

# Ultrapulse CO<sub>2</sub> Used for the Successful Treatment of Basal Cell Carcinomas Found in Patients with Basal Cell Nevus Syndrome

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**BACKGROUND.** Basal cell nevus syndrome (BCNS) is an inherited condition marked by multiple basal cell carcinomas (BCCs) associated with several other abnormalities. Various treatment modalities have been used to eradicate these tumors. However, recurrences and scarring limit their use.

**OBJECTIVE.** To evaluate the treatment of multiple BCCs associated with BCNS.

**METHODS.** We describe three cases of BCNS in which multiple BCCs were effectively treated with ultrapulse CO<sub>2</sub> laser. Post-

operative Mohs micrographic surgical sections (thin sections looking for residual tumor) verified complete histologic clearance of the tumors.

**RESULTS.** All three patients were effectively treated with ultrapulse CO<sub>2</sub> laser. Minimal scarring was noted at follow-up.

**CONCLUSION.** Ultrapulse CO<sub>2</sub> laser can be used to effectively treat small BCCs in low-risk areas associated with BCNS with minimal posttreatment scarring.

BASAL CELL NEVUS SYNDROME (BCNS), also known as Gorlin–Goltz syndrome, is an autosomal dominant inherited disease in which the affected gene resides on chromosome 9q22.2–3.<sup>1,2</sup> The syndrome is marked by numerous basal cell carcinomas (BCCs) that may be seen in conjunction with other abnormalities of the skin, skeletal, and central nervous systems. Various therapeutic modalities have been applied in the management of BCCs. We discuss three patients with BCNS effectively treated with ultrapulse CO<sub>2</sub> laser.

## Case Reports

### *Patient 1*

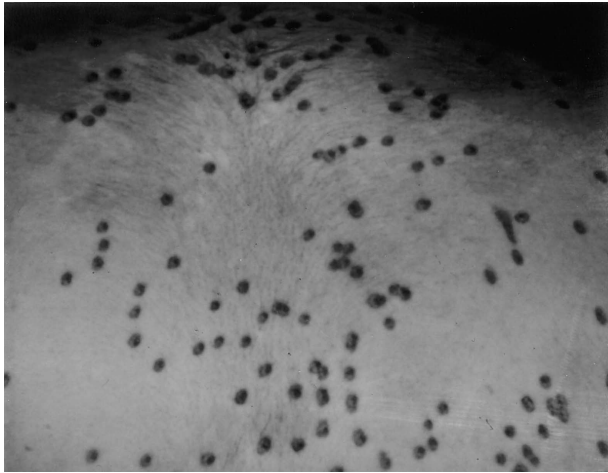
A 16-year-old boy with skin type IV presented with several 2–5 mm pink and skin-colored papules on his face, chest, back, and extremities which appeared shortly after birth. Also numerous palmoplantar pits were noted. Multiple BCCs were diagnosed by biopsy at the age of 5 years. Yearly magnetic resonance imaging (MRI) scans of the head have been done to rule out any cranial involvement (such as cranial membrane calcifications) as a result of the BCNS. This is standard in BCNS examinations. All MRIs were negative.

The patient had previously been treated with two courses of photodynamic therapy (PDT), curettage and electrodesiccation, topical retinoids, and cryosurgery. The PDT consisted of intravenous porfimer at 1 mg/kg, followed 48 hours later by administration of 630 nm light at 72–288 J/cm<sup>2</sup>. Both the photodynamic therapy and the curettage with desiccation were complicated by hypopigmentation and atrophic scarring of the lesions treated on the upper back and chest. Topical retinoids had no effect on the BCCs and recurrences were noted with cryosurgery.

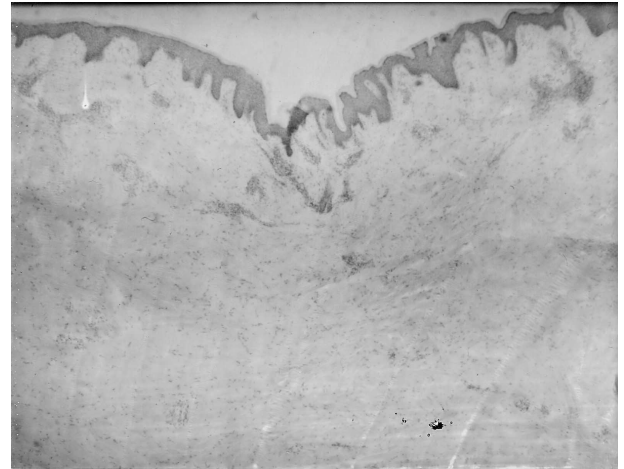
Before beginning treatment, the patient was given intravenous sedation with propofol, fentanyl, and versed, as well as local anesthesia. We treated about 100 BCCs on the patient's trunk, 20 on the neck, and 2 on the face with ultrapulse CO<sub>2</sub> laser (500 mJ, 5 W, 3 mm spot size, three to four passes) (Figure 1). All lesions were 1–4 mm. There was no wiping between passes, only at the end of the treatment session. Once the tissue being treated turned yellow, no further passes were done. No bleeding was noted. There was only one treatment session.

The treated sites healed after 10–14 days. At 1 month follow-up the treated sites appeared as erythematous plaques, 1–3 mm in size. At this time, random sites, which were previously treated with ultrapulse, were evaluated by Mohs micrographic surgical sections, cutting horizontally through the entire tissue (40 sections, 8 μm/section, reviewed one section every 40 μm) looking for residual tumor (Figure 2). No residual tumor cells were noted. Furthermore, minimal transient hyperpigmentation was noted in the areas

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**Figure 1.** After ultrapulse CO<sub>2</sub> laser treatment of multiple BCCs on the back of patient 1.



**Figure 2.** Mohs histologic sections after ultrapulse CO<sub>2</sub> laser treatment of the BCCs of patient 1 showing no residual tumor.

treated with ultrapulse, but significantly less than past treatment modalities. There was no evidence of recurrence or hypertrophic scarring noted 18 months after treatment. There was only minimal hypopigmentation noted at the time, which was of no consequence to the patient.

#### *Patient 2*

A 2-year-old girl with skin type IV presented with multiple 1–3 mm brown papules on her neck, fingers, axilla, abdomen, and back. Multiple palmoplantar pits were present. The patient was born with hydrocephalus and was subsequently developmentally delayed. Her mother, grandmother, and uncle all were diagnosed with BCNS. A biopsy of one of the papules was obtained which revealed a pigmented BCC. The patient was diagnosed with BCNS, based on her biopsy results, clinical presentation, and family history.

The patient had received no treatment for BCNS in the past. Before beginning treatment the lesions were injected with local anesthesia. Two BCCs were treated on her stomach, one on her back, one on her axilla, and two on her neck with ultrapulse CO<sub>2</sub> laser (500 mJ, 5 W, 3 mm spot size, three to four passes, 100 pulses). The size of the lesion treated ranged from 1 to 3 mm. There was no wiping between passes, only at the end of the treatment session. The endpoint of the treatment was the yellow appearance of the tissue. There was no bleeding. Only one treatment session was done.

The treated lesions healed within 2 weeks. At her 6 month follow-up, the treated sites appeared as erythematous plaques. At this time, one previously lasered site on her neck was evaluated by Mohs micrographic surgical sections looking for residual tumor

(as previously described). The site was chosen randomly. No residual tumor cells were noted. Also there was some minimal hyperpigmentation of the treated areas, otherwise treated sites healed without any problems. There was no evidence of recurrence or hypertrophic scarring noted 18 months after treatment. There was residual minimal hypopigmentation at the sites of the treated lesions.

#### *Patient 3*

A 35-year-old woman with skin type IV and a history of BCNS diagnosed at 7 years of age presented with multiple brown papules on her back and neck. She also had multiple palmoplantar pits. Her mother, uncle, and daughter were also diagnosed with BCNS. Two biopsies were obtained which revealed pigmented BCCs.

The patient had not been treated previously for her BCNS. Prior to treatment the sites were injected with local anesthesia. Three BCCs were treated on her left temple, three on her neck, one on her left hip, two on her right chest, and one on her chest with ultrapulse CO<sub>2</sub> laser (500 mJ, 5 W, 3 mm spot size, three to four passes). The lesions ranged in size from 1 to 3 mm. There was no wiping between passes, only at the end of the treatment. The endpoint of the treatment was the yellow appearance of the tissue. There was no bleeding. Only one treatment session was done.

The treated lesions healed within 2 weeks. At her 6 month follow-up the treated sites appeared as erythematous plaques. At this time, one previously lasered site on her neck and one on her chest were evaluated by Mohs micrographic surgical sections looking for residual tumor cells (as previously described). The sites were chosen randomly. No residual tumor cells

were noted. Also there was some minimal hyperpigmentation of the treated areas, otherwise treated sites healed without any problems. There was no evidence of recurrence or hypertrophic scarring noted 18 months after treatment. However, there was mild scarring at the treated sites on the anterior chest.

## Discussion

Basal cell nevus syndrome is a genetically inherited disorder characterized by numerous BCCs in association with other abnormalities.<sup>1,2</sup> These abnormalities include epidermoid cysts, palmoplantar pits, dental cysts, bifid ribs, scoliosis/kyphosis, hypertelorism, broad nasal root, frontal bossing, cleft lip, soft tissue calcifications, bicornuate uterus, cataracts, congenital blindness, mental deficiencies, and various neurologic problems. The changes seen in bone, the central nervous system (CNS), and eyes can occur before the appearance of BCC. The BCCs are generally distributed symmetrically and bilaterally on the eyelids, nose, cheeks, forehead, neck, trunk, and axillae. Individual BCC can measure approximately 1–15 mm in size and can increase in number up to late adolescence. Although these tumors have the potential to become invasive, especially on the eyelids and nose, the majority remain benign and have a low risk of recurrence after treatment.

There are many different treatment modalities for BCC reported in the literature. Mohs micrographic surgery (MMS) has become the treatment of choice for BCC.<sup>2</sup> It carries a cure rate of up to 99%. However, MMS is not always necessary or feasible in certain situations. Because patients with BCNS have numerous BCCs, MMS becomes impractical. Many other treatments have been utilized in BCNS patients in an attempt to duplicate the high cure rate and low incidence of scarring seen with MMS.

Cryotherapy has been used in the treatment of BCC.<sup>3,4</sup> This therapy is useful for biopsy-diagnosed BCCs with definable margins. Even though this technique is easy to apply, there are several disadvantages, such as postoperative pain, hypopigmented scarring, and recurrence of the tumors. Cryosurgery is a better choice for treatment of BCC in patients who are anticoagulated or at increased risk of infection, or cannot be operated on. Also, certain areas of the body, like the anterior chest, have less risk for scarring with cryosurgery. However, treatment of BCCs on the anterior lower leg, lateral fingers, and tongue are contraindicated.

Photodynamic therapy with systemic or topical photosensitizers and an appropriate laser light source have shown good results.<sup>5–7</sup> Systemic PDT includes the intravenous injection of porphyrins, which are selec-

tively taken up by the malignant cells. When exposed to light, the cytotoxic substances lead to selective destruction of the tumor cells. However, concern exists regarding prolonged (4 weeks) postoperative photosensitization.<sup>5</sup> Similarly the efficacy of topical PDT is related to the selective uptake of 5-ALA by the BCC.<sup>6,7</sup> Once the tumor cells absorb the photosensitizer 5-ALA, the substance is then metabolized by the tumor cells to a photosensitizing porphyrin, which, when exposed to photoactivating light, destroys the skin cancer. This topical treatment has shown good results in eradicating superficial BCC.<sup>6–8</sup> However, transient changes in pigmentation and persistence of nodular forms of BCC have been noted.<sup>6</sup>

Intralesional interferon (IFN)- $\alpha$  has also been reported for the treatment of BCC.<sup>9</sup> The exact mechanism of action is unknown. Although reports of eradication of small superficial and nodular BCCs have been noted, this therapy is limited by local irritation and erythema of the treated areas, and the relative high cost of the medication.<sup>8–10</sup>

Curettage and electrodesiccation is a common procedure used in the treatment of BCC. This approach is simple and time efficient.<sup>11,12</sup> Nevertheless, atrophic hypopigmented and hyperpigmented scarring have been noted due to nonspecific thermal injury related to this procedure.<sup>13,14</sup>

Various lasers, such as argon, ruby, Nd:YAG, and continuous wave CO<sub>2</sub>, have also been utilized in the eradication of BCC via coagulation.<sup>7,8,15–18</sup> Lasers have been combined with curettage. The literature has supported laser treatment of patients with multiple BCCs, as seen in individuals with BCNS. Nevertheless, the nonspecific thermal injury potentially caused by these lasers may lead to atrophic scarring or changes in pigmentation.<sup>18,19</sup> More recently, high-energy pulsed CO<sub>2</sub> laser has shown favorable results in the treatment of BCC.<sup>20,21</sup> This pulsed system uses high fluences delivered in short pulses to minimize nonspecific thermal damage to adjacent tissue. Subsequently there is a low risk of scarring or changes in pigmentation with this laser.<sup>22,23</sup> Currently ultrapulse CO<sub>2</sub> laser is used for skin resurfacing because of its low risk of scarring. Other potential side effects include transient erythema, postinflammatory hyperpigmentation, infection, hemorrhage, and hypertrophic scarring.<sup>19,22,23</sup> The advantages of ultrapulse CO<sub>2</sub> laser treatments include precision treatment with minimal destruction of normal surrounding tissue, decreased postoperative pain, decreased recurrence, rapid and predictable treatment of many lesions, shortened healing time, bloodless field, and better cosmesis.<sup>18,20,24,25</sup> However, large nodular BCCs, with diameters greater than 10 mm, cannot reliably be removed with this method.<sup>21</sup> The deeper penetration needed to ablate larger nodular BCCs will

also result in a greater risk of delayed healing and subsequent scarring without complete removal of the tumor. However, superficial BCCs ablated to the mid-dermis or deeper had 100% clear margins.

Other studies have shown the success of ultrapulse CO<sub>2</sub> laser for the treatment of BCCs. Grobbelaar et al.<sup>24</sup> reported complete eradication of BCCs in six patients at 20 months follow-up. Krunic et al.<sup>25</sup> presented a case report showing complete eradication of large BCC plaques at 15 months follow-up with the use of ultrapulse CO<sub>2</sub> laser after microscopically controlled excision.

The three cases presented in this article lend support to the treatment of multiple, small, superficial BCCs associated with BCNS with ultrapulse CO<sub>2</sub> laser. Ultrapulse CO<sub>2</sub> laser allows for treatment of multiple BCCs in a relatively short period of time with minimal scarring. Lastly, recurrence is also minimized, as supported by the negative postoperative histology seen after MMS of the lasered areas.

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