Treatment of cutaneous leishmaniasis using a carbon dioxide laser

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Use of a carbon dioxide laser to vaporize the local lesions caused by cutaneous leishmaniasis is reported. A total of 108 patients have been treated in this way and followed up. The treatment reduces the management time of patients at least 1.5 times and is followed by satisfactory aesthetic outcomes. No recurrences have been observed among the 82 patients who have been followed up for 7 years.

Introduction

Cutaneous leishmaniasis manifests itself through multifocal necrotic skin ulcers, which can reach up to 6–8 cm in diameter. Untreated, the disease leads to lymphadenitis (34%) or lymphangitis (66%).

The current treatment for cutaneous leishmaniasis lesions includes excision, diathermocoagulation, or cryodisruption (1–6). If effective, each of these techniques is followed by a long recovery period and poor cosmetic results are produced. Also, their use is recommended only for lesions that are localized on the face or for the largest lesions on other parts of the body.

Materials and methods

Our experience with the use of carbon dioxide lasers in the treatment of suppurative diseases of soft tissues, together with results reported by other workers, suggested that lasers could be used for the débridement of necrotic tissues (7–9). A laser beam can be used in this way with an acceptable degree of precision since more energy is required to vaporize living tissues than is required for necrotic lesions. Compared with electro- or cryosurgery, use of a carbon dioxide laser produces two-to-four times less thermal necrotic changes in the surrounding normal tissues; also bleeding is easy to control and the technique ensures that wounds are sterilized. As a result, wounds heal rapidly and better aesthetic results are produced.

In 1981 we first carried out laser treatment of six patients with cutaneous leishmaniasis and the results proved encouraging. Subsequently we have used the technique on a total of 108 patients, 101 of whom were young or middle-aged (89 (82%) were men). The duration of the disease was estimated to be 3 months for 81 (75%) and over 3 months for 27 (25%) of the patients. Previously, 97 (90%) of these patients had been treated unsuccessfully: localized treatment (80) or general treatment (17). Altogether 254 skin manifestations occurred in the form of ulcers as follows: one lesion, 47 patients; 2–4 lesions, 39; and five or more lesions, 22 patients. Of these ulcers, 75% were located on the extremities and 25% on the trunk or head–face area. The surface area of 91% of the ulcers was ≤ 15 cm², while that of 9% was 16–30 cm².

Surgical technique

Soviet medical carbon dioxide lasers ("Scalpel-1" and "Romashka-1") operating in the continuous mode at λ = 10.6 μm and powers of up to 40 W and 100 W, respectively, were used.

Patients were administered a local anaesthetic (0.5% procaine hydrochloride solution) injected under the ulcer, and the latter together with the perifocal zone and a 0.3–0.5 cm strip of normal surrounding skin was vaporized by scanning with a focused laser beam. The laser surface power density used was about 2.3–3.0 kW/cm². Coagulated tissues were removed using a damp gauze. Vaporization and removal of carbonized masses were repeated until the wound had a smooth even pink base. Special care should be taken to ensure complete vaporization of the perifocal zone. Finally, the defocused laser beam is directed at the wound (laser surface power density: 200–400 W/cm²) until the entire wound surface becomes covered with a thin light-brown film. This serves as a barrier that prevents bacterial infection.

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Single tuberculæ of leishmania lesions are vaporized using a focused laser beam. With multiple lesions, the largest and most infected ulcers are removed in one session (up to 5–6 focuses) and the remainder as soon as the first wounds begin to epithelialize.

The wounds that result from the treatment are brilliant green in colour and are managed open. In contrast, other methods of treatment involve covering the wounds with sterile bandages, which have to be changed every 2–3 days.

Results
The dry coagulated film that forms over the wound begins to loosen 4–5 days after the operation, exposing the pink granulations of the papillary layer of the skin. On the 6–7th post-operative day, a tender border of epithelial tissue can be seen both around the wound and in the form of single islands on the wound. Cicatrization of the wound begins on day 5–7 and is fully complete by day 10–30.

Pain and oedema sharply diminish 1–3 days after the operation and signs of lymphadenitis and lymphangitis gradually disappear.

Bacteriological studies showed that the wound produced by the laser treatment was 96% sterile. During the early part of the study, Leishmania spp. were isolated from wound samples just after laser débridement in 8 out of 73 patients, but later in the study all the samples tested were sterile.

A total of 36 patients completely recovered 15 days after the treatment, another 32 after 20 days, a further 16 after 25 days, and 24 after 30 days. The mean recovery time was estimated to be 21 ± 2.2 days. We failed to find any association between recovery time and the pre-operative treatment. Furthermore, there was only a slight association between the recovery time and the ulcer surface area. Thus, ulcers of up to 5 cm² took 18 ± 0.9 days to heal, those up to 15 cm², 21 ± 1.2 days, and those up to 30 cm², 24 ± 2.9 days. Comparison of these periods with those for other methods of treating the skin lesions caused by cutaneous leishmaniasis indicates that the laser treatment cuts the management time of patients by at least 1.5 times.

Of the 108 patients in the study series, 25 had surgery in hospital and 83 in the outpatient unit, although all of them could have been treated as outpatients.

The cosmetic results of the treatment, particularly for lesions on the face, neck, and on the base of the auricle, are quite satisfactory.

An intradermal allergic test was subsequently carried out on 32 of the study patients: a positive hypersensitive delayed response was exhibited by 16

![Fig. 1. Front facial view of the patient with multifocal cutaneous leishmaniasis lesions showing the nasal ulcer before laser treatment (top). Profile view of the same patient before treatment (bottom).](image-url)
and a highly positive response by a further 12. The laser treatment presumably therefore does not affect production of specific antileishmania cellular immunity.

After 7 years' follow-up of 82 patients who received the laser treatment, no recurrence was observed. The method seems therefore to be effective for the management of cutaneous leishmaniasis. Presumably removal of the bulk of the parasites by the laser beam leads to the elimination of the remainder by the body's immune system.

**Case report**

A 21-year-old male Turkoman was admitted to hospital on 10 December 1982 with cutaneous leishmaniasis, the first stigmata of which had appeared 2 months previously; on his body, face, and both upper and lower extremities were 12 ulcers (diameter, 0.5–3 cm), some of them covered with necrotic crusts that retained underlying pus. Some of the ulcers on the legs were surrounded by secondary leishmaniasis islands. *Leishmania* spp. were isolated from samples of the ulcerous tissues.

The laser treatment consisted of three sessions, each separated by an interval of 4–5 days; there were no post-operative complications. The patient remained in hospital for 19 days and was subsequently observed as an outpatient for 7 days. Recovery was full.

The man was examined again 2 months after surgery: the ulcers had completely healed and been

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**Fig. 2.** Front facial view (left) and profile view (right) of the same patient as in Fig. 1, after laser treatment.
replaced by tender smooth scars (Fig. 1–3). Subsequently, he has been able to lead a fully active life.

Résumé

Traitement de la leishmaniose cutanée par un laser au gaz carbonique

Un total de 108 malades atteints de leishmaniose cutanée, qui avaient été précédemment traités sans succès, l’ont été par un laser au gaz carbonique (1.6 μ/m). En utilisant un rayonnement alternativement focalisé et non focalisé, les ulcérations ont été complètement vaporisées de même que les régions environnantes et les minces zones de tissu normal enflammées. La chirurgie au laser permet l’ablation radicale des tissus affectés par les leishmania et les lésions guérissent sans douleur, et au moins cinq fois plus vite qu’avec d’autres traitements comme l’excision, l’électrocautérisation, le curetage ou la cryochirurgie.

L’examen post-opératoire de 82 malades n’a pas permis d’observer de rechutes, et les résultats esthétiques étaient satisfaits. Les résultats d’un test intradermique ont montré que la chirurgie au laser n’affecte sans doute pas l’apparition d’une immunité cellulaire antileishmania.

References