Laser surgery

Scanner-assisted carbon dioxide laser surgery: A retrospective follow-up study of patients with hidradenitis suppurativa

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Background: The chronic fistulating lesions of hidradenitis suppurativa spread by contiguous growth, and all affected tissue needs to be surgically removed.

Objective: The aim of our study was to evaluate a surgical method for treatment of Hurley stage II hidradenitis suppurativa (HS), the carbon dioxide laser rapid-beam optomechanical scanner system in continuous mode.

Methods: Thirty-four patients were evaluated after treatment; 31 patients were women, and the mean age was 33.9 years (range, 15-55 years). All patients had had HS for a mean of 13.4 years (range 1-35 years) and more than 3 recurrences of suppurating lesions in the year before inclusion in the study. All lesions had been classified as Hurley stage II. The mean follow-up time after carbon dioxide laser surgery was 34.5 months (range, 7-87 months), and patients were later contacted by telephone about recurrences and the end results.

Results: The mean healing time was about 4 weeks (range, 3-5 weeks). During follow-up, 4 of the 34 patients had recurrences at the surgical site, that is, locoregional HS. Thirty had no recurrences in the treated area, but in 12 cases de novo suppurating lesions, separated from the initial surgical site by >5 cm, developed. Twenty-five patients had flares of HS lesion(s) in an area other than the treated site. Eight had no recurrences.

Conclusion: Macroscopically controlled tissue-selective carbon dioxide laser treatment of HS is a fast, efficient treatment and well accepted by the patients. (J Am Acad Dermatol 2002;47:280-5.)

Hidradenitis suppurativa (HS) (also called acne inversa) is a cicatrizing and frequently persistent inflammation of the terminal hair follicles of apocrine gland-bearing areas in adults. One or both axillae and the inguinal region may be affected, often with spread to the scrotum, labia, mons pubis, mammary or perineal region, and buttocks. This condition may remain relatively mild, but it is nevertheless distressing, ranging from a few but recalcitrant suppurating lesions to an advanced, widespread, and disabling disease lasting for years or decades. In long-standing cases HS can be complicated by squamous cell cancer as a result of chronic inflammation. The etiology of HS is not clear, but genetic predisposition, bacterial infection, and hormonal factors have been discussed.

Many therapies have been used, often with limited or temporary results, including systemic or local antibiotics, hormones such as estrogen, progesterone, and cyproterone acetate, corticosteroids, and retinoids. Surgery is essential and should be done as soon as possible. Wide excisions, well beyond the clinical borders of activity, are mandatory, regardless of the location. In this article, we describe a surgical technique for HS and the results at follow-up. The aim of this technique is complete radical ablation of diseased tissue combined with preservation of healthy tissue, with the use of a carbon dioxide laser and a miniature microprocessor-controlled flash scanner.

Materials and Methods

The study protocol was approved by the local ethics committee. The medical records, including outpatient files, of 35 patients (31 females) who
underwent surgery for HS in our department between 1993 and 2000 were analyzed retrospectively. The diagnosis of HS was based on history and clinical presentation on the initial examination. All patients had one or more active suppurating lesions and had 3 to 12 recurrent episodes of abscesses during the 12 months before examination or continuous suppurating lesions involving the axillary, inguinal, and perineal (perianal, genital, pubic) areas, buttocks, upper thighs, or the breast in women. One or more lesions 10 cm or less in length were selected for treatment. All lesions were clinically classified as Hurley stage II, that is, recurrent abscesses with tract formation and cicatrization and single or multiple widely separated lesions. No patients who had concurrent diseases with tendencies toward fistulization, such as regional enterocolitis, ulcerative colitis, or rheumatoid arthritis, were included. The mean duration of disease was 13.4 years (range, 1-35 years). Previous therapy included injections of and multiple courses of antibiotics (18 patients); local incisions (n = 20), isotretinoin (n = 3), isotretinoin and cyproterone acetate, followed by finasteride (n = 1); excision surgery (n = 2); and excision surgery with transplantation (n = 1). Five patients had undergone previous successful in loco carbon dioxide laser surgery before 1993 in our department. The anatomic areas treated were the axillary area in 10 cases and the inguinal-gluteal-perineal area in 22 cases. In one patient, both the axillary and perineal areas had been treated, and in another, both the axillary and periumbilical areas had been treated.

In accord with the patient’s views, we selected for treatment the symptomatic lesions (ie, those with discharge, inflammation, infiltration, or suspected abscesses). Areas that had been asymptomatic for more than 2 years but showed signs of previous activity (eg, scars with postinflammatory hyperpigmentation, sometimes with dry comedones) but no current inflammation were not treated. The diseased skin was examined macroscopically for scarring, tissue distortion and discoloration, dry or suppurating sinuses, macrocomedones, and other superficial signs. The examination was completed by palpating the defects for bulky indurations and small, firm subcutaneous nodules or fluctuating purulent tissue.

Anesthesia

The affected area was outlined with ink (Fig 1). After the skin was cleaned with 0.05 mg/mL chlorhexidine solution, the area was anesthetized by injection of lidocaine, 0.5 to 1.0 mg/mL, and epinephrine (Xylocaine adrenalin; AstraZeneca, Södertälje, Sweden). To reduce pain, we applied a lidocaine prilocaine cream (EMLA, AstraZeneca) for an hour to richly innervated areas, such as the groin, before the injections. The solution was injected and infiltrated around and not directly into the affected site to

Fig 1. A 42-year-old woman. Lesions have been delineated in ink after anesthesia before (A) and during (B) carbon dioxide laser surgery with the optomechanical microprocessed flash scanner on hidradenitis suppurativa lesions of axilla with (C) and (D) close-ups, respectively.
avoid direct contact with inflamed tissue and injection into the abscess.

**Scanner-assisted carbon dioxide laser surgery**

The surgical technique with the scanner-assisted carbon dioxide laser was modified from the previously used rapid hand movement–controlled carbon dioxide laser method15 and takes advantage of the introduction of carbon dioxide laser scanners (rapid-beam optomechanical microprocessed scanner system 1993-1994: SwiftLase model 755 [ESC-Sharplan Lasers, Inc, Allendale, NJ] 1995-2000: SilkTouch model 765 [ESC-Sharplan Lasers].) A focusing handpiece from a Sharplan carbon dioxide laser 1030 is attached to the miniature optomechanical flash scanner delivery system that generates a focal spot, which rapidly and homogeneously spiral scans and covers a round area on tissue at the focal plane. The area selected was ablated with the laser beam by passing it over the tissues, and this was followed by repeated ablations in the same manner after devitalized tissues were removed by cleansing the surface with a swab soaked in 0.9% sodium chloride solution. The depth of each level of vaporization is controlled by the selection of power, focal length, scanner-controlled spot size, and the velocity of the movements of the hand-held scanner. We used 20 to 30 W, a spot size of 3- to 6-mm, and a focal length setting of 12.5 or 18 cm. The vaporization procedure is repeated in downward and outward directions until fresh yellow adipose tissue is exposed in the deep, relatively thin and anatomically normal skin margins laterally, with no remaining dense or discolored tissue. Usually the vaporization reached the deep subcutaneous fat or fascia. In the axillary region, major vessels and the nerve plexus must be protected, but this depth was seldom reached in the Hurley stage II14 lesions in this study. The smaller blood vessels were coagulated by the laser, but bleeding from vessels larger than 0.5 to 1 mm in diameter should be stopped with electrocoagulation or ligation. The wound, left to heal by secondary intention, was immediately covered with dry dressings or ointment-impregnated dressings and a covering bandage attached with surgical adhesive tape or gauze underwear.

**Postoperative therapy**

The patients remained in the department for 3 hours after the procedure for assessment of function and to permit them to have a bowel movement, empty the bladder, and discover any bleeding before leaving. The dressings were initially left on for 2 or 3 days without changing to prevent early bleeding. Thereafter, the wound was cleaned and rinsed with tap water, and the bandage was changed as often as necessary, sometimes daily, pending complete healing. Since 1998, a hydrofiber dressing (Aquacel; ConvaTec Ltd, Deeside, UK) has been used. Patients are usually able to change dressings without professional help. The wounds were inspected after 1 week and then, until they healed, if there were signs of complications. Wounds were also examined at 6 weeks and 6 months after surgery.

**Questionnaire**

For the purpose of assessment of the clinical postoperative course, persistent or recurrent HS, and late sequelae after discharge, the patients were asked in a letter to take part in a telephone interview including questions on healing time, recurrences, and satisfaction. Recurrence was defined as persistent or new signs of HS in any of the operated areas. On follow-up during the telephone interview, they were asked questions by two of the authors, neither of whom was directly involved in surgery (K. S. and L. E.), including the following: How was the postoperative period regarding pain (0, none; 1, did not interfere with daily activities; 2, did interfere with daily activities; or 3, prevented other activities)? As a whole, is your disease now better than before surgery (yes, no, same, or no opinion)? In case of recurrence, would you choose this laser method for treatment again (yes, no, or undecided)? Do you have or have you had acne (yes, no)? Do you have first-degree relatives with HS (history of one or more boils in axillary or inguinal area) (yes, no)?

**RESULTS**

Table I summarizes the baseline characteristics of the patients who completed the follow-up.

**Table I. Baseline characteristics of the 34 patients treated for hidradenitis suppurativa with scanner-assisted carbon dioxide laser surgery**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
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<tbody>
<tr>
<td>Age (y)</td>
<td>33.9 ± 11.0</td>
</tr>
<tr>
<td>Sex (M/F)</td>
<td>3/31</td>
</tr>
<tr>
<td>Age at onset (y)</td>
<td>22.3 ± 6.6</td>
</tr>
<tr>
<td>Disease duration (y)</td>
<td>13.4 ± 8.6</td>
</tr>
<tr>
<td>Acne: past or present (yes/no)</td>
<td>16/18</td>
</tr>
<tr>
<td>Hereditary/nonhereditary variant†</td>
<td>11/23</td>
</tr>
<tr>
<td>Smoker/nonsmoker‡</td>
<td>25/9</td>
</tr>
<tr>
<td>Children (yes/no)</td>
<td>16/18</td>
</tr>
<tr>
<td>Follow-up (mo)</td>
<td>34.5 ± 25.7</td>
</tr>
</tbody>
</table>

*Plus-minus values are means ± standard deviation.
†Family history of hidradenitis suppurativa in one or more first-degree relatives reported by the patient.
‡Smoking reported by the patients at the time of surgery.
The modified minimal invasive carbon dioxide laser method was performed in 34 patients (31 women) with a mean age of 33.9 years (range, 15-55 years). One male patient was lost to follow-up. He did not respond to our invitation to participate in the telephone interview. The mean age at onset of disease was 22.3 years (range, 5-37 years). The areas treated varied from 5 to 50 cm² in area in a total of 67 operating sites (1 in sixteen, 2 in ten, 3 in two, 4 in four, and 5 in two cases). In most cases, the duration of the procedure, including anesthesia, was less than 20 minutes. Each lesion was vaporized in a few minutes. The mean follow-up time was 34.5 months (range, 7-87 months). A typical case is shown in Figs 1 and 2.

The mean healing time was 4 weeks (range, 3-5 weeks). Four patients had recurrences in the scars of treated lesions less than 6 months after surgery. The remaining patients had no recurrence in the treated regions, but in 12 patients, new lesions or recurrences >5 cm away from the operation scars developed more than 8 months after surgery. Twenty-five of the patients had recurrences of their HS in an anatomic region different from the one on which surgery had been performed. Eight patients had no apparent symptoms from their HS. Table II shows the results of the follow-up. On a scale from 0 to 3, four patients classified their pain in the postoperative period as 3, fifteen as 2, nine as 1, and six as 0.

Table II. Number of recurrences after scanner-assisted carbon dioxide laser treatment of 34 patients with hidradenitis suppurativa

<table>
<thead>
<tr>
<th>Recurrence Type</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>8</td>
</tr>
<tr>
<td>In operated areas</td>
<td>4</td>
</tr>
<tr>
<td>In same anatomic region, but &gt;5 cm from operated area</td>
<td>12</td>
</tr>
<tr>
<td>In another anatomic region</td>
<td>25</td>
</tr>
</tbody>
</table>

After healing, at the time of interview, 31 patients considered that their condition was better than before surgery, two patients considered that their condition had hardly changed, and one patient thought it was worse. The treated and most troublesome areas had become asymptomatic, except in 4 cases. Although there was much postoperative scarring, the patients’ general and local functions were not impaired. All but one of them were pleased with the appearance of their scars after complete wound healing. One inguinal scar in a female patient was hypertrophic after delayed healing and ulcerated in a 10-mm area during the first 2 months after surgery. However, it healed after a single intralesional injection of steroids.

Postoperative course

Hospitalization was not needed, but professional medical assistance for wound care was necessary in
DISCUSSION

The carbon dioxide laser has previously been used in HS surgery. Before scanner devices became available, we used a carbon dioxide laser operating at 30 W with a manually controlled handpiece. Tissue vaporization with freehand movement is very dependent on the surgeon’s experience. The rapid-beam microprocessor-controlled optomechanical scanner system uses parallel mirrors to produce a fine spiral beam with an extremely short laser exposure time, ablating tissue with minimum thermal injury. When set at the continuous mode, the scanned laser beam drills downward into the tissues and removes the lesion rapidly in an even and controlled manner. This provides a bloodless operating field, which permits macroscopic examination of the pathologic features of the tissue. The main aim is to attempt to maintain a majority of the uninvolved tissue with appropriate surgical margins for radicality and thus provide a better chance of cure and a smaller defect that can result in a lesser scar. The carbon dioxide laser has been used by others to excise HS lesions. Excision technique is essential in cases requiring pathologic anatomic examination to rule out suspected squamous cell carcinoma. This method is also of value in removal of larger amounts of tissue from HS lesions.

The scanner makes ablation quicker, smoother, and more precise than the freehand, surgeon-dependent technique. It also permits early detection and minimal unintended damage of healthy or vascular tissues. Special caution is recommended in patients who have a low ratio of diseased skin to healthy subcutaneous tissue underlying the lesions or in whom the procedure is limited by muscular fascia or vital parts other than subcutaneous fat (ie, nerves and blood vessels). In this study, we suspected an injury to an axillary nerve because one patient complained of paresthesia that lasted for 6 months after surgery.

The hypothesis underlying this surgical method is that radical removal and vaporization of macroscopically active HS tissue will prevent recurrences. It is thought that if the epithelial sinuses produce keratin and harbor debris and the bacteria survive the treatment, the epithelial sinuses will be the locus of recurrence.

Postoperative wound care

Four patients stated that their pain after surgery made other activities impossible, and 15 stated that it interfered with daily activities. In our experience, the pain during care of the wound (ie, changing the dressings) was the most difficult aspect of the postoperative course in these patients. The hydrofiber bandage used in our department since 1998 seemed to be less painful to remove than other dry or ointment-impregnated dressings. This should be studied in a controlled manner.

Most patients seen in departments of dermatology and many patients with HS have a milder course, usually Hurley stage II, that is, recurrent abscesses with tract formation, cicatrization, and single or multiple widely separated lesions that have not yet become more severe. Although they cannot be considered candidates for advanced major plastic surgery, they do have a chronic disabling disease.

In our study, 4 patients had recurrences in the scars of treated lesions, and 12 patients had new lesions or recurrences at a distance of >5 cm from the surgical scars. Twenty-five patients had active HS in other areas. Only 8 patients had no apparent symptoms from their HS. Our results are in accord with those achieved with other surgical methods, and the need to repeat the treatment must be considered. Development of new abscesses outside symptomatic skin area cannot be prevented by any known surgical method and seems to indicate activity of the underlying disease rather than a shortcoming of the method. Treatment with the laser can be repeated, and because it is tissue-sparing, can result in smaller scars. In cases of disease that recur after carbon dioxide laser surgery, laser surgery should be done again, but in conjunction with supplemental medical management such as long-term administration of tetracyclines, retinoids, or cyprioterone acetate.

However, some limitations should also be noted in the interpretation of our findings. First, the outpatient files were analyzed retrospectively, and during follow-up, all patients were interviewed by telephone with the use of a questionnaire. This information was therefore reported by the patient. Second, because of the small number of patients, the results of surgery are sensitive to chance effects. Third, our patients had been referred to us by other specialists who had treated them unsuccessfully.
with other methods. Therefore, we may have selected patients with a relatively more therapy-resistant type of HS. Finally, our patients had Hurley stage II disease, which we regarded as operable with this method. In our department, patients with disease classified as Hurley stage III are referred to plastic surgeons for wide excision and reconstructive surgery. However, Hurley stage II is the most common type of HS. When patients were considered to be suitable candidates for surgery, they were usually operated in our department; only a few were referred for wide-excision surgery.

In conclusion, our results indicate that in patients with chronic HS, macroscopically controlled, tissue-selective, and skin-preserving scanner-assisted carbon dioxide laser treatment is a safe and rapid surgical method with satisfactory cosmetic and functional results and is suitable for use on an outpatient basis. The use of carbon dioxide laser microprocessor-controlled scanner devices has made the technique safer and less surgeon-dependent. The technique allows early treatment of HS lesions that were previously managed with less effective local conservative remedies.

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REFERENCES
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