

Superpulsed CO₂ Laser Treatment of Basal Cell Carcinoma with Intraoperative Histopathologic and Cytologic Examination

Piero Campolmi, MD*, Benedetta Brazzini MD*, Carmelo Urso MD †, Ilaria Ghersetich MD*, Luciano Mavilia MD*, Jana Hercogova MD ‡, and Torello Lotti MD*.

*Department of Dermatology, University of Florence, and † Dermatopathology Section, S.M. Annunziata Hospital, Florence, Italy, and ‡ Department of Dermatology and Venereology, Charles University, 2nd Medical School, Prague, Czech Republic.

Introduction

A MAJOR advantage of using CO₂ laser in the superpulsed mode is that it allows one to vaporize exclusively the epidermis or to concentrate treatment on the papillary or reticular dermis.¹⁻³ Thus the operator can directly estimate the level reached during treatment on a "step-by-step" basis. It is well known that when vaporization is limited to the epidermis, there is opalescent bubbling of the skin surface accompanied by audible crackling sounds. When this surface is wiped clean with saline, the papillary dermis is seen, as an intact smooth, pink, plane, similar to strawberry flesh. Further vaporization leads to contraction of the tissue, revealing a yellowish, hardened, roughened tissue, similar to chamois cloth. Following vaporization of the papillary dermis, one reaches the reticular dermis, with big beams of collagen fibers that seem to resemble waterlogged cotton threads.⁴⁻⁷ A major criticism regarding laser treatment for basal cell carcinoma (BCC) has been that this technique does not allow the operator to perform any intraoperative histopathologic/cytologic examination, thus limiting the certainty of complete removal of the BCC. We report here our experience in treating BCCs with CO₂ laser associated with intraoperative cytologic/histopathologic examination⁸.

Materials and Methods

We treated 140 patients with superficial or nodular BCCs of small size (less than 1.5 cm in diameter), without local anesthetics, with a superpulsed CO₂ (SmartXide from Deka - Florence, Italy) laser with the following parameters: level 2-3, pulse duration 2-3 msec, frequency 10 Hz, 1-3 mm spot size. Three scrape biopsies were taken for cytologic examination in all 140 patients. The biopsies were taken prior to the operation, when the papillary dermis was clinically recognizable, and when we could visually estimate complete vaporization of the lesion. Histopathologic examination was also performed in 12 patients in the same series of shave biopsies, using local anesthetics (mepivacaine 2%). The technique used can be summarized as follows. A sample of the lesion is taken by scraping the lesion for cytologic examination prior to laser therapy; the material is fixed on a slide and then

stained with the Papanicolaou method. Examination by optical microscope shows a number of extremely orangiophile anucleate cells in the stratum corneum and single cells or cells organized in groups in the lower layers. The latter appear to have more or less pronounced characteristics of malignancy: irregularly organized groups of cells with loss of polarity and with hyperchromic and polymorphic nuclei (Figure 1).

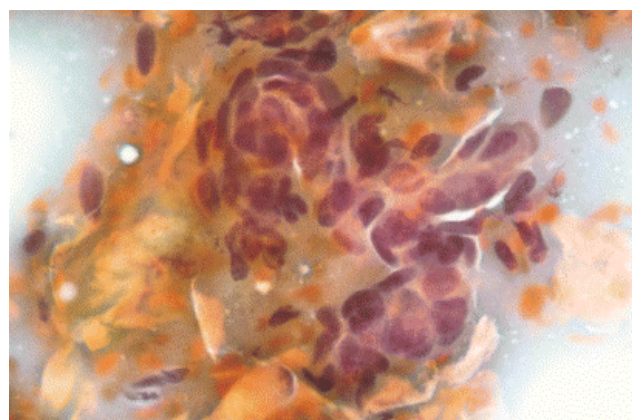


Figure 1. Cytologic preparation of scrapings from lesional skin. Note the group of squamous cells with hyperchromic enlarged nuclei of a BCC, blood cells, and many anuclear scales. (Papanicolaou; magnification 40×.)

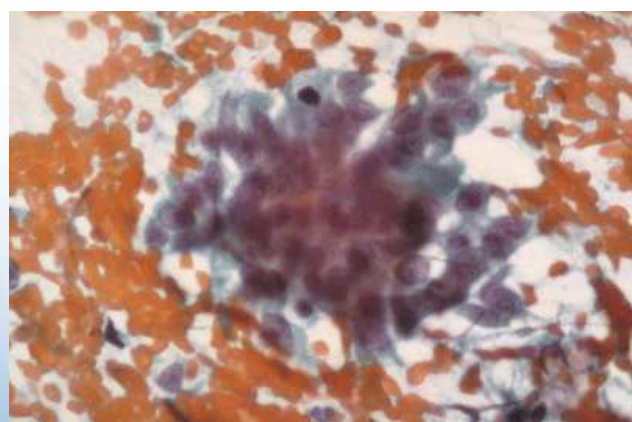


Figure 2. Cytologic preparation of scrapings from lesional skin after the first CO₂ laser treatment. Note the group of scaled cells with large cytoplasm, enlarged nucleus from a BCC and blood cells. The scales are absent, eliminated by the first treatment. (Papanicolaou; magnification 40×.)

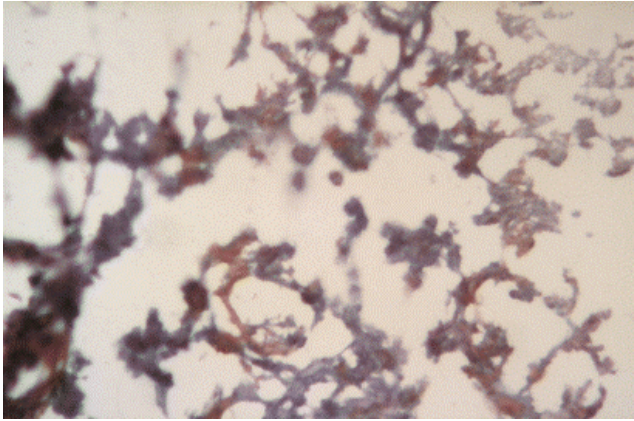


Figure 3. Cytologic preparation of scrapings from lesional skin after the second CO₂ laser treatment. Note the absence of epithelial cells, blood cells, and amorphous material and cellular debris. (Papanicolaou; magnification 40×.)

After taking the first skin sample, we vaporized the lesion including at least 2 mm of unaffected skin around the BCC. The carbonized residue was then removed with a gauze soaked with physiologic solution, revealing a flaming red surface with central bleeding (in the area corresponding to the tumor) surrounded by a pink peripheral area of 1-2 mm (unaffected skin) (Figures 2 and 3). At this time a second skin sample was taken for cytologic examination, which showed erythrocytes, absence of the components of the stratum corneum, and cells of the lower layers with the morphologic characteristics of malignancy (Figure 4). Further vaporization was performed until a yellowish surface with big beams of fibers, similar to waterlogged cotton threads, could be appreciated (Figure 5). At this point, having reached the deep dermis, a third cytologic examination was performed. In most cases this last sample demonstrated complete absence of the epithelium, with only residual proteinic material together with very few inflammatory cells and some cellular residue (Figure 6). In those cases where malignant cells were seen, we continued the laser surgery until the area was completely free of tumor cells.



Figure 4. Basal cell carcinoma.



Figure 5. Flaming red surface with central bleeding (in the area corresponding to the tumor) surrounded by a pink peripheral area of 1-2 mm (unaffected skin) evident after the carbonized residue is removed.



Figure 6. Yellowish surface with big beams of fibers similar to waterlogged cotton threads evident after further vaporization.

Results

In the 140 patients treated, the healing process took from 7 to 10 days, with good aesthetic outcomes. No clinical evidence of recurrences during the next 3 years of follow-up was observed. Cytologic examination of the first skin sample revealed groups of BCC cells with typical hyperchromic, enlarged nuclei. Similar cells were evident in scrapings from lesional skin after the first CO₂ laser treatment, but nuclear keratinocytes, seen in the first sample, were absent, having been eliminated by the treatment. Cytologic preparations obtained with scrapings from lesional skin after the second CO₂ laser treatment revealed an absence of epithelial cells, red blood cells, white blood cells, amorphous material, and cellular debris. The histopathologic examination revealed BCC in samples 1 and 2; no neoplastic cells were found in sample 3.

Discussion

Intraoperative cytologic examination offers interesting perspectives for optimal cure of BCC

with laser surgery⁹⁻¹². In fact, since this technique causes very minor thermal cellular damage, it is possible for the operator to carry out intraoperative histologic/cytologic examination, which is not possible during or immediately after treatments such as cryotherapy, diathermocoagulation, or topical application of 5-fluorouracil cream. A similar procedure could be used for other skin diseases, including actinic keratosis, squamous cell carcinoma, actinic cheilitis, Bowen's disease, and leukoplakia, where intraoperative cytologic examination can be advantageous.

The efficacy of superpulsed CO₂ laser in the case series presented here demonstrates that this method is a valid alternative to surgery and/or diathermocoagulation, in particular for subjects with multiple scattered BCCs, pacemakers, or who cannot undergo local or total anesthesia. The benefits of the superpulsed regime are precise and adequate vaporization, with minimal thermal damage. The technique guarantees clinical efficacy, rapid recovery, and the possibility of laser application without anesthesia, even in cases of multiple, scattered BCCs, with fewer postoperative complications, and finally, the possibility of intraoperative histologic and/or cytologic examination.

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