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TOTAL RESECTION OF GLANS PENIS SURFACE BY CO₂ LASER MICROSURGERY

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Abstract

Fifteen patients underwent resection of the whole glans surface with laser microsurgical technique from May 1983 to September 1987. The operations were performed in one stage in 11 cases and in two stages in 4. In 3 cases the resected lesions represented multiple dysplasia grade III or carcinoma in situ, in 1 case hyper/parakeratosis and penile horn, and in 11 cases superficial squamous cell carcinoma. In 8 cases primary superficial and flat tumors occupied more than half the circumference of the organ, and in the remaining 7 cases there were flat, superficial residues after systemic chemotherapy for exophytic, non-infiltrating carcinomas. The CO₂ laser beam was used under constant microscopic visual control at a mean output power of 20W, CW or pulsed for the tissue excision from the meatus to the sulcus level. Maximum depth of resection was 2.6 mm. Postoperative external radiotherapy (60 Gy) was given in the first case of the series (microscopically invasive cancer). Satisfactory cosmetic and functional results were observed in all cases. During the follow-up period, ranging from 2 to 48 months, persistent cancer was found at the perimeatal area in 1 case 4 months after laser resection. The procedure can be considered for conservative treatment of wide or multiple superficial lesions of the glans penis.

Key words: Penis; superficial tumors, laser resection, total glans surface.

The glans area is one of the easiest bleeding surgical surfaces which prevents precise radical conservative resection, especially for wide intraepithelial and superficial microinvasive tumors (5). Some treatment modalities, such as cautery, cryosurgery, laser vaporization, or radiation therapy do not allow complete examination of the lesion since biopsy specimen can be obtained only before treatment. External radiotherapy may give good primary control of superficial carcinomas but involves a risk of progressive atrophy and late complications. A high incidence of severe complications has been reported after ¹⁹²Ir wire implant (1). Severe psychological sequelae are unavoidable after surgical amputation. To provide both adequate histologic examination of the surgical specimen

and a conservative management, a laser microsurgical technique was used for complete removal of the glans penis surface in cases with extensive or multiple superficial lesions.

Material and Methods

Study population. Between May 1983 and September 1987, 15 patients underwent total resection of the glans surface with CO₂ laser microsurgery. The age ranged from 32 to 72 years, with a mean of 54 years. The clinical indications were: diffuse hyperkeratosis in 1 case, plurifocal and/or confluent dysplasia in 3 patients, flat and superficial cancer in 4 patients and flat, residues after systemic chemotherapy for exophytic carcinoma without lymph node involvement in 7 patients. The distribution according to histologic findings is shown in Table 1.

The diameter of the lesion surface was more than half the circumference of the organ. All lesions involved the major part of the glans surface, whereas the meatal area was involved in 8 patients only.

The microsurgical resection required hospitalization in 10 patients, whereas the remaining 5 were treated as outpatients. The hospitalized patients were older than 60 years or pretreated with chemotherapy.

Laser instruments and surgical techniques. Two CO₂ laser instruments were used in conjunction with the Zeiss OPMI-6H operating microscope. Of the lasers the Valfive LSS 25 had a maximum output power of 25 W, and the Cooper 250Z a maximum output power of 35 W, CW, and a peak power of 250 W when used in pulsed mode. Timed emission was available for each laser instrument for continuous or pulsed waves, with exposure times of 1/30, 1/15, 1/8, 1/2 and 1 s for LSS 25 device, and continuously adjustable exposure from 1×10^{-3} to 1 s for the 250Z model. Crater diameter and crater depth were examined

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repeatedly as earlier reported (3). Particular importance was given to the accurate recognition of the anatomical landmarks of the tissue layers to ensure exact control of the depth of penetration during the microsurgical procedure. With experience from the previously reported technique used for the first series (2), the CO₂ laser microsurgery was standardized (Table 2).

Local anesthesia with a 2% solution of lidocaine was used, with added epinephrine hydrochloride 1:100 000 for patients without cardiovascular problems. The anesthetic was injected by a 30 gauge needle, mounted on a dental syringe, under the whole surface of the glans penis from meatus to sulcus for the out-patients. General anesthesia was used for in-patients and in these cases the anesthetic solution was injected only around the sulcus and the meatus in order to obtain detachment of layers, which facilitated the excision.

The choice of physical parameters of the laser source varied according to the tissue characteristics and the desired surgical effect. At 200 mm focal length, the spot size of the CO₂ laser beam was varied from 0.5 to 2 mm depending upon the coagulation required. Pulsed generation of laser energy was used to cut the lateral margins of the surgical specimen at the sulcus and meatus level in healthy tissue. It was used at 150 W peak power, 400–500 Hz repetition rate and 600 µsec of pulse width, in order to reduce lateral thermal damage. Irradiance was about 10⁵ W/cm. Continuous wave energy was used to incise the deep surface of the surgical specimen at a mean output power of 20 W, and an irradiance of 10³–10⁵ W/cm, depending on the spot diameters. Also, timed emission was used (1/10 to 1/30 s) both for CW or pulsed energy, to control exactly the depth of penetration into the stromal tissue, thus minimizing the blood loss. The mean speed of laser beam movement was about 3 mm/s. The whole glans penis surface was resected by first incising a sulcus longitudinally from the preputial area to the meatus. The tissue was then grasped gently with a forceps and retracted to allow the beam to cut the base of the surgical specimen under the lesion, until the entire circumferential surface was excised. The tissue surface was cooled by wet gauze sponges during the laser resection, to remove carbonized particles while secondary heating effects were reduced and the surgical layers more easily recognized. Tissue coagulation was usually obtained in real time during laser cutting of small vessels, whereas for hemostasis of larger bleeding vessels the defocused beam was used (up to 3–4 mm diameter).

An anesthetic cream (Xylocaine, Byk Gulden), ice and Betadine solution were, in some of the more recently treated patients, applied on the operated surface for 2 weeks. A vesical catheter was inserted and maintained for 2 days when deep perimeatal tissue was excised. Especially the out-patients were informed about the possible complications. The preoperative and postoperative conditions were photographically documented in most patients.

Table 1

Laser microsurgical resection of the total surface of the glans penis from May 1983 to September 1987

Disease	No. of patients
Hyperkeratosis and penile horn	1
Dysplasia grade III—carcinoma in situ	3
Microscopically invasive carcinoma	4
Residual squamous cell carcinoma after systemic chemotherapy	3
No residual disease after systemic chemotherapy	4
Total	15

Table 2

Laser microsurgery for lesions of the glans surface. Standardized parameters.

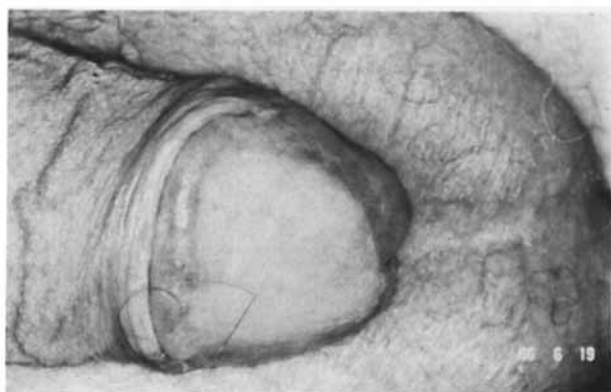
Instruments	CO ₂ laser, microscope micromanipulator, suction device, caliper
Microscopic magnification	6–24 ×
Output power (CW)	20 W
Peak power (puls.)	150 W
Spot size	0.5–1.5 mm
Mean irradiance	10 ³ –10 ⁵ W/cm ²
Repetition rate	400–500 Hz
Pulse width	600 microsec.
Timed emission	1/30–1/15 s
Focal length	200 mm
Depth of removal	1–2.5 mm
Width of removal	Whole surface resection

Results

Technical. The speed of beam movement for tissue incision and the spot diameter at a constant power output were the most important physical parameters of the laser beam. Timed emission of laser energy (1/10–1/30 s, CW or pulsed), was necessary to prevent uncontrolled bleeding during excision of the superficial glans tissue at a mean level of 1.5 mm depth. This led to a slow cutting speed with a mean operating time of about 60 min (range 50–80 min). Slow speed of incision allowed the surgeon to continuously adjust the beam spot diameter from 0.5 to 2 mm according to the tissue characteristics at different anatomical sites. The excision of irregularly vascularized tissue planes, especially when dealing with squamous cell carcinoma with areas of microinvasion, required larger spot diameter, whereas for the removal of intraepithelial or hyperkeratotic lesions a 0.5 to 1 mm diameter at focal point was adequate. Consistency in depth of resection was maintained with 6 to 24× magnification of the operating microscope. The greatest magnification was required during incision of curve areas of the sulcus or around the meatus, in order to obtain maximum precision in desired



a



b



c

Fig. 1. Flat and superficial, a microscopically invasive carcinoma involving the ventral area of the glans penis. a) Before laser surgery. b) Two months after first resection of more than half the circumference of the glans surface. Histologic report showed areas (subclinical) of intraepithelial neoplasia adjacent to the invasive squamous cell carcinoma and reaching the incision margins. c) Appearance 6 months after total surface resection of the glans penis, performed in two stages. No sutures were placed postoperatively at the glans or sulcus. Healing with granulation tissue led to preputial adherence at new sulcus. Re-epithelialization of the glans surface occurred without scars and with satisfactory anatomical and functional results.

Table 3

Total resection of glans penis surface by CO₂ laser microsurgery. Complications and results (n=15)

Operative bleeding	Minimal
Delayed hemorrhage	1/15
Postoperative pain	Minimal to absent
Edema	Minimal
Infection	None
Healing time	5–8 weeks
Scars	Absent
Satisfactory sexual activity	14/15
Disease persistence or early recurrence	1/15 (invasive tumor)

depth and proper hemostasis. All resections up to 2.5 mm depth did not require adjunctive hemostatic measures, such as electrocoagulation diathermy or surgical sutures.

Surgical specimen. The thickness of the 15 histologic specimens varied from 1 to 2.6 mm, excluding the thermally damaged volume, whereas the maximum infiltration depth of microinvasive squamous cell carcinoma was 1.82 mm. In 11 patients, total resection of the glans surface was indicated by the clinical appearance of the lesion, which was plurifocal and/or occupied more than half the circumference of the organ. Total resection was conducted during one surgical session in 11 cases. Thereby a single surgical specimen, containing the entire surface, was obtained in 8 cases and two specimens, each containing half the surface, in 3 cases. The remaining 4 cases (out-patients), had first a partial resection of about half the surface of the glans (Fig. 1) and then a complementary resection with removal of the rest of the surface at a subsequent session, when histologic evaluation of the margins of the first surgical specimen had been obtained. The histologic examination demonstrated margin involvement in 3 of the 4 above mentioned cases (1 multifocal dysplasia grade III, and 2 microinvasive cancers), thus suggesting that the second resection was necessary for radical removal of the lesion. The fourth patient (hyperkeratosis and penile horn) underwent the complementary surface resection because of a previous history of multiple recurrences after partial electrosurgical resections. Noteworthy, 4 of the 7 cases pretreated with systemic chemotherapy did not show residual disease in the total surgical specimen removed. In the remaining cases histologic confirmation of radicality (defined as tumor not reaching the incision borders) was obtained after thorough examination (lateral margins and depth) of the primarily removed total specimen or in the secondarily removed specimen. One case, the first invasive carcinoma of the present series, received postoperative external beam radiotherapy with a total dose of 60 Gy in the glans area.

Clinical results. As summarized in Table 3 secondary healing occurred in all patients. The healing time varied from 5 to 8 weeks (mean 7 weeks) and it was shorter in the non-pretreated patients. One case had prolonged healing

time (about 3 months), probably due to a uniformly deep resection and previous treatment (radiation therapy and chemotherapy). One patient had significant arterial hemorrhage (controlled by cautery) 2 days after the resection. No infection of the wound was observed. The anatomic end result was classified as satisfactory to excellent. No hyperplastic scars or stenosis of the meatus were observed. During the follow-up period, ranging from 2 to 48 months (median 7 months, 75% of cases had follow-up duration shorter than 27 months), one persistent lesion or early recurrence was observed. This patient had documented tumor at the perimeatal area 4 months after the primary (one stage) laser surgery. A second laser partial resection was performed and the patient was free of disease 12 months later. One patient died free of disease (heart failure) 6 months after the microsurgery. Sexual activity was conserved and satisfactory in all but one patient, whose sexual problems probably had psychological causes (4).

However, long-term follow-up is necessary in order to evaluate the curative potential of total resection of the glans penis in wide or multiple superficial lesions.

Discussion

In our series of 124 lesions of the penis, treated by CO₂ laser microsurgery from January 1982 to September 1987, resection of the total surface of the glans penis was necessary in about 12% of the cases. This kind of an operation can be considered as an effort to perform a conservative but nevertheless radical surgical management. The technique allows the surgeon to remove the whole superficial tissue of glans penis without significant complications. Multistage surgery, as described by Mohs et al. (6), though effective in the reported cases, does not involve resection of the total glans surface and is not free of local complications. Moreover, the procedure does not seem to be well suited for extensive lesions.

Subclinical involvement often histologically observed in areas adjacent to a macroscopic tumor of glans penis, suggests the usefulness of a method which allows histologic control of the radicality. Radical laser microsurgery can be adequately performed in flat and superficial primary lesions of the glans which are plurifocal or occupies a large part of the organ. It can also be performed for

removal of the potential area for recurrence of superficial, exophytic cancers which have regressed after systemic chemotherapy. The high therapeutic effectiveness of a schedule, including vincristine, bleomycin and methotrexate (7) may contribute to the overall success rate of the method. In fact, our 7 patients pretreated with chemotherapy had complete or nearly complete regression of the exophytic tumor, and were regarded as good candidates for conservative laser microsurgery in order to prevent local recurrence.

If the physical and surgical parameters have been optimized, laser resection of the total surface of the glans penis is a precise conservative treatment modality which seems to be well suited for adequately selected patients with superficial extensive lesions.

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