

Carbon Dioxide Laser for Laparoscopic Enterocele Repair

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Abstract

The use of the carbon dioxide (CO₂) laser for laparoscopic enterocele repair was evaluated in four women with an enterocele as the only pathology. Three women had a large enterocele after earlier hysterectomy, and one young woman had a congenital enterocele. The technique consists of vaporizing the peritoneum of the enterocele; however, it is important first to delineate carefully the lesion's circumference because of the strong retraction during vaporization. Subsequently, a posterior culdotomy is performed taking care to restore the horizontal position of the upper vaginal axis by shortening the uterosacral ligaments, which are sutured together on the midline and the posterior vaginal wall. The CO₂ laser has the advantage that the superficial vaporization it produces is rapid (<5 min), safe, and completely bloodless. The shrinking during vaporization facilitates subsequent repair. Postoperative morbidity and recovery were uneventful for all patients. The CO₂ laser seems to have some advantages over sharp endoscopic resection of enteroceles. The relative simplicity of technique and the low postoperative morbidity suggest that endoscopy could become routine in pelvic floor surgery, improving diagnosis and complementing vaginal surgery while avoiding laparotomy.

An enterocele is a peritoneal sac containing small bowel or omentum. It is usually associated with a cystocele, rectocele, or uterine descent, as part of general pelvic floor relaxation. It also occurs in the absence of any other pelvic floor pathology, suggesting different pathogenetic mechanisms, such as congenital defects or an altered upper vaginal axis.¹

Although the pelvic floor anatomy has been known for more than a century, only recently have the mechanics of the forces involved in maintaining the anatomy been investigated in greater detail. This has led to the

concept that the strength of the pelvic floor and uterine ligaments is relatively less important² than the levator ani muscle tone, its innervation, and its reflex contraction when intraabdominal pressure increases. Also, the mechanical importance of the horizontal upper vaginal axis³ was realized only recently, as evidenced by the fact that in older books of anatomy the vagina is invariably depicted as a straight line.⁴

Surgical repair of enterocele was based on the prevailing concepts of anatomy and physiology. It included resection and closure of the enterocele sac,

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repair or shortening of “elongated” ligaments, and repair of the dehiscent levator ani muscles that simultaneously would shorten the genital hiatus. Surgery was generally performed vaginally. For larger enteroceles and because of occasional difficulties of vaginal surgery, several abdominal techniques were developed, such as the Moschowitz, Halban, and McCall procedures.⁵

Recent achievements in our understanding of the functional anatomy of the pelvic floor and the possibilities of endoscopic surgery⁵ prompted us to evaluate the use of a carbon dioxide (CO₂) laser for laparoscopic enterocele repair.

Materials and Methods

Patients

Four women with an enterocele as their only pathology (i.e., no general pelvic floor relaxation) were included in this study. Three, ages 54, 59, and 62 years, had had an abdominal hysterectomy for a uterine myoma or dysfunctional bleeding at ages 35, 47, and 49 years, respectively. They had a vaginal delivery of two, one, and three children, respectively. None of these women had received hormone replacement therapy other than intermittent estriol 2 mg/day. The fourth woman, age 27 years, experienced primary infertility as well as vague pelvic complaints that were compatible with an enterocele.

Endoscopic Surgery

Endoscopic surgery was performed as described previously.⁶ The key features were a high-flow insufflator⁷ (Thermoflator; Storz AG, Tuttlingen, Germany) to maintain the pneumoperitoneum at 30 L/minute, an operative laparoscope with a CO₂ laser (Sharplan 1060, Tel Aviv, Israel), and two suprapubic 5-mm secondary cannulas.

In the women with a previous vaginal delivery and an enlarged genital hiatus, a posterior vaginal repair was performed first. After an incision in the posterior vaginal wall and dissection of the fossae ischioirectalis, the levator ani muscles were approximated with several stitches of 0 polyglactin. This shortened the genital hiatus and pushed the lower vagina ventrally (Figure 1). The vaginal portion of the procedure was concluded by suturing the bulbocavernosus muscles, followed by perineal repair.

Laparoscopically, the enterocele was easily identified between the uterosacral ligaments, the vaginal cuff or the posterior vault, and the rectum. The ureters were carefully identified. Although it is easy to recognize their position in some women, it can be very difficult in others, necessitating dissection, eventually starting from the landmarks at the pelvic brim. In addition, in women with large enteroceles the ureters can be displaced laterally. The eventual difficulty of this procedure could be an argument for prophylactic stenting of the ureters in women with a large enterocele.

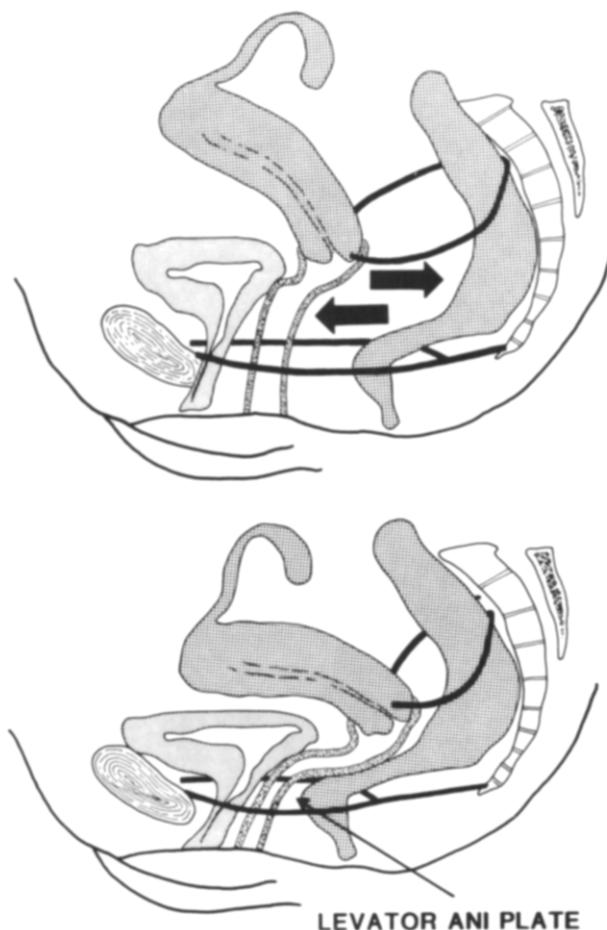


FIGURE 1. Surgical correction of the enterocele. (Top) The vertical axis of the upper vaginal axis, together with an enlarged genital hiatus favoring an enterocele. (Bottom) After correction by shortening the genital hiatus and the uterosacral ligaments, the horizontal position of the upper vagina resting on the levator ani plate is restored.

After the enterocele and the ureters were identified, the procedure continued as follows. First, the circumference of the enterocele was delineated with the CO₂ laser using a continuous 15-W superpulse beam. Next, a superficial peritoneal incision was made lateral from the uterosacral ligaments using the same power setting. Finally, the peritoneum of the enterocele was superficially vaporized and destroyed using a 50-W continuous defocused beam.

If an enterocele is very large, we prefer first to close the deepest part with two or three sagittal Halban sutures,⁵ taking care not to include the upper part of the vagina and thus compromise the subsequent McCall sutures. Finally, the uterosacral ligaments are closed at the midline and shortened by suturing them to the vaginal vault, which is pulled up and backward (Figure 2). This closes the enterocele and restores the horizontal position of the vagina, resting on the levator ani plate. This is achieved by gently pushing the upper vagina upward with a forceps to estimate its length, and simultaneously backward to elevate to a degree at which the uterosacral ligaments can be shortened.⁵ Some intentional overcorrection of the horizontal position of the vagina is thus achieved. The former enterocele now occupied by the vagina is closed with two or three additional sutures through the uterosacrals and the vaginal cuff.

Postoperative recovery was uneventful for all four women, except for one whose ureters were stented preoperatively and who developed transient ureter pain postoperatively for 24 hours. There were no late complications as evaluated 6 weeks after surgery.

Discussion

Enterocele repair traditionally was performed vaginally, since postoperative morbidity is much less than after a laparotomy, and since in most women the enterocele is accompanied by either general pelvic floor relaxation or at least some reparation of the levator ani muscles, meaning that some portion of the procedure must be performed vaginally. Several abdominal approaches have been described.⁵ The Moschowitz procedure closes the enterocele with a spiral suture, the Halban procedure introduced sagittal sutures, and the McCall operation stresses the importance of approximating the uterosacral ligaments to close the cul-de-sac. The introduction of these techniques suggests that over the decades surgeons have been aware of the technical difficulty of vaginal surgery in some women,

of the complexity of the pathology, or possibly of the occasional unsatisfactory results.

Since the degree of pelvic relaxation and the importance of an enterocele are difficult to measure, and since the end points of surgical correction are difficult to evaluate objectively, quantitative data are hard to find in the literature. Instead of randomized trials comparing techniques and outcome, most articles are based on logic, commonsense, and the experience of the surgeon. Hence it is not surprising that the approach chosen for the surgical repair of an entero-

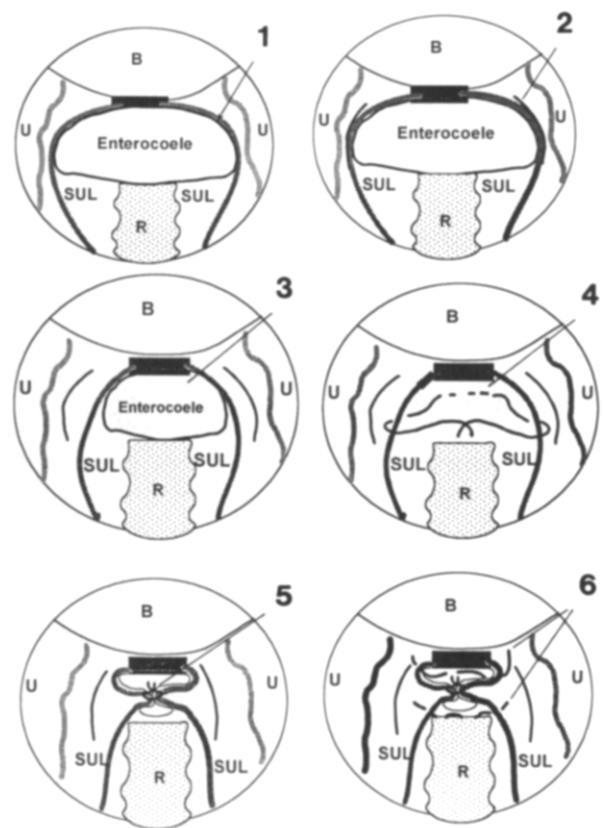


FIGURE 2. Endoscopic enterocele repair using the CO₂ laser. (1) Delimitation of the circumference of the enterocele. (2) Incision of peritoneum between ureters and uterosacral ligaments. (3) Superficial vaporization of enterocele peritoneum causes retraction. (4) The first suture is placed 1 cm below vaginal cuff and uterosacral ligaments. The ligaments are shortened as much as possible, that is, as permitted by the length of vagina. (5) Inspection of ureteral retraction. (6) Closing the enterocele by suturing the uterosacral ligaments, incorporating the posterior border of the enterocele and/or the posterior vaginal wall.

cele—vaginal or abdominal—is often more a philosophical decision or a consequence of the surgical school to which one belongs, than based on scientific arguments. It has always been clear, however, that the morbidity associated with a vaginal approach is less than that after a laparotomy, whereas the abdominal approach has the advantage that the ureters can easily be identified, permitting the surgeon safely to move the uterosacral ligaments farther back. This has led to the general attitude of restricting the abdominal approach to women with a large enterocele. One has to realize, however, that the final decision in the individual patient is always subjective to a large extent.

The important advantage of the laparoscopic approach is that it can be used in all women for enterocele repair without increasing postoperative morbidity and the duration of hospitalization. The statement of Nichols, “Although a surgeon tends to concentrate on operations he or she performs best, the various combinations of damage suggest that he or she should be familiar with a spectrum of alternative techniques”¹ emphasizes that the choice of surgery depends on correct evaluation of the pathology. Laparoscopy seems to be the ultimate diagnostic tool to determine the extent of an enterocele. Hence, the abdominal and vaginal approaches, about which opposing views are sometimes held, become complementary. After localizing the uterosacral ligaments and the ureters, and after evaluating the size of the enterocele, the surgeon decides what is the best approach in the individual patient. This laparoscopic diagnosis could improve surgery at least in some women in whom incomplete vaginal correction would be avoided; this occurs sometimes as a consequence of caution to avoid the ureters when the uterosacral ligaments have to be sutured far back.

The CO₂ laser allows the surgeon to delineate the circumference of the enterocele in less than a minute, to incise the peritoneum very rapidly lateral from the uterosacral ligaments, and to vaporize and destroy the peritoneum of the enterocele in less than 5 minutes. This procedure, comparable with the effect of flow-erig during salpingostomy, shrinks the peritoneum to such an extent that the enterocele disappears almost completely by vaporization. Simultaneously, the uterosacral ligaments are pulled medially, whereas the ureters are left in place because of the incision of the peritoneum between the uterosacral ligaments and the ureters.

The CO₂ laser for endoscopic repair of an enterocele seems to have some advantages over sharp dissection and electrosurgery. First, this technique is much faster and absolutely bloodless: delimitation and superficial vaporization can be performed in a few minutes provided a high-flow insufflator allows removal of smoke continuously. Second, retraction of the peritoneum is so pronounced that the enterocele is almost repaired by this procedure alone, thus facilitating suturing to close the enterocele. Sharp dissection of the peritoneum initially enlarges the enterocele, which subsequently has to be closed.

Because of the important retraction, and to facilitate safe suturing of the uterosacral ligaments, it is mandatory to delineate clearly the circumference of the enterocele before vaporization is started. It is also strongly recommended that the peritoneum be incised lateral from the uterosacral ligaments to prevent a retraction of the ureters. Carbon dioxide laser vaporization of the peritoneal surface might be less complete than sharp excision; but this is not considered relevant since the importance of excision of the peritoneum is questionable, the results of surgery depending mainly on correcting the underlying pelvic floor defect.

The technique of shortening the uterosacral ligaments and pulling the upper vagina backward has the theoretical advantage of restoring the physiologically important horizontal position of the upper vaginal axis over the levator ani plate. The most posterior part of the vagina is not the vaginal cuff but the fornix posterior, which is 1 or 2 cm below the cuff. Delimitation of the enterocele with the CO₂ laser at the beginning of the procedure is helpful, since the area of enterocele remains clearly identified, even during the repair when important distortions occur as a consequence of suturing.

No other interventions were performed in this selected group of women. The technique, however, is applicable to the broad field of pelvic floor relaxation.⁵ Future evaluations will be necessary to decide whether endoscopy should become a routine procedure, complementing the vaginal approach. Similarly the 10% to 12% frequency of enteroceles after Burch urethropexy could prove to be prevented by a simultaneous endoscopic enterocele repair. This is not unrealistic, since when performed by endoscopy, the procedure lengthens the duration of surgery by less than 20 minutes, and postoperative morbidity is increased minimally.

Although we realize that this series is small and the follow-up short, the relative ease and rapidity of this technique, the low postoperative morbidity, and the seemingly excellent results make us suggest that laparoscopic enterocele repair together with a vaginal approach could become a standard procedure.

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