

The cosmetic treatment of urticaria pigmentosa with Nd:YAG laser at 532 nanometers

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Summary

Background Urticaria pigmentosa is a cutaneous disorder involving infiltration of the skin with mast cells. Histologically the papillary dermis has an increased number of mast cells with an increase in basal layer pigmentation. In addition to possible systemic symptoms, patients with urticaria pigmentosa can suffer emotionally from the cosmetic nature of this skin disease.

Objective The purpose was to investigate the use of a diode-pumped Nd:YAG laser at 532 nm for the treatment of the cosmetic comorbidity of urticaria pigmentosa lesions.

Methods A 19-year-old white male with urticaria pigmentosa had multiple lesions on the dorsum of the hands and forearms. A test site on the right inner arm was treated with a DioLite™ 532 nanometer laser. Because of satisfaction with the treatment of the test site lesions, multiple lesions on the dorsal hands and forearms were also treated with the DioLite™ 532 nanometer laser.

Results There was a dramatic clinical reduction in the amount of lesions on the dorsum of the hands and forearms. The test site lesions on the right inner arm had not recurred.

Conclusion The diode-pumped Nd:YAG laser at 532 nanometers should be considered part of a dermatologist's armamentarium for the treatment of a patient's cosmetic concerns with lesions of cutaneous mastocytosis.

Keywords: laser, Nd:YAG, urticaria pigmentosa

Introduction

Urticaria pigmentosa is a cutaneous disorder involving infiltration of the skin with mast cells. The disease is mainly seen in children, but when occurring in adults there is an increased risk of associated systemic disease. The lesions present as red-brown macules, papules, and plaques in a random, generalized distribution that may form clusters. The etiology of the hyperproliferation of

mast cells is unknown; however, multiple theories have been proposed.¹ Histologically the papillary dermis is infiltrated with mast cells that cluster around blood vessels. The pigmentation of the lesions is caused by increased melanin deposition in the basal layer of the epidermis. If nodules or papules are present, the mast cells may extend through the dermis into the subcutaneous tissue. The risks identified with isolated cutaneous urticaria pigmentosa correlated to the role of excessive histamine release. The lesions, as described by Darier, become pruritic on rubbing, as well as erythematous and edematous. Other clinical signs include dermatographism, generalized pruritis, and flushing.^{2,3} Prevention of disease exacerbation can be achieved by avoiding triggering factors such as temperature, alcohol, NSAIDs, and skin friction. Symptomatic treatment

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Table 1 Therapeutic principles of urticaria pigmentosa (adapted from Brockow, 2004⁹).

Patient subgroup	Treatment
All patients	Avoidance of known trigger factors
Patients at risk for anaphylactoid reactions	Emergency kit Epinephrine (e.g., Epi-Pen IM) H1 antihistamines (e.g., diphenhydramine) Glucocorticoids (e.g., prednisolone)
Skin lesions of cutaneous mastocytosis	Encourage sunlight exposure in asymptomatic cases; UVA1 or PUVA in selected cases Topical glucocorticoids in highly symptomatic mastocytomas Surgical excision in highly symptomatic mastocytomas
Bullous lesions of cutaneous paediatric mastocytosis	Local care
Mast cell mediator release syndrome associated with cutaneous mastocytosis	Prevention of infection Glucocorticoids topically, intralesionally or orally as a bolus H1 antihistamines H2 antihistamines Cromolyn sodium UVA1 or PUVA for recalcitrant disease
Flushing and hypotensive episodes	Trial with aspirin or other NSAID (beware of intolerant patients, side effects of high doses)
Gastrointestinal disease	
Peptic ulcer disease	H2 antihistamines, omeprazole
Abdominal cramping	H2 antihistamines, cromolyn sodium, leukotriene antagonists
Diarrhea	Cromolyn sodium, omeprazole, anticholinergics, leukotriene antagonists
Malabsorption	Cromolyn sodium, glucocorticoids
Osteoporosis	Calcium supplementation, vitamin D Biphosphonates Estrogen for postmenopausal women Testosterone for men with low testosterone levels IFN- α 2b for severe osteoporosis (e.g., bone fractures)
Mastocytosis with SM-AHNMD	Treatment of SM-AHNMD IFN- α 2b Bone marrow transplantation with appropriate HLA match
Aggressive mastocytosis, mast cell leukaemia, mast cell sarcoma	IFN- α 2b Splenectomy (when hypersplenism is present) Bone marrow transplantation with appropriate HLA match Polychemotherapy Future research treatments (e.g., imatinib in patients with Asp816Val mutations)

is provided with a combination of H1 and H2 antihistamines. Other treatments include mast cells stabilizers such as disodium cromoglycate, and tricyclic antihistamines such as doxepin.¹ Topical corticosteroids have provided relief from pruritus and flushing. Psoralen and ultraviolet A phototherapy (PUVA) have provided symptomatic relief of pruritis, albeit temporary with relapses 3–6 months after therapy cessation² (Table 1). The disease is usually self-limited with lesions regressing within a few years, sometimes leaving only postinflammatory changes. Adults with urticaria pigmentosa can have malignant transformation of their disease, but this is mainly seen in patients with cutaneous and systemic symptoms.¹

In addition to systemic symptoms, patients with urticaria pigmentosa suffer from cosmetic distress. Lasers have recently become a common treatment for cosmetically sensitive conditions. The use of lasers to treat urticaria pigmentosa and telangiectasia macularis eruptiva perstans, a variant of cutaneous mastocytosis, has been shown to provide some cosmetic relief.^{4,5}

We investigated the use of a diode-pumped Nd:YAG laser (DioLite™ 532; IRIDEX, Mountain View, CA, USA) at 532 nm directed at treating lesions of urticaria pigmentosa in cosmetically sensitive areas on a young male patient. The device utilized in this article uses a high-power diode laser at 808 nm to optically pump an Nd:YAG crystal,

which produces a 1064-nm wavelength of light. This wavelength of light is then focused onto a KTP crystal to double its frequency, obtaining a 532-nm wavelength. The pulse durations typically range during treatment between 10 and 25 ms, and the fluence can range from 0.1 J/cm² to 950 J/cm².⁶ Parameters that can be adjusted by the physician are the spot size, the power, the repetition rate, and the fluence.

Case report

The patient was a 19-year-old white male university student who was clinically diagnosed with urticaria pigmentosa at 18 years of age. The patient had refused a skin biopsy to confirm the clinical diagnosis of urticaria pigmentosa and was being followed yearly for his disease. He presented to our clinic in June of 2004 for treatment of a verruca vulgaris and follow-up of his urticaria pigmentosa. Our patient denied any history of cutaneous or systemic symptoms associated with urticaria pigmentosa, including fevers, joint pains, generalized pruritis, or flushing. He had no significant past medical history and had been counseled on multiple occasions to avoid the triggering factors for his disease. On physical exam the patient had 2–4 mm brown to red macules and papules scattered over his torso and extremities. The lesions spared his head, neck, and groin. The lesions did urticate when stroked, thus a positive Darier's sign was felt to be elicited. The patient complained of mild focal pruritis at the site of the Darier's sign. Prior laboratory analyses had all been within normal limits. During this visit he admonished that his main complaint regarding his urticaria pigmentosa was the unsightly nature of the lesions on his arms and hands. He also did not enjoy avoiding alcoholic beverages, being a college student. At that visit the patient agreed to have three lesions treated on his right inner arm with the diode-pumped Nd:YAG laser at 532 nm, 27 J/cm² fluence, 700 micron spot size, 3W power, and a 5-Hz repetition rate (Figure 1). The patient was given diphenhydramine, 25 mg p.o. × 1, 30 min prior to the procedure. The three sites healed post-treatment but the patient had no systemic complaints (Figure 2). After 3 weeks the patient returned satisfied with the appearance of the test sites. The test site lesions were clinically much improved with no scarring (Figure 3). The patient once again premedicated with diphenhydramine, and treatment of multiple lesions on the dorsal hands commenced. Initially, the treatment was started at 27 J/cm² fluence, 700 micron spot size, 3W power, and a 5-Hz repetition rate, but because of immediate crusting of the lesions and fear of scarring on the dorsal hands, the fluence was decreased to 17 J/cm² to maintain a visible response without superficial crusting of the lesions.



Figure 1 Three test site lesions on right inner bicep before treatment.

The patient returned in October 2004, almost 4 months later, extremely pleased with the results. There was a dramatic clinical reduction in the amount of lesions on the dorsum of the hands. Although the patient did complain of new lesions on his torso, he again denied any cutaneous or systemic complaints associated with urticaria pigmentosa. The test site lesions on the right inner arm had not recurred (Figure 3). Again, multiple areas were treated on the bilateral forearms, inner arms, and hands with 17 to 18 J/cm² fluence, 700 micron spot size, 3W power, with a repetition rate of 5 Hz. Once again a visible response without superficial crusting was the immediate goal of treatment. At the patient's request, no follow-up biopsies were performed. The patient tolerated all treatments without any systemic complaints. No cooling device or any topical applications were used during any of the treatments.

Discussion

This is the first report of the use of a diode-pumped Nd:YAG laser at 532 nm for the treatment of the cosmetic



Figure 2 Healed test site lesions post-treatment with the diode-pumped Nd:YAG laser at 532 nm.

comorbidities of urticaria pigmentosa. Previously reported in the literature was the use of a frequency-doubled Q-switch Nd:YAG laser in the treatment of urticaria pigmentosa.⁴ The authors concluded that their results allowed a temporary cosmetic treatment for urticaria pigmentosa, one that will not treat the underlying mast cell proliferation. The patient treated with the Q-switch Nd:YAG laser had a recurrence of erythema at 9 months with a biopsy post-treatment showing a proliferation of mast cells within the dermis, but a decrease in the amount of basal layer melanin deposition.⁴

Telangiectasia macularis eruptive perstans is a rare form of mastocytosis that occurs mainly in adults, characterized by 2–6 mm red, telangiectatic, confluent macules, with ill-defined borders on an erythematous base.¹ Ellis investigated the treatment of telangiectasia macularis eruptive perstans with a 585-nm flash-pumped dye laser.⁵ This laser provided cosmetic improvement of all treated lesions without scarring but a 70% recurrence of lesions at 14 months after treatment. Again, it was concluded that the treatment failed to impact the mast cell proliferation but rather caused a reduction in the vasculature.⁵



Figure 3 Test site lesions at 4-month follow-up appointment.

We utilized a diode-pumped Nd:YAG laser at 532 nm to successfully reduce the cosmetic comorbidity of urticaria pigmentosa lesions in a cosmetically sensitive area for our patient. This laser has also shown efficacy in the treatment of facial telangiectasias,⁶ solar lentigines,⁷ and surgical and traumatic scars.⁸ A known disadvantage of the 532-nm diode-pumped Nd:YAG laser is that 532 nanometers is the wavelength at which oxyhemoglobin highly absorbs green light, at which there is also a high absorption by melanin which can interfere with the treatment of darker skin types.⁶ It also has a more limited depth of penetration caused by scattering across the dermis, compared to longer wavelengths. Burns and subsequent hyper- or hypopigmentation, with or without scarring, can be caused when overlapping pulses are delivered.⁶ However, this disadvantage of a high absorption of melanin with laser light at 532 nm can be seen as an advantage in the treatment of lesions of urticaria pigmentosa. We utilized the 532-nm diode-pumped Nd:YAG laser for its known ability to target melanin to treat the pigmentary histologic component of urticaria pigmentosa lesions (i.e., increase in basal layer hyperpigmentation).

This study is limited in that our success at follow-up has only been evaluated over a 4-month period as well as a single patient experience. Prior studies had recurrence of treated lesions at 9 and 14 months.^{4,5} We were also not able to comment on the histopathological treatment of these lesions without the opportunity for a pre- or post-treatment biopsy. Therefore, we are unable to know if the lesions we treated were postinflammatory hyperpigmentation changes of regressed urticaria pigmentosa lesions. It is important to note that the clinical diagnosis of urticaria pigmentosa was confirmed by two of the authors (EJ and DAG) on multiple visits (DAG only), and the lesions were not felt to be postinflammatory hyperpigmentation.

In total, the initial results of our treatments were interpreted by our patient as a cosmetic success, even if it is felt that we are not treating the underlying cause of the disease. The diode-pumped Nd:YAG laser at 532 nanometers should be considered part of a dermatologist's armamentarium for the treatment of a patient's cosmetic concerns with lesions of cutaneous mastocytosis.

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