Thoracoscopic Splanchnicectomy for Pain Relief in Unresectable Pancreatic Cancer

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**Hypothesis:** Unilateral truncal thoracoscopic splanchnicectomy (TS) provides safe and effective treatment for pain relief in patients with unresectable pancreatic cancer.

**Design:** Before-and-after trial of 24 patients undergoing 25 TS procedures.

**Setting:** Surgical unit at a university teaching hospital.

**Patients:** A consecutive sample of 24 patients with severe pain due to unresectable (primary or recurrent) pancreatic cancer refractory to drug therapy and with a life expectancy of less than 6 months.

**Intervention:** The key point of the reported operation is intrathoracic carbon dioxide insufflation, which allows a more distal division of the greater splanchnic nerve and a 2-port technique.

**Main Outcome Measures:** Pain and the effect of this symptom on quality of life were assessed before and after TS using a 10-point visual analog pain scale (VAS) and the Nottingham Health Profile questionnaire, respectively.

**Results:** Four TS procedures were technical failures because of pleural adhesions. One patient required a contralateral procedure 12 weeks after TS. Mean (± SD) preoperative VAS basal score was 7.4 ± 1.7. Twenty-four hours after TS, it was reduced to 0.6 ± 1.0. Significant reduction of VAS scores persisted over the first 3 months after TS (P<.001). Recurrence of pain of low intensity (mean VAS basal score, 4.2) was observed in 8 patients. Significant improvement (P<.001) in each area covered by the Nottingham Health Profile questionnaire was reported at 1 month after TS.

**Conclusion:** Thoracoscopic splanchnicectomy offered substantial short-term relief of pain in patients with unresectable pancreatic cancer, and significantly ameliorated the quality of their residual life.

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**Severe Pain** is the single most distressing and debilitating feature of pancreatic cancer. Most patients have pain at some time during the course of their disease, and failure to control this symptom often results in major behavioral changes or depression. Pain score tests and quantitative assessment of health-related quality of life provide a measure of the individual and social impact of this chronic condition. In patients with unresectable pancreatic cancer, initial relief of pain usually is attempted through the use of long-acting analgesics in appropriate doses.1 Afterwards, several treatment modalities may be considered to manage pain that fails to respond to oral medications, which involve the chemical block of the celiac ganglion or the surgical interruption of fibers of the splanchnic nerves. Assessment of results and effectiveness of the neurolytic celiac plexus block have been controversial, and serious complications have occasionally been reported.2-4 However, reluctance to suggest the more precise but highly invasive open splanchnicectomy has made the percutaneous approach the most widely adopted procedure in patients with pain refractory to oral medications.

Thoracoscopic splanchnicectomy (TS), which obviates the morbidity of thoracotomy and of the laparotomic transhiatal approach to the splanchnic nerves, has recently been proposed by a number of authors as an attractive alternative in the management of upper abdominal pain syndromes secondary to chronic pancreatitis or supramesocolic malignant neoplasms, including unresectable pancreatic cancer.5-7 This procedure 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. However, inclusion of patients with benign disease in the reported series of TS, an as-yet-unstandardized surgical technique, and the inconstant use of reliable outcome measures make establishing efficacy and the

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PATIENTS AND METHODS

PATIENTS

From September 1, 1997, through April 30, 1999, 24 patients (14 men and 10 women) with a mean age of 65 years (range, 52–77 years) underwent 25 attempted TS procedures. Indications included primary unresectable pancreatic cancer or recurrent disease in patients with severe pain who failed to benefit from drug therapy and with a life expectancy of less than 6 months. In 18 patients with primary pancreatic cancer, unresectability was documented by radiological evidence of hepatic metastases in 9, massive tumor encasement of the superior mesenteric vessels or portal vein in 5, and laparoscopic disclosure of peritoneal tumor deposits in 4. The primary pancreatic tumor was always located in the head of the gland. Six other patients previously had undergone pancreatic head resection and presented with radiologically documented local (preaortic) recurrence of the disease, which was associated with hepatic or systemic metastases in 4 patients. All patients had severe upper abdominal pain radiating to the back. The mean (± SD) duration of pain before splanchnicectomy was 9 ± 4 weeks. Eighteen patients required narcotics administration, whereas the remaining 6 were taking nonopioid analgesics.

OPERATIVE TECHNIQUE

Right-sided splanchnicectomy was performed for rightsided pain, whereas centralized, bilateral, and left-sided pain were managed by left splanchnicectomy. Under general anesthesia, with conventional endotracheal double-lung ventilation, the patient was placed in the flank thoracotomy position. Partial pulmonary collapse and downward displacement of the diaphragm were induced by carbon dioxide (CO₂) insufflation delivered via a Veress needle and maintained at 8 mm Hg throughout the procedure. A 10-mm port for the 30° telescope was placed in the sixth intercostal space along the midaxillary line. Two operative 5-mm ports subsequently were inserted under visual control, one in the eighth intercostal space at the posterior axillary line and another in the seventh intercostal space at the anterior axillary line. A 3-cm horizontal incision was made on the pleura along the costophrenic reflection, just lateral to the descending aorta as it leaves the thorax on the left side and lateral to the aygous vein on the right side. The main trunk of the greater splanchnic nerve was isolated using blunt dissection as distally as possible and sectioned between hemoclips (Figure 1). Also, the lesser nerve had been looked for and, if identified, transected. The lung was then completely reinflated under visual control, and no chest tube was left in place.

In the last 4 patients, a 2-port technique was used successfully with a 3-mm 0° telescope in the sixth space and another 5-mm operative trocar in the eighth space to further minimize the invasiveness of the procedure.

Patients were mobilized on the same operative day, begun on a free diet the following morning, and allowed to leave the hospital on the third postoperative day, provided pain control was adequate.

OUTCOME MEASURES

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 current pain (VAS basal) and that of the worst pain experienced within the last 24 hours (VAS peak). The effect of TS on pain control was assessed by collecting VAS scores on the first postoperative day, weekly for the first month, and monthly thereafter. Postoperative pain medication requirement was monitored on a monthly basis.

Overall disability due to pain and perceived health were estimated by means of part I of the Nottingham Health Profile (NHP) questionnaire. The NHP consists of 38 items covering 6 areas assessing energy, sleep, pain, physical mobility, emotional reaction, and social isolation. The NHP is well documented with regard to reliability and validity and has been found to be a useful guide to the extent that health problems restrict normal physical and social activities. The higher the score on a section, the greater the perceived health problems were in that area. Patients were invited to complete preoperative and follow-up NHP questionnaires at 1-month intervals after TS, until death.

Treatment satisfaction was estimated by periodically asking the patient to score the efficacy of TS in achieving pain relief, using a 5-step scale system (ie, excellent, good, sufficient, poor, and very poor).

Duration of the procedure, occurrence of complications, and length of hospital stay were recorded. Paired data for individual patient pain and quality of life scores were compared over time using a Friedman 2-way analysis of variance.

RESULTS

Procedures in 4 patients were classified as technical failures because of dense and diffuse pleural adhesions that made the splanchnic nerves impossible to reach and section. In all 20 other patients, the main trunk of the greater splanchnic nerve was identified and transected, whereas the lesser nerve was seen and divided in only 5 instances. There were 15 left- and 6 right-sided splanchnicectomies. One patient required a contralateral proce-
PAIN SCORES

Mean VAS scores are shown for the 20 patients undergoing TS at the preoperative and postoperative assessments up to 3 months after the procedure (Figure 2). Paired analysis comparing preoperative pain assessment with each postoperative assessment score demonstrated a significant reduction in pain scores that persisted for the first 3 months after TS (P<.001). Twenty-four hours after TS, relief from severe abdominal and back pain was complete in all patients. Before operation, the mean (± SD) VAS basal score was 7.4 ± 1.7; mean (± SD) VAS peak score, 9.3 ± 0.9. After operation these scores decreased to 0.6 ± 1.0 and 1.1 ± 1.5, respectively (P<.001). The slope in the pain curves of Figure 2, which suggests a time-dependant increase of mean scores, results partly from the early recurrence of pain within the first month after TS in 4 patients undergoing TS for recurrent pancreatic cancer, and partly from the resurgence of this symptom in 4 other patients with primary pancreatic cancer during their last 2 weeks of life. In both circumstances, the intensity of pain was moderate (mean VAS peak score, 4.2), and the symptom was localized to the abdominal quadrants, without radiating to the back. Eight patients with primary cancer who were completely relieved from pain by TS had no pain recurrence before death. The only patient who required a contralateral TS died 6 months after the second procedure, free of pain.

USE OF ANALGESICS

Fourteen of 15 patients who were using narcotics before a successful TS no longer used them at 1 and 3 months postoperatively. The patient who continued to use narcotics had reduced his intake by 50%. Occasional, discontinuous use of nonopioid analgesics was reported by 4 (24%) of 17 patients surviving at 1 month.

QUALITY OF LIFE ASSESSMENT

Mean NHP scores measured at monthly intervals are depicted in Figure 3. Paired assessment of health-related quality of life measures showed a significant improvement in each area at 1 month after TS (P<.001). An increase in NHP scores was observed for pain, emotional reaction, and energy at 3 months after TS.

TREATMENT SATISFACTION

Seven days after the procedure, 12 patients (60%) rated the efficacy of TS in achieving pain relief as excellent and 8 (40%) as good. Treatment satisfaction remained high (Table) at 1 and 3 months, although the proportion of patients rating the treatment as excellent become progressively smaller as the number of survivors decreased from 20 to 11.

COMMENT

Disabling pain for many patients with unresectable pancreatic cancer is poorly managed and can remain a significant problem until their deaths. Results and effectiveness of percutaneous celiac plexus block have been controversial, and addiction to opiates often becomes the most prominent feature of these patients. Video-assisted TS has emerged as an efficient alternative to the chemical blocks and to the more invasive open approaches. Although a technique of TS was reported 30 years ago,10 still there is no consensus on how
procedure using CO2 insufflation, we found no need for maintenance of a positive endopleural pressure during the procedure. Using CO2 insufflation, we found no need for maintenance of a positive endopleural pressure during the procedure. Moreover, dividing only the main trunk of the greater splanchnic nerve will result in an easier and faster procedure than 30 minutes. It results in significant reduction of pain and consequent improvement of quality of life in patients with unresectable pancreatic cancer. Perhaps this technique should be indicated earlier in the course of pancreatic cancer, before the onset of drug-seeking behavior rather than as a salvage procedure in patients already refractory to narcotic treatment. Because technical failures can be anticipated in patients with diffuse pleural adhesions, and because the likelihood of complete pain relief decreases the longer the patient with unresectable cancer survives, a combination of analgesic therapies will still be needed in some patients. Therefore, TS should be provided within a broader model of palliative care.

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and when this procedure should be performed. A TS through a posterior approach with the patient in the prone position has been described, which has the theoretical advantage of obviating the need for selective ventilation and allowing a bilateral procedure at the same sitting.11,12 This technique entails identification and division of all the roots of the splanchnic nerves, from T5 through T12. Although a bilateral procedure might be required in some cases, the unilateral operation, as described by Maher et al.,13 was almost always successful in providing immediate relief of pain in our patients. Moreover, dividing only the main trunk of the greater splanchnic nerve will result in an easier and faster procedure as opposed to denervation of selective roots. Despite the lateral decubitus position that we have adopted, with the maintenance of a positive endopleural pressure during the procedure using CO2 insufflation, we found no need for selective double-lung ventilation to create the working space.

The use of CO2 insufflation, which is peculiar to our technique, allowed the performance of a 2-trocar technique in the last 4 patients, since the partial lung collapse that is induced can obviate the need for a third trocar placement; this was used mainly in the initial cases for lung retraction. The low intrapleural pressure of 8 mm Hg was well tolerated by our patients and allowed a more distal division of the greater splanchnic nerve by pushing the diaphragm further downward, below the merging of the last splanchnic root to form the main trunk of this nerve (Figure 1).

The partial loss of efficacy in the final stages of pancreatic cancer, as well as the observed drop-off in benefit within 4 weeks after TS in some patients with recurrent disease, could be attributed to tumor spread beyond the fibers that conduct pain through the splanchnic nerves.2 Involvement of peritoneum by cancer seeding implies concomitant abdominal pain of somatic origin in these patients.

The NHP questionnaire was used in our patients to measure perceived health problems secondary to chronic pain before and after TS. The high preoperative scores in each of the 5 areas considered by this test, which encompass social, psychological, behavioral, and physical functioning, reflected the relevant number of problems experienced by patients with severe pain. At 1 month after TS, NHP scores were significantly reduced, approximating the estimated scores of a healthy population (Figure 3). The NHP was confirmed to be a sensitive marker to changes in perceived health concomitant with sudden relief from severe pain.

Our data indicate that unilateral truncal TS is safe and effective. The use of CO2 insufflation makes TS a simple procedure that usually can be performed in less than 30 minutes. It results in significant reduction of pain and consequent improvement of quality of life in patients with unresectable pancreatic cancer. Perhaps this technique should be indicated earlier in the course of pancreatic cancer, before the onset of drug-seeking behavior rather than as a salvage procedure in patients already refractory to narcotic treatment. Because technical failures can be anticipated in patients with diffuse pleural adhesions, and because the likelihood of complete pain relief decreases the longer the patient with unresectable cancer survives, a combination of analgesic therapies will still be needed in some patients. Therefore, TS should be provided within a broader model of palliative care.

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![Figure 3. Quality of life assessment using mean scores on part I of the Nottingham Health Profile (NHP) for each area at preoperative and 1- and 3-month postoperative assessments. Graphics for each area have been normalized to healthy population (mean score, 10) for reference purposes.](image-url)