

Nodular Amyloidosis Treated with a Pulsed Dye Laser

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BACKGROUND. Nodular amyloidosis is a rare form of primary localized cutaneous amyloidosis which is characterized by single or multiple nodules located on the extremities, trunk, genitalia, or face.

OBJECTIVE. To determine the clinical and histologic response of nodular amyloidosis to pulsed dye laser treatment.

METHODS. Biopsy-proven amyloid nodules were treated with a 585-nm pulsed dye laser (average fluence 5.25 J/cm²; 10mm spot) at 6- to 8-week time intervals. Clinical and histologic examination of laser-irradiated nodules were performed before and 6 weeks after the final laser treatment.

RESULTS. Clinical improvement in the color, size, and pliability of nodules was noted and maintained for 6 months. Histologic examination revealed decreased inflammation and improvement in dermal collagen after laser irradiation.

CONCLUSIONS. Since amyloid fibrils may be formed in association with dermatan sulfate—an essential matrix component in collagen fiber formation, it is postulated that the improvement seen in amyloid nodules after pulsed dye laser treatment may be attributed to a mechanism similar to that seen with hypertrophic scars.

AMYLOIDOSIS IS characterized by the deposition of extracellular proteinaceous material that possesses distinctive staining and ultrastructural properties. This relatively rare condition is classified into primary or idiopathic and secondary forms, and may be systemic or localized. Primary localized cutaneous amyloidosis presents clinically with significant deposition of amyloid that is limited to the skin without any underlying systemic disease. Three different forms have been identified: macular, lichen, and nodular. Nodular amyloidosis is a rare form of primary localized cutaneous amyloidosis and presents as single or multiple nodules found commonly on the extremities, trunk, genitalia, or face.¹

Current therapeutic modalities used for nodular amyloidosis include excision, intralesional corticosteroid injections, electrodesiccation and curettage, dermabrasion, and carbon dioxide (CO₂) laser irradiation.²⁻⁵ We report a case of primary localized nodular amyloidosis successfully treated with the 585 nm flashlamp-pumped long-pulse dye laser.

Case Report

A 56-year old man presented with a 4 cm × 5 cm grouping of erythematous, indurated, non-pruritic nodules on his chin and submental neck. The lesions had been present for 6 years and a tissue biopsy and laboratory work-up confirmed the diagnosis of nodular amyloid without systemic involvement (Figure 1).

He subsequently received treatment with a series of intralesional steroid injections which resulted in mini-

mal reduction of lesional size. When intralesional injections showed no further benefit, the patient was referred for possible pulsed dye laser therapy.

A 1 cm × 1 cm test area of a chin nodule was irradiated with a 585 nm flashlamp-pumped long-pulse (1.5 ms) dye laser (ScleroPlus, Candela Laser Corp., Wayland, MA) using a 10 mm spot size at a fluence of 5.0 J/cm². Laser-treated skin showed the expected immediate purpuric tissue response. Examination 8 weeks after the test treatment revealed an improvement in lesional color and pliability of the treated area. Laser therapy of the entire lesion was then performed at 5.0 J/cm². Three laser sessions with fluences ranging 5.0–5.5 J/cm² (average = 5.25 J/cm²; 10 mm spot) were subsequently delivered at 6 week intervals. Postoperative wound care consisted of daily application of topical antibiotic ointment and a non-stick bandage until purpura resolved (5–7 days).

Subjective improvement in lesional color, size, and pliability was appreciated by both the patient and physicians at the 6 week follow-up visit (Figures 2 and 3). At that time, histologic examination of the laser-irradiated nodules revealed decreased inflammation and an improvement in the dermal collagen (Figure 4). Clinical improvement was maintained 6 months after the final laser session.

Discussion

While the exact pathogenesis of localized nodular amyloidosis remains unknown, several therapeutic modalities have been employed in its management with variable success. Shave excision, electrodesiccation, and curettage afforded temporary cosmetic im-

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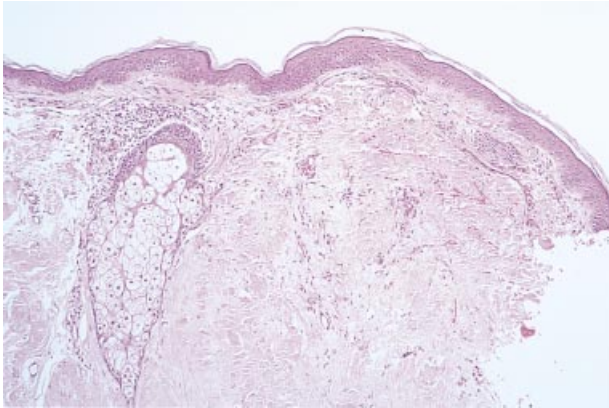


Figure 1. Epidermal atrophy with deposits of amphophilic homogeneous material in the upper three-quarters of the dermis and mild to moderate perivascular mononuclear infiltrate. (Hematoxylin-eosin, $\times 25$).

provement.³ Shave excision followed by superficial dermabrasion has also been used, but atrophy developed.⁴ Carbon dioxide laser vaporization yielded good cosmetic results despite incomplete eradication of amyloid deposits and prolonged healing.⁵

The benefits of pulsed dye laser treatment include its relative ease of application with an uncomplicated postoperative course and minimal risk of scarring or other untoward sequelae. However, the necessity of multiple treatment sessions in order to obtain the desired clinical effect is a clear disadvantage, leading to increased expense to the patient.

The mechanism of action of this vascular-specific laser in the treatment of nodular amyloidosis is unknown. The fact that the 585 nm pulsed dye laser emits energy that is preferentially absorbed by oxyhemoglobin-containing cutaneous vessels, at a pulse duration shorter than the thermal relaxation time of



Figure 2. Multiple grouped, erythematous papules and nodules on the chin and submental neck prior to laser treatment.

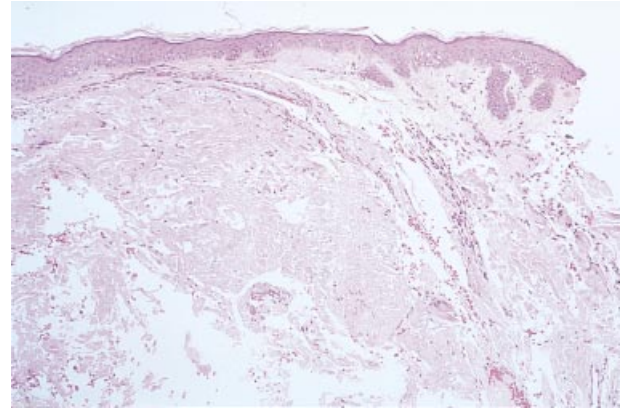


Figure 4. After pulsed dye laser irradiation, amyloid deposition and dermal inflammation are reduced with increased fibrillar collagen pattern (Hematoxylin-eosin, $\times 25$).

small- to medium-size blood vessels, enables the effective treatment of vascular lesions such as port-wine stains and hemangiomas with minimal risk of scarring from nonspecific tissue damage.^{6,7} In the same vein, it is possible that specific injury to the cutaneous blood vessels depletes the amyloid nodule of plasma cells and macrophages presumed to be responsible for the local accumulation of amyloid deposits.

The 585 nm pulsed dye laser has also been shown to significantly improve hypertrophic scar color, height, and pliability after an average of two laser sessions.⁸⁻¹⁰ Decreased microvascular perfusion, superheating of collagen fibers, and histamine-related activity on fibroblasts have all been proposed as possible explanations of the pulsed dye laser's effect on scar collagen.^{11,12}

An increased amount of glycosaminoglycans (GAGs) predominantly composed of dermatan sulfate have been



Figure 3. Marked decrease in lesional size and color 2 months after 4 treatment sessions using the 585 nm long-pulse dye laser. No recurrence or worsening of lesions were observed for 6 months following the final treatment session.

extracted in primary localized cutaneous nodular amyloidosis. In light of this finding, it was hypothesized that amyloid fibrils in nodular amyloidosis may be formed in association with dermatan sulfate derived from abnormal glycosaminoglycan metabolism.¹³ Since dermatan sulfate is an essential matrix component in collagen fiber formation, it is possible that the 585 nm pulsed dye laser improves amyloid nodules using a mechanism similar to that seen with hypertrophic scars.¹⁴

While good clinical response of amyloid nodules has been shown in this report, the mechanism of action of the 585 nm pulsed dye laser in the treatment of primary localized nodular amyloidosis remains speculative. A better understanding of the pathogenesis of this rare skin condition and further studies using pulsed dye and/or other laser technology are needed to determine the basis of the observed laser-tissue interaction.

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