immediate pain relief was achieved in all 12 patients after unilateral thoracoscopic splanchnicectomy. Pain relief persisted till death in 8 patients and till latest postoperative follow-up visit at 5 months in one patient. Two patients required a contralateral procedure for pain recurrence. A third patient had a recurrent pain but refused contralateral intervention. Except the latter, none of the patients required opioids.

**Conclusion:** Thoracoscopic splanchnicectomy is a safe, simple, and effective minimally invasive procedure. It offers a substantial relief of pain in patients with unresectable pancreatic cancer.

**Keywords:** pain management, sympathetic denervation, splanchnic nerves.

## INTRODUCTION

Severe pain is the most distressing and debilitating feature of pancreatic cancer and most patients are suitable for palliation only at the time of diagnosis. Different methods have been suggested for pancreatic pain control, ranging from the use of narcotic analgesics and celiac plexus block to open surgical procedures.<sup>(1)</sup> Medical therapy has often been ineffective, and narcotic addiction is a common consequence, which itself interferes with the patients' quality of life.<sup>(2)</sup> Open splanchnicectomy at laparotomy<sup>(3)</sup> or thoracotomy<sup>(4)</sup> is highly invasive and associated with high morbidity. Although percutaneous neurolysis has offered a less invasive alternative to open procedures,<sup>(5,6)</sup> pain relief

is not always satisfactory, and the procedure is not without its own associated risks and morbidity.<sup>(7-9)</sup>

Thoracoscopic splanchnicectomy has recently been proposed as a minimally invasive procedure which has the potential to achieve, through a minimally invasive approach, an interruption of pain-conducting nerve fibers, which is similar to the percutaneous block with a higher degree of precision, also avoiding the side effects associated with the local diffusion of neurolytic solutions.<sup>(10,11)</sup> The as-yet unstandardized surgical technique and the inconstant use of reliable outcome measures make establishing efficacy and the current role of

this procedure difficult in the treatment of patients with pancreatic cancer.

Our aim was to evaluate the safety and efficacy of thoracoscopic splanchnicectomy for pain control in patients with irresectable pancreatic cancer.

## PATIENTS AND METHODS

From June 1, 2005, through December 31, 2006, 13 patients (9 men and 4 women) suffering from intractable pain due to irresectable pancreatic cancer underwent 15 attempted thoracoscopic splanchnicectomy procedures. Their ages ranged from 50 to 72 years, with a mean of  $57.9 \pm 8.1$ . Pain was epigastric in all patients with radiation to the hypochondrium in 7 patients (2 right, 3 left, and 2 both sides) and to the back in 10 patients. Pain was limited to the epigastrium with no radiation in 3 patients. All patients required narcotics administration. Five patients (38%) had undergone one previous surgical procedure: diagnostic laparoscopy (n=2), diagnostic laparotomy (n=1), and gastrojejunostomy (n= 2). Unresectability was documented by radiological and/or operative evidence of hepatic metastases in 6, massive tumor encasement of the superior mesenteric vessels or portal vein in 5, and peritoneal tumor deposits in 2 patients. The tumor was situated in the body in 8 patients and in the head of the gland in 5 patients.

To assess the effect of splanchnicectomy, data on pain and pain medication were collected prospectively before and after splanchnicectomy. Using a 10-point visual analog pain scale (VAS) where 0 indicated no pain and 10, unbearable pain, all patients were preoperatively required to rate the extent of their pain. The effect of thoracoscopic splanchnicectomy on pain control was assessed by collecting VAS scores on the first postoperative day, 2 weekly for the first month, and monthly thereafter. Postoperative pain medication requirement was monitored on a monthly basis. The following parameters were also evaluated for each patient: procedure-related morbidity and mortality, operative time, and length of hospital stay.

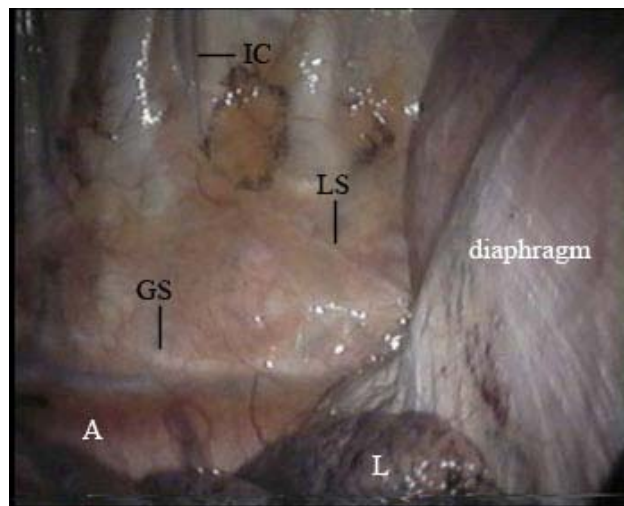
Statistical analysis was performed using simple descriptive statistics (mean, standard deviation) and paired t test.

### Operative technique

The side chosen for splanchnicectomy depended on the site of pain. Right-sided splanchnicectomy was performed for a dominantly right-sided pain, whereas a centralized, bilateral, or left-sided pain was managed by left splanchnicectomy. If pain recurred or the response was unsatisfactory, patients were offered to have the procedure repeated on the contralateral side.

Under general anesthesia, with double-lumen endotracheal intubation allowing single-lung ventilation, the patient was placed in the lateral decubitus position with slight tilt anteriorly to displace the lung forward. A nasogastric tube

was inserted during left thoracoscopic splanchnicectomy to deflate the stomach and avoid upward displacement of the left hemidiaphragm. The surgeon stands in front of the patient with the assistant on his left side. A 10-mm trocar was placed in the sixth intercostal space 2 cm anterior to the mid-axillary line, and a 0° optical angle thoracoscope was introduced. After inspection of the thoracic cavity, two 5-mm trocars were placed in the seventh and ninth intercostal spaces in the posterior axillary line of the chest. While retracting the lung cephalad and anteriorly, the posterior costovertebral region can be visualized. The greater and lesser splanchnic nerves could usually be identified through the parietal pleura (Fig. 1). On the left, the greater splanchnic nerve parallels the aorta and receives multiple roots from the sympathetic chain. A pleural incision was made just posterior to and parallel to the aorta. At the diaphragm, the pleural incision was turned laterally for 1 to 2 cm length, and the resulting flap of pleura was elevated by using blunt dissection (Fig. 2). The main trunk of the greater splanchnic nerve was isolated using blunt dissection as distally as possible and sectioned using electro-surgical scissors. The lesser nerve was then identified about 1 cm lateral to greater splanchnic nerve. It was dissected as distally as possible and sectioned. A 1 to 2 cm segment of each nerve was excised and sent for pathological examination. On the right side, the procedure is essentially the same taking care that the greater splanchnic nerve crosses the azygos vein and it was excised lateral to this to avoid the vicinity of the thoracic duct. A 28F chest tube was inserted and connected to water seal. The lung was then reinflated by the anesthetist. The chest tube was removed 24 hours postoperatively after a chest X-ray control.



*Fig 1. Thoracoscopic view during left splanchnicectomy showing the greater (GS) and lesser (LS) splanchnic nerves identified through the parietal pleura. A, Aorta; IC, intercostal vessels; L, lung.*

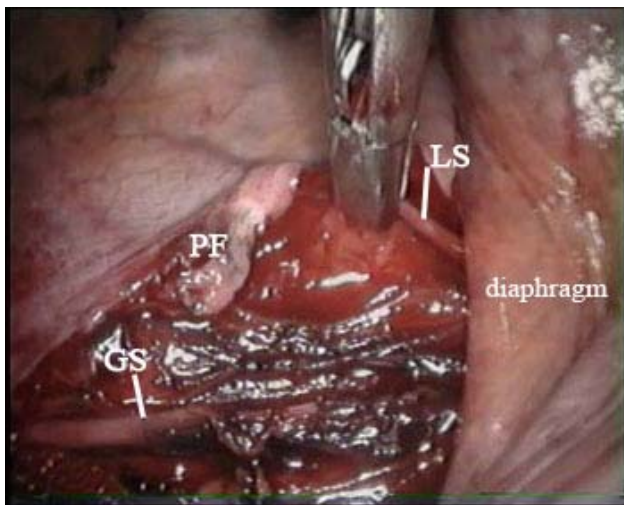


Fig 2. The same patient in figure 1 after dissection and elevation of the pleural flap (PF). GS, greater splanchnic nerve; LS, lesser splanchnic nerve.

## RESULTS

Fourteen thoracoscopic splanchnicectomies were successfully completed in 12 patients, while the procedure failed in one patient because of dense pleural adhesions that made the splanchnic nerves impossible to reach and section. There were 10 left- and 4 right-sided splanchnicectomies. Two patients required a contralateral procedure for pain recurrence after a left-sided splanchnicectomy. The mean duration of the procedure was  $31 \pm 12$  minutes. No death or complication occurred during thoracoscopic splanchnicectomy. No orthostatic change of blood pressure was observed after the procedure. There were no postoperative complications, aside from temporary intercostal neuralgia in 2 patients and transient pleural effusion in one patient, which required keeping the chest tube till the sixth postoperative day. The mean postoperative stay was  $2.6 \pm 1.2$  days (range, 2-6). All patients were available for follow-up. At the time of this report, follow-up was completed until death for 11 patients. Mean postoperative survival in this group was  $3.7 \pm 2.5$  months (range, 1.5-9). Two patients are still alive, and their postoperative follow-up durations are 5 and 12 months respectively.

Immediate pain relief was achieved in all 12 patients after unilateral thoracoscopic splanchnicectomy. The mean value of pain intensity reported by the patients on the VAS scale decreased from  $8.08 \pm 1$  (range, 7-10) before operation to  $0.58 \pm 0.79$  and  $1.08 \pm 0.8$ , 1 day and 1 month after operation respectively. Both were significant at the level of  $p < 0.001$ . Pain relief persisted in 8 patients till death (mean duration =  $2.8 \pm 0.9$  months) and in one alive patients till latest available postoperative follow-up at 5 months. In 2

patients, initial pain relief after left thoracoscopic splanchnicectomy was followed after 2 months in one patient and 3 months in the second by contralateral procedure, with almost complete relief of pain till death (9 months) in one patient and at 12 months follow-up in the second patient. One patient had recurrent pain on the right side 2 months after left thoracoscopic splanchnicectomy and refused contralateral intervention till death 8 months after surgery.

All patients required narcotics preoperatively to control their pain. After thoracoscopic splanchnicectomy, analgesic requirements at the latest available follow-up visit were nothing in 8 patients (66.7%), non steroidal anti-inflammatory drugs (NSAID) in 3 patients (25%), and narcotic analgesics in one patient (8.3%).

## DISCUSSION

Disabling pain for many patients with unresectable pancreatic cancer is poorly managed and can remain a significant problem until their deaths. The sympathetic pancreatic innervation constitutes the main pathway for the afferent transmission of pancreatic pain. Anatomical interruption of this sympathetic innervation can be achieved at the level of the celiac plexus or at the level of the splanchnic nerves. Interruption at the celiac plexus may be performed by precise percutaneous injection of alcohol or phenol. However, it is associated with a rather high complication rate due to the proximity of neural and vascular structures.<sup>(7-9)</sup> In addition, it has a brief response and unpredictable effect. In 1942, Mallet-Guy<sup>(12)</sup> performed the first left splanchnicectomy by laparotomy to alleviate intractable pancreatic pain due to chronic pancreatitis. In 1990, Stone and Chauvin<sup>(4)</sup> first reported the clinical results of splanchnicectomy by thoracotomy. In 1993, Melki et al.<sup>(13)</sup> and Worsey et al.<sup>(10)</sup> described the use of video thoracoscopy to perform a left splanchnicectomy in patients with intractable abdominal pain due to advanced pancreatic cancer as an efficient alternative to the chemical blocks and to the more invasive open approaches.

Recently, thoracoscopic splanchnicectomy for pancreatic pain relief has been reported by many authors with diversity of the technique. The technique originally described by Worsey et al.<sup>(10)</sup> entailed identification and division of all the roots of the splanchnic nerves, from T5 through T11. In the present study, we found dividing only the main trunk of the greater and lesser splanchnic nerves, as proposed by Pietrabissa et al.<sup>(14)</sup>, an easier and faster procedure with the same good results as opposed to denervation of selective roots.

There is still no general consensus on whether thoracoscopic splanchnicectomy should be performed on the left or right side or bilaterally. Some authors recommend that thoracoscopic splanchnicectomy be

routinely performed bilaterally to obviate the need for a second procedure if pain recurs. Consistent good results with bilateral thoracoscopic splanchnicectomy have been reported.<sup>(11,15-17)</sup> Cuschieri et al.<sup>(16)</sup> described a thoracoscopic splanchnicectomy through a posterior approach with the patient in the prone position. This approach has the theoretical advantage of obviating the need for selective ventilation and allowing a bilateral procedure at the same sitting. However, after bilateral splanchnicectomy, some side effects, such as transient orthostatic hypotension or diarrhea, may be observed.<sup>(11,18)</sup> In addition, splanchnicectomy is usually performed in patients with advanced pancreatic cancer. Life expectations in these patients are very short; most of them die shortly after the procedure before they need a second procedure if any pain recurs. Good results with unilateral left thoracoscopic splanchnicectomy for pancreatic pain relief have also been reported.<sup>(10,11,19,20)</sup> The mechanism by which unilateral splanchnicectomy performed on the left side relieves pain in pancreatic cancer remains poorly explained. Choosing the left side for a unilateral splanchnicectomy has been based on the experimental study reported by White et al.<sup>(21)</sup> that only left-sided stimulation of the splanchnic nerves produced pancreatic inflammation, whereas right-sided stimulation had no effect. This concept has been challenged by the observation of Barthes et al.<sup>(11)</sup> that equally satisfactory results was achieved in a patient when the procedure was not feasible on the left side due to previous pleurectomy and was conducted on the right side. They also reported that in patients in whom left thoracoscopic splanchnicectomy failed to provide pain relief, an adjunctive procedure on the right side proved consistently to be effective. Also, stimulation of the central cut ends of the splanchnic nerves above the diaphragm results in pain felt on the same side as the stimulation.<sup>(22)</sup>

In the present study, a unilateral procedure was initially performed. The side was chosen according to the site of pain. For mid or left abdominal pain, we performed a left-sided splanchnicectomy; for predominant right abdominal pain we performed a right-sided splanchnicectomy. When the pain was equally severe on both sides, a left-sided thoracoscopic splanchnicectomy was performed first. The unilateral operation was always successful in providing immediate relief of pain in our patients. However, repeating the procedure on the contralateral side was required in 25% of patients because of pain recurrence.

In conclusion, thoracoscopic splanchnicectomy is a safe, simple, and effective minimally invasive procedure. It offers a substantial relief of pain in patients with unresectable pancreatic cancer. While a unilateral procedure is enough for the majority of patients, some patients may require repeating the procedure on the contra-lateral side if pain recurs.

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