

## Adhesion reformation after reproductive surgery by videolaseroscopy

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After initial videolaseroscopy for the treatment of endometriosis-associated infertility, 157 patients underwent a second-look laparoscopy to evaluate and treat recurrence of disease and/or adhesions. The patients were divided into two groups. Group 1 consisted of 135 patients who underwent second-look laparoscopy for persistent infertility and/or recurrence of pain. Group 2 consisted of 22 patients who achieved pregnancy after initial surgery and underwent second-look laparoscopy for evaluation of ectopic pregnancy or in association with uterine evacuation for first trimester spontaneous abortion. Both groups of patients demonstrated a significant reduction in adhesion scores involving the ovaries, tubes, posterior cul-de-sac, anterior cul-de-sac, and omentum/bowel. Although the initial mean adhesion scores were similar for both groups, at second-look laparoscopy the mean adhesion scores were significantly lower for group 2, particularly for ovarian and tubal adhesions. None of the patients formed de novo adhesions. From these results we may conclude that videolaseroscopy: (1) is effective in reducing peritoneal adhesions; (2) is associated with a low frequency of postoperative adhesion recurrence; and (3) appears to completely avoid de novo adhesion formation. *Fertil Steril* 53:1008, 1990

In addition to the severity of the pre-existing disease, postoperative adhesion formation is the most important determinant of the success of infertility surgery and is largely responsible for the majority of failures associated with these procedures.<sup>1-3</sup> An inverse relationship exists between the grade of adhesions and pregnancy rates, regardless of the condition of the adnexa.<sup>3</sup> Microsurgery, which was developed in the hope of preventing postoperative adhesion formation, has yielded improved results for midtubal and cornual occlusions over conventional

surgery, but its potential to enhance fertility in distal tubal obstruction has not been realized.<sup>4-6</sup>

Recurrence of periadnexal adhesions has been reported to occur in the majority of patients after reproductive microsurgery or laser surgery by laparotomy.<sup>7-10</sup> The clinical impression that postoperative adhesion formation is uncommon after operative laparoscopic surgery has been tested in laboratory animals<sup>11,12</sup> but not in clinical studies. The purpose of this study was to determine the efficacy of videolaseroscopy in reducing peritoneal adhesions and in preventing postoperative adhesion recurrence and de novo formation.

### MATERIALS AND METHODS

This study included 157 patients treated for endometriosis-associated infertility by the same surgeon (C.R.N.) using videolaseroscopy. The patients were divided into two groups. Group 1 con-

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**Table 1** Adhesive Scores at Initial and at Second-Look Videolaseroscopy at Each of the Studied Sites in the 135 Patients Comprising Group 1\*

	Ovaries	Tubes	Posterior cul-de-sac	Anterior cul-de-sac	Omentum/bowel	De novo
No. of patients	181	102	68	48	50	—
Initial laparoscopy	2.3 ± 0.05	2.5 ± 0.07	1.7 ± 0.1	2.1 ± 0.1	2.02 ± 0.1	—
Second laparoscopy	0.9 ± 0.09	0.6 ± 0.1	0.7 ± 0.1	0.8 ± 0.16	0.9 ± 0.2	0
P value	<0.001	<0.001	<0.001	<0.001	<0.001	—

\* Values are means ± SEM.

sisted of 135 patients who underwent a second-look laparoscopy 9 to 18 months after the initial surgery because of persistent infertility and/or recurrence of pain. Group 2 consisted of 22 patients who achieved pregnancy 4 to 6 months after their initial procedure and had a second-look laparoscopy for either ectopic pregnancy (n = 6) or electively at the time of dilatation and curettage for first trimester spontaneous abortion (n = 16).

At the initial surgery, all intraperitoneal adhesions and endometriosis implants were treated via videolaseroscopy. This surgical technique, which has been developed over the course of many years of experience by the first author,<sup>13,14</sup> uses the CO<sub>2</sub> laser as a tool for dissection, excision, and ablation. A camera attached to the laparoscope allows visualization of intra-abdominal manipulation by way of a television monitor. Magnification is produced by both the laparoscope and the video monitor. Hemostasis is accomplished with either a low power, defocused laser beam or bipolar electrocautery. No sutures or medical adjuvants were used during the course of this study and all cases were video recorded, with particular documentation of the pelvic findings initially and at the end of each surgical procedure.

The intraperitoneal adhesions were graded 0 to 3 by the same investigator (C.R.N.) according to the standardized scoring system which has been previously described.<sup>12</sup> A score of 0 indicated no adhesions; 1, thin and avascular adhesions; 2, thick and avascular; 3, thick and vascular. The sites assessed included ovaries, tubes, omentum/bowel, anterior and posterior cul-de-sac, and other sites in the case of incidental or de novo adhesion development. Adhesion reformation was defined as the recurrence of adhesions at the same sites at which adhesions were originally present or at any of the sites that were involved in the operative procedure, i.e., periovarian adhesion development after resection of ovarian cysts from an otherwise normal ovary. De novo adhesions were defined as the occurrence of new adhesions involving structures

that not only had been free of adhesions, but were also not involved in the operative process at the initial surgical procedure, i.e., surfaces that were not touched by the laser or other surgical instruments. Therefore, in this study we determined the extent of intraperitoneal adhesion formation and reformation after videolaseroscopy in a population of patients who had failed the initial corrective procedure (group 1), and in a second group of patients whose initial surgical procedure had been successful in achieving a pregnancy (group 2). The data were analyzed by the Wilcoxon signed test.

## RESULTS

At the time of initial surgery, all patients had intraperitoneal adhesions at one or more of the sites studied and each site was assigned a specific adhesion score according to the classification above. At second-look laparoscopy, adhesions were found to be reduced by 60% to 79% at all sites without the formation of new adhesions. Therefore, the initial videolaseroscopy was associated with significant adhesion reduction. Moreover, no patient developed de novo adhesions at any site. A significant reduction in the mean postoperative adhesion scores at each of the study sites was observed in both groups of patients, as shown in Tables 1 and 2. Although the mean adhesion scores at the time of the initial surgery were similar between the two groups of patients, the adhesion scores (mean ± SEM) at second-look laparoscopy were significantly lower for the ovarian adhesions ( $P = 0.02$ ) and for the tubal adhesions ( $P < 0.01$ ) in the second group of patients who had conceived between the first and second operative procedure. Figure 1, which illustrates the distribution and the degree of peritoneal adhesions in patients with endometriosis before and after the initial surgical procedure, reveals a significant reduction in both the severity and the percentage of patients with intraperitoneal adhesions after operative laparoscopy for all sites.

**Table 2** Intraperitoneal Adhesion Scores at Initial and Second Videolaseroscopy at Each of the Studies Sites in the 22 Patients Comprising Group 2<sup>a</sup>

	Ovary	Tubes	Posterior cul-de-sac	De novo
No. of patients	32	16	9	—
Initial laparoscopy	2.3 ± 0.14	1.9 ± 0.25	1.7 ± 0.26	—
Second laparoscopy	0.25 ± 0.1	0.5 ± 0.25	0.22 ± 0.23	0
P value	<0.001	<0.001	<0.001	

<sup>a</sup> Values are means ± SEM.

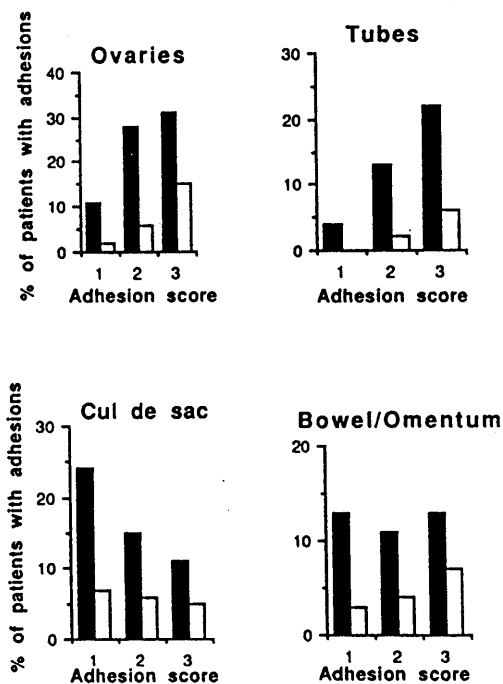
## DISCUSSION

During the past decade, we have witnessed the emergence of operative endoscopy and laser surgery with the hope of achieving improved results. Although they are both versatile and useful, lasers in general practice do not seem to have significant advantage over the more traditional microsurgical or electrosurgical tools.<sup>15</sup> However, more promising appears to be the discipline of endoscopic surgery,<sup>16,17</sup> which fulfills the important microsurgical principles of gentle handling of tissue, constant irrigation, meticulous hemostasis, and precise tissue dissection without the need for laparotomy, which is in itself a significant invasion of the peritoneal cavity.

In a previous publication, we reported that the overall pregnancy rate after videolaseroscopy for

the treatment of endometriosis-associated infertility was 69.1%, similar to those reported after laparotomy for mild and moderate disease.<sup>17</sup> However, for the more severe and extensive stages of disease, operative laparoscopic surgery has been associated with better pregnancy rates and higher fecundity rates than those reported after laparotomy.<sup>16,17</sup> The results from this study suggest that effective adhesiolysis coupled with a low rate of adhesion recurrence may account for the improved pregnancy rates obtained when more advanced disease is treated by laparoscopy. This conclusion is further supported by our findings that women who fail to conceive within a short time after surgery (group 1) tend to have a higher rate of adhesion recurrence.

When performed by laparotomy, reproductive pelvic surgery procedures are frequently complicated not only by adhesion reformation but also by de novo adhesion formation.<sup>8-10</sup> After microsurgical salpingoplasty, Trimbos-Kemper et al.<sup>8</sup> found that adhesions were present in >50% of cases when evaluated on the 8th postoperative day. Similarly, using microlaser technics during laparotomy, recurrence of adnexal adhesions occurred in 40% to 72% of patients,<sup>9,10</sup> and de novo adhesions developed in at least one new location in 51% of patients.<sup>10</sup> Our results from comparable surgical procedures performed by laparoscopy suggest that the recurrence of intraperitoneal adhesions may be lower than those reported by laparotomy, especially in the group of patients who conceived after the initial surgical procedure (group 2) in whom the recurrence of pelvic adhesions was only 9%. Most impressive was the complete absence of de novo or incidental adhesions with laparoscopic intervention compared with what has been reported after laparotomy.<sup>10</sup> Similar results were obtained from a comparative animal study of postoperative adhesions after laser surgery by laparoscopy versus laparotomy, where not only was postoperative adhesion formation greater for the laparotomy group, but de novo adhesion formation occurred exclusively after laparotomy, not laparoscopy.<sup>12</sup>



**Figure 1** Percentage of patients with the indicated adhesion score at each of the studied sites at the initial (dark bars) and second (white bars) videolaseroscopy.

Although this is not a prospective study, the adhesions were assessed and scored at the same sitting, by the same observer, from videotapes of the initial and second-look surgical procedures. Therefore, although the scorer's potential bias was not eliminated, the interobserver variability and the inaccuracy of retrospective data collection were avoided. To our knowledge, this is the only clinical study that has evaluated postoperative adhesion formation and reduction after operative laparoscopy. Although we cannot compare our results directly with those obtained by laparotomy, from our data we may conclude that videolaseroscopy: (1) is very effective in reducing peritoneal adhesions; (2) is associated with a low frequency of postoperative adhesion recurrence; and (3) appears to completely avoid the formation of de novo adhesions. These findings confirm the clinical impression that postoperative adhesion formation is uncommon after operative laparoscopic surgery,<sup>11</sup> and justify our belief that in experienced hands, operative laparoscopy should be preferred over the more traditional laparotomy approach in the treatment of most benign gynecological surgical conditions.

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## GYNAECOLOGY

# A simplified method of laparoscopic presacral neurectomy for the treatment of central pelvic pain due to endometriosis

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### ABSTRACT

**Objective** To describe optimal procedures and preliminary results for videolaparoscopic presacral neurectomy as part of the surgical treatment of endometriosis associated with intractable dysmenorrhoea.

**Design** Observational study with follow up for at least one year.

**Setting** Subspecialty practice: Endometriosis Clinic and Centre for Special Pelvic Surgery.

**Subjects** Eighty five women (18-45 years) with endometriosis and intractable pain, referred because medical and surgical management had failed. Subjects without a central (midline) component to their discomfort were excluded.

**Interventions** Excision and vaporization of endometriotic pathology was followed by presacral neurectomy.

**Outcome measures** During surgery, severity of endometriosis was assessed using revised American Fertility Society scoring. Overall pelvic pain and dysmenorrhoea relief were determined by office visit, telephone interview and questionnaire at a minimum of one year postoperatively.

**Results** There were no operative complications and all women left hospital within 24 h of surgery. Overall pain relief was reported by 49 (94%) of 52 patients followed. The other three subjects noted no pain abatement. Dysmenorrhoea was reduced in 48 (92%) whereas four (8%) women claimed no relief.

**Conclusions** Laparoscopic presacral neurectomy is an option for treating dysmenorrhoea and pelvic pain in selected women, but is indicated only if medical management has failed. Videolaparoscopic presacral neurectomy using the CO<sub>2</sub> laser is safe in trained hands. Pain relief achieved is within the range reported for laparotomy.

Though surgical interruption of pelvic autonomic afferent nerves to combat serious dysmenorrhoea was independently described by Jaboulay (1899) and Ruggi (1899), a variety of more apt procedures, well reviewed by Fontaine & Herrmann (1932), subsequently evolved. Among them was ablation of the superior hypogastric plexus by Cotte (1925) to ameliorate pelvic pain. While controversy that has been evident from the beginning concerning case selection, variability in the anatomy (Elaut 1933; Davis 1936; Labate 1938) and results achieved remains unresolved (Black 1964; Tjaden *et al.* 1990; Vercellini *et al.* 1991), we deemed it appropriate to study the effects of presacral denervation in women with endometriosis and severe uterine pain, referred because medical and surgical management had proven inadequate. Accordingly, we have devised procedures using the CO<sub>2</sub> laser, hydrodissection and videolaparoscopy to treat endometriosis and a variety of other pelvic pathologies (Nezhat *et al.* 1991; Nezhat & Nezhat 1989, 1991). Our purpose here is twofold: firstly, to describe the lapa-

roscopic methods employed in 85 women thus far and, secondly to summarize early results in the 52 patients treated since the project was initiated in September, 1989.

### Subjects and methods

The 85 subjects included in the study were between 18 and 45 years of age and had been referred with endometriosis and severe pelvic pain unresponsive to medical and surgical treatment. All had severe dysmenorrhoea and some also had adnexal or other discomfort. Those without prominent menstrual pain were excluded.

Preoperative and immediate postoperative routines were those for videolaparoscopic gynaecological surgery (Nezhat & Nezhat 1989, 1991). Prophylactic antibiotics and general endotracheal anaesthesia were used and the presacral neurectomies followed any surgical intervention necessary to treat pelvic disease. For research and record purposes, all procedures were video and audio taped. Fifty-two of the patients have been followed for a minimum of 12 months through office

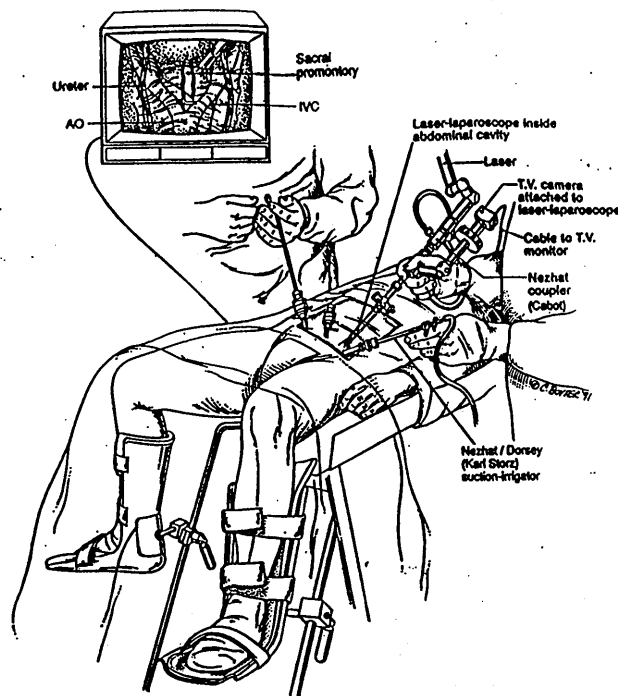


Fig. 1. Room set-up.

visits, telephone interviews and a questionnaire. There were two pain relief assessments: one for 'overall' pain relief; the other specifically and *only* for dysmenorrhoea.

#### Videolaparoscopic presacral neurectomy

After establishing a pneumoperitoneum, an operating laser laparoscope (Karl Storz) was inserted through a 10 mm trocar (Ethicon, Somerville, NJ) placed through an umbilical incision. A 5.5 mm second puncture trocar (Ethicon) was placed in the midline approximately 4 cm above the symphysis pubis. Through this, a suction irrigator (American Surgical Instruments, Delray Beach, Florida) was introduced to remove smoke and char created by the laser and to serve as a backstop for the CO<sub>2</sub> laser beam. A third, and if necessary a fourth trocar were inserted 7.5 cm lateral to the suprapubic midline trocar to introduce grasping forceps, bipolar electrocoagulator or other necessary instruments (Fig. 1). The CO<sub>2</sub> laser, delivering its beam through the operating channel of the laparoscope (Coherent, Palo Alto, CA or Lasersonics, Milpitas, CA) via a direct lens was used at a power setting of 30–100 W in super-pulse or ultrapulse mode for excision, ablation and hemostasis.

Steep Trendelenburg position was employed to keep the bowel away from the operating field. Following identification of the aortic bifurcation, the common iliac arteries and veins, the ureters and the sacral promontory, the peritoneum overlying the promontory was elevated with grasping forceps and a small opening made with the CO<sub>2</sub> laser (Fig. 2). Through this the suction irrigator was inserted and the peritoneum elevated by hydrodissection (Nezhath & Nezhath 1989). The peritoneum was incised horizontally and vertically and the opening extended cephalad to the aortic bifurcation. Bleeding from peritoneal vessels was controlled with the CO<sub>2</sub> laser or bipolar electrocoagulator. Within the triangular area known as the

interiliac trigone, the following critical structures were identified: the left common iliac vein forming the floor of the left side of the pre-lumbar space defined; the inferior mesenteric, superior hemorrhoidal and mid sacral arteries. As noted by Elaut (1933), this trigone is defined caudally by the sacral promontory and laterally by the common iliac arteries meeting at the aortic bifurcation above. The midsacral artery lies in the midline and very near, or on the peritoneum. Centrally and to the left, multiple nerve fibres, sometimes in bundles, run from the aortic plexus above, caudally, through the interiliac trigone to form the superior hypogastric plexus. They continue inferiorly to comprise the inferior hypogastric plexus. These fibres, the so called presacral nerve, are buried in loose areolar tissue. They display no particular patterns and are variable from woman to woman (Fig. 3). Using blunt dissection and the laser, the nerve fibres were skeletonized and extraneous tissue removed. Nerve fibres, bundles and sheaths were cauterized and excised with the CO<sub>2</sub> laser (Fig. 4). It is important to remove all of the nerves between the two ureters that lie within the boundaries of the interiliac triangle, including any fibres entering the area from under the common iliac arteries (Fig. 5).

Finally, the retroperitoneal space was copiously irrigated and bleeding points controlled with the CO<sub>2</sub> laser or bipolar electrocoagulator. No sutures were used on the plexiform nerves or to approximate the edges of the peritoneum. Excised tissue was sent for histological examination to verify removal of nerve elements.

#### Results

For the 85 patients, the duration of surgery was 45–185 min including the presacral neurectomies. Time for the latter ranged from 5 to 18 min. Blood loss was minimal. No intra-operative or immediate postoperative complications were noted. Most women were discharged on the day of surgery. Some remained overnight for convenience, but all left hospital within 24 h of surgery.

Fifty two patients have been followed for at least one year. Table 1 shows estimated pain relief achieved for 31, 13, 5 and 3 patients with minimal, mild, moderate and severe endometriosis, respectively (revised American Fertility Society 1985). Also given is the age distribution for each group, ranging from a mean of 27.4 years for minimal to 35.3 years for severe

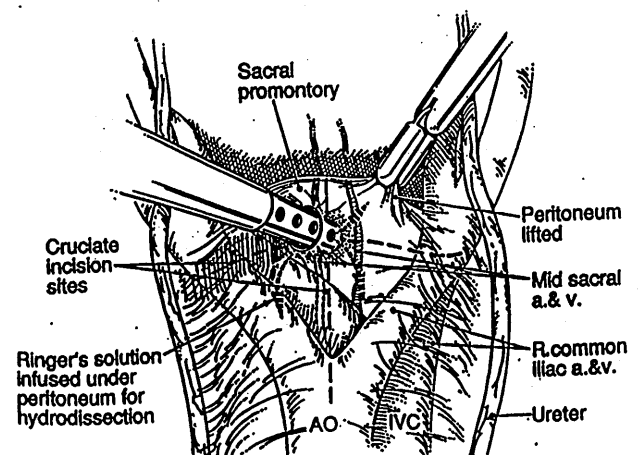


Fig. 2. Peritoneum being lifted and incision sites.

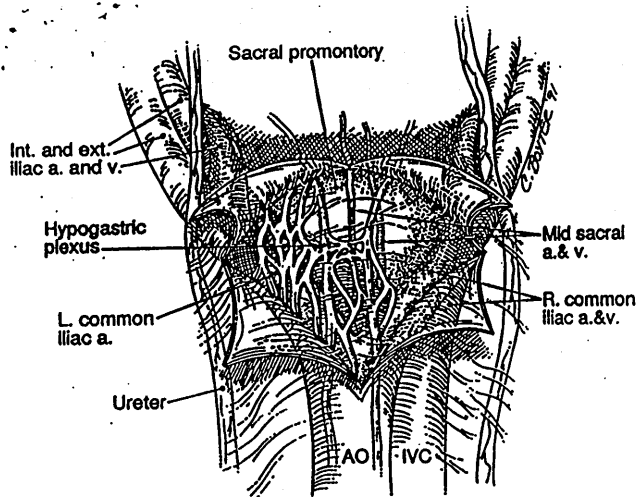


Fig. 3. Hypogastric plexus.

disease. Seven women had minor complications: constipation (3), urine urgency (1), vaginal dryness (1), 'painless' labour (2), one with very little pain and the other felt backache but no cramping pain.

Of the 31 patients with minimal endometriosis (Table 1) 16 (52%) reported 100% relief of dysmenorrhoea. Ten (32%) and 3 (10%) judged relief at 50–80% and less than 50%, respectively. Two women stated they experienced no relief at all.

Of 52 patients followed, 4 (8%) noted no relief of dysmenorrhoea, the other 48 (92%) reported some relief and 27 of these reported 100% relief of dysmenorrhoea. Of these 27 patients, 16 (67%), 6 (25%) and 3 (12%) had minimal, mild and moderate endometriosis, respectively.

Patient estimates of 'overall' relief of dysmenorrhoea and of any other pelvic pain were essentially similar to those for dysmenorrhoea. In contrast to the four women experiencing no relief of dysmenorrhoea, there were three who obtained no overall relief. Small sample constraints discourage emphasizing any other differences between overall pain relief and dysmenorrhoea relief but, taken together, one can speculate there may be a 50–50 chance for long-term, complete pain alle-

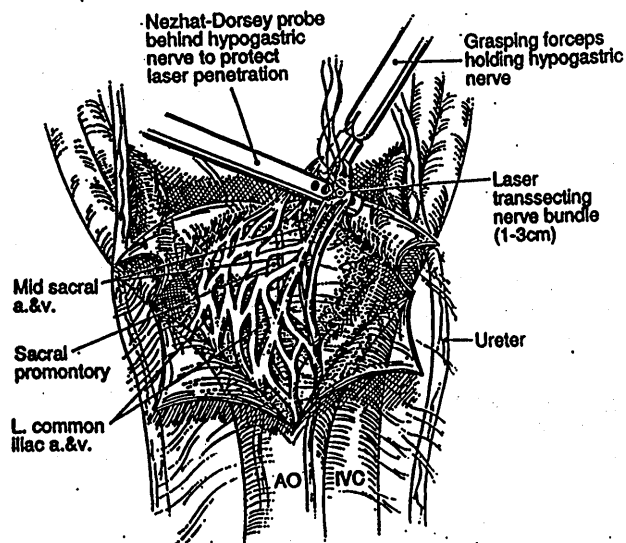


Fig. 4. Transecting nerve bundle.

viation in selected patients with endometriosis undergoing a presacral neurectomy at the same time as thorough surgical treatment of coexisting endometrial and other pelvic pathology.

## Discussion

The most favourable results reported with presacral neurectomy to treat pelvic pain described only 2% failures in 1500 selected patients (Cotte 1949). In contrast, Black (1964) reviewed 2516 patients described between 1936 and 1963 in the world literature where primary and secondary dysmenorrhoea had been treated by presacral neurectomy. Good results were noted in 70%, 19% were improved and 11% were not improved. More recently, Lee *et al.* (1986) tabulated data from 11 studies of pelvic denervation (1939–1985) involving 576 patients, including 40 of their own. The combined figures reveal a 74% success rate (range 53–89%). Partial success occurred in 14% (range 6–13) and failures in 12% (range 6–12). Thus the pain relief achieved in the present study is well within the published range. It is relevant that Perez (1990) has also described a laparoscopic approach for presacral neurectomy, though he used an umbilical laparoscope to retract the bowel. Results in 25 patients with endometriosis with dysmenorrhoea, in which adnexal pain was minimal and medical treatment unsatisfactory, were assessed using a 0–10 pain scale. The mean preoperative score was 8.4 (7–10) compared with a post-surgical figure of 2.2 (0–8). Initially, all patients had incapacitating pain keeping them from school or work, and, with one exception, each resumed and maintained near normal activity over a follow-up period of 3–12 months. The only complication noted was one example of retroperitoneal haemorrhage requiring laparotomy.

Any attempt to compare presacral neurectomy by open laparotomy with laparoscopy is premature. Suitable data are sparse and there has been no consistent and clearly defined collection of information of the results obtained thus far by laparotomy.

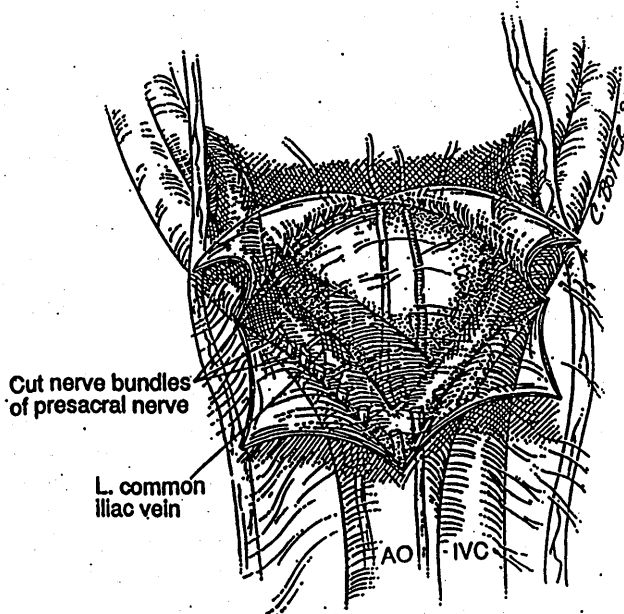


Fig. 5. Sacral promontory after neurectomy.

Table 1. Patient estimated relief of menstrual/overall pelvic pain at a minimum of one year after surgery

Stage of endometriosis*	Patients n (%)†	Age (years) mean (range)	Estimated % relief	Dysmenorrhoea relief n (%)	Overall pelvic pain relief n (%)
Minimal	31 (60)	27.4 (18-38)	100	16 (52)	17 (55)
			50-80	10 (32)	7 (22)
			<50	3 (10)	5 (16)
			0	2 (6)	2 (6)
Mild	13 (25)	33.6 (33-39)	100	6 (46)	6 (46)
			50-80	6 (46)	4 (31)
			<50	0 (—)	2 (15)
			0	1 (8)	1 (8)
Moderate	5 (10)	30.5 (22-34)	100	3 (60)	2 (40)
			50-80	2 (40)	0 (—)
			<50	0 (—)	3 (60)
			0	0 (—)	0 (—)
Severe	3 (9)	35.3 (31-45)	100	2 (67)	2 (67)
			50-80	0 (—)	0 (—)
			<50	0 (—)	1 (33)
			0	1 (33)	0 (—)

\*Revised American Fertility Society staging (American Fertility Society 1985).

†Percentages may not total 100 due to rounding.

There has been confusion over the anatomical nomenclature. The Cotte operation was not presacral, but pre-lumbar. The presacral nerve is not, except perhaps rarely, a single nerve bundle. Rather, what the surgeon obliterates is the superior hypogastric plexus. The procedure is not only a sympathetic afferent neurectomy but includes severance of afferent fibres as well, particularly those concerned with vascular control, along with other nervous elements, the functions of which are not known.

Also, the Cotte procedure was first used to combat pelvic pain of obscure aetiology because the adage: 'physiologic function depends upon anatomic structure' led gynaecologists to believe that removal of the superior hypogastric plexus was not indicated for back pain or that associated with ovarian pathology, but might be effective for dysmenorrhoea, dyspareunia and vaginal discomfort. Thus from the beginning (and even currently) pelvic denervation surgery was empirical. Cotte, who did the first 'presacral neurectomy' in December 1924, understood this very well for he wrote: 'In the absence of precise and certain physiologic data concerning the nature and origin of the presacral nerve (superior hypogastric plexus of Hovelacque) it is difficult to explain the successful results obtained by presacral sympathectomy' (Cotte 1937). Unfortunately, the statement is applicable today even though a great deal of effort, much of it inter-disciplinary, has been expended to improve understanding.

For instance Elaut (1933), Davis (1934), Labate (1938) and Curtis *et al.* (1942), among others, reported results based on 50, 60, 75 and 30 cadaver dissections, respectively. The gross findings were variable and together emphasized the case-to-case differences to be expected. One study noted that fibres of the superior hypogastric plexus were not found on the right but were present in 75% and 50% to the left and in the midline, respectively, of the interiliac triangle. Another found the plexus to be on the left or central in one or two thirds of women. In 8-15%, the mesocolon was over the triangle, mak-

ing neurectomy impossible or very difficult. A single nerve was observed in 8-13% of the early reports, reviewed by Fontaine & Herrmann (1932). Labate (1938), in an informative review of 95 dissections, noted a plexus in 84%, parallel nerve trunks in 8% and single nerves in 8%. Black (1936) described 27 presacral neurectomies and found 3 (11%) had single nerves and 23 (85%) plexiform arrangements. Davis (1933) in 20 operative cases, reported an accessory ureter lying in the midline. It is germane that Lichten & Bombard (1987), in a prospective, double blind study of the efficacy of laparoscopic uterine nerve ablation to alleviate dysmenorrhoea, noted that half the patients showed complete relief over a 12 month period. They speculated that failures were likely to be due to anatomical variations, including nociceptive afferents coursing centrally with the pelvic arteries. In fact, after reviewing the presacral neurectomy studies described by Black (1964) and the uterosacral nerve results reported by Doyle (1955) they stated that a failure rate of 30% could be expected as a result of anatomical variations between patients.

Uterine enervation remained an enigma. In his seminal review of uterine physiology, Reynolds (1965) noted 'There are no published data which show the course of the sensory nerves from the uterus to the central nervous system.' He did, however, note relief of uterine pain followed severance of the hypogastric nerves, making it probable that sympathetic afferents from the uterus were involved. It is important that Bonica (1990), contrary to prior teaching, has shown sacral afferent sensory fibres do not supply the lower uterus and cervix. Rather, segmental pain enervation of the uterine fundus, lower uterine segment and cervix involve T-10, T-11, T-12 and L-1. Uterine fibres travel centrally in order through the uterine, cervical and inferior hypogastric (pelvic) plexuses, then the middle and superior hypogastric and aortic plexuses to course upwards through the lower thoracic sympathetic chain. They reach the appropriate dorsal horn interneurons via communicating rami with the parent spinal nerve roots. These findings



were derived from a study over 22 years of 240 deliveries in 35 women, utilizing a variety of segmental, regional and local anesthesia blocks to interrupt afferent transmission pathways. These data may have a bearing upon post-neurectomy complications involving the bowel and bladder whose central connections are through the lumbar and sacral roots.

A comprehensive review by Janig & McLachlan (1987) provides further understanding of pelvic innervation, in particular a quantitative classification of preganglionic neurons in splanchnic nerves. Of these, 15% were estimated to be vasoconstrictive in function, 41% motor and 44% unclassifiable in that they were not involved in demonstrable local reflexes. Most of the latter were silent to electrical stimulation and were assumed to be involved in reproductive organ physiology, possibly through the release of bioactive substances.

Janig & McLachlan (1987) also suggested that there were local and regional autonomy and redundancy in the control of pelvic mechanisms. Data based on frequency distribution of neurons, functional activity of fibres with similar biophysical characteristics and biochemical coding, indicated that activity patterns, arising in the spinal cord or at higher levels, were transmitted via different routes from the cord to target areas. It appeared that both lumbar and sacral enervation were important in control of the bladder and colon. Functional disturbances occurred in animals if lumbar fibres were reduced or eliminated, but motor evacuative function was preserved when sacral elements remained intact. These findings are not inconsistent with what is known about bladder and colon complications following presacral neurectomy, but are insufficient to help surgeons achieve a zero complication rate.

Finally, it is important to keep in mind that presacral neurectomy does little to improve adnexal pain (Perez 1990; Tjaden *et al.* 1990) and, therefore, should be reserved for patients with central pain or intractable dysmenorrhoea. Given these complications, it is essential that patients are carefully assessed before surgical management. Only properly selected patients who have failed medical therapy should be considered.

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