

# Treatment of Necrobiosis Lipoidica with 595 nm Pulsed Dye Laser – A Case Report

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**Abstract:** *Introduction:* Necrobiosis Lipoidica (NL) had no adequate treatment. Some case has been treated by different vascular lasers. Third generation pulsed dye lasers with a wavelength of 595 nm has been attempted. Their selectively destroys shallower ectatic blood vessels.

*Material and Methods:* We used a 595 nm, Dermobeam 2000<sup>®</sup> laser (manufactured by Deka© MELA Calenzano, Italy), with a dynamic skin cooling system (Spray). The parameters were 7 mm spot, 6 J/cm<sup>2</sup>, 0.5 Hz, and 0.5 msec.

*Case Report:* A young Caucasian girl was diagnosed at 9 years of age (January 2002) with Necrobiosis Lipoidica over the entire pretibial region of both legs. She had been suffering from type 1 diabetes mellitus for 4 years. She received 3 insulin injections per day.

*Results:* A long-standing skin breakdown of the left leg was observed which required two months' dressing with hydrocolloids. A cosmetic improvement was obtained after this single treatment, with a decrease in erythema and telangiectasias, and stabilization in terms of progression. However, 13 months after treatment, an extension of the peripheral telangiectasia and erythema border of the lesions was observed.

*Discussion:* Laser therapy is proven useful to treat Necrobiosis Lipoidica only in rare cases. It is possible to treat telangiectasias, however there is a risk of ulceration.

**Keywords:** Necrobiosis lipoidica, pulsed dye laser, Infancy.

## INTRODUCTION

Necrobiosis Lipoidica is very rare in childhood. It is an idiopathic, asymptomatic, chronic skin disease often associated with diabetes mellitus, but not pathognomonic of the same [1]. In children it may follow diagnosis of diabetes mellitus but may also precede it [2]. Necrobiosis Lipoidica is linked with diabetes mellitus in 80% of cases, but only 0.3% of all diabetics with type 1 (insulin-dependent) diabetes are affected. It is more commonly seen in women than men (two to three times), and in adults than in children (average age of onset, 30 years) [3]. The lesions are usually localized pretibially, but may be found elsewhere on the body: scalp, face, limbs, or trunk. Primary vascular disturbances are considered pathogenetic for Necrobiosis Lipoidica [4]. This is an inflammatory microangiopathy, with production of anticollagen antibodies and defective neutrophil migration. Children and adult diabetics with Necrobiosis Lipoidica are at a higher risk of nephropathy and retinopathy [5]. This condition is generally independent of metabolic control quality [1, 2].

All dye lasers permit treatment of port-wine stains, which are classic indications for the dye laser [6], while Necrobiosis Lipoidica is hardly ever treated [7, 8]. Third generation

dye lasers emit light with a wavelength of 595 nm, and offer best performance for treating Necrobiosis Lipoidica. Treatment is not always recommended as it is not always capable of preventing complications (spontaneous ulceration, infection, tetanus etc.) or cosmetic disfigurement (cover mark application could be a solution). Treatment is required if the lesion has an active expanding edge, or develops surface ulceration. Different treatment methods have been proposed for Necrobiosis Lipoidica Diabeticorum, however clinical response is unpredictable. All active therapeutic methods have a substantial risk of side-effects: local therapies include class IV local corticosteroids, or intralesional steroids, carbon dioxide snow on the periphery of the lesions with an ulceration risk, and liquid nitrogen [1, 2]. To this date, Tacrolimus topic (FK 506 ointment) has also been used with best local result without any side effects. Surgery is limited to patients in whom lesions are old and not in progress, but this is not the case with children. General treatments using low-dose acetylsalicylic acid have proven to be non-effective for Necrobiosis Lipoidica (4), likewise a combination of aspirin and dipyridamole [9].

The described investigation of this single case study, was to evaluate the usefulness of pulsed dye laser for treatment of a 9-cm Necrobiosis Lipoidica on front side of a leg of a diabetic child.

However, there have been no reports of treatment with third generation pulsed dye laser (wavelength of 595 nm) in pediatric cases of Necrobiosis Lipoidica [7, 8].

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## MATERIALS AND METHODS

### Patient

A 9-year old Caucasian girl was examined by a pediatric endocrinologist (January 2002) for dermatological changes on both legs. She had been suffering from type 1 diabetes mellitus for 4 years (March 1997), since she was 5 years old. She had no familial history of diabetes mellitus or autoimmune disease. She received 3 insulin injections per day and her mean glycosylated hemoglobin level was  $7\% \pm 1$ , which was within limits (the norm for a diabetic child is 6-8%). There was no persistent microalbuminuria, or glycosuria on the urinalysis, no signs of peripheral neuropathy upon neurological examination, or retinopathy upon ophthalmological examination. There was no other concomitant medication. The head, ears, nose and throat, lung, heart, and abdominal examinations were normal. A well-defined erythematous papule had first appeared bilaterally on the pretibial area when she was 8 years old. Afterwards, the lesions slowly enlarged causing a plaque which was slightly depressed in the center. The entire pretibial region of the two legs was affected at the date of examination (Fig. 1). The plaque was well-defined with a shiny atrophic surface, an active irregular border that remained erythematous, and a center that was telangiectatic and yellow (due to the depositing of lipids). She had diminished sensation in all lesions, compared with the rest of the legs. She did not respond to either topical hydrocortisone butyrate 0.1%, or betamethasone valerate 0.1%, and her lesions had been dressed with hydrocolloids for 6 months. No histological examination was performed. Photographs were taken under standardized conditions before and after treatment.



Fig. (1). Before treatment: left leg.

### Laser Therapy

We used a 595 nm, Dermobeam 2000<sup>®</sup> laser (manufactured by Deka<sup>®</sup> MELA Calenzano, Italy), associated with a skin cooling system (Spray, manufactured by Deka<sup>®</sup> MELA Calenzano, Italy) [5]. A spot test was made in a 1 cm<sup>2</sup> area at the periphery of the lesions, with 6.0 J/cm<sup>2</sup> energy fluence without any side effects. This energy fluence was selected after a 2-month postoperative evaluation. The treatment was made on necrobiosis lipoidica area and 5 mm around the same. One passage was performed with a 10% overlap. Laser energy was delivered to the skin through an optical fiber and

a lens which focused the beam. The spot size was 7 mm and the energy density (or fluence) was 6 J/cm<sup>2</sup>. This was purpuragenic fluence. The repetition rate was 0.5 Hz. We chose pulse duration of 0.5 ms to limit thermal damages. The pressurized gas (tetrafluoroethane C<sub>2</sub>H<sub>2</sub>F<sub>4</sub>) was in a frozen bottle. The SmartSpray Cooling system parameters were: freezing, flood, duration, and advance. The spray pulse length was 30%. The delay (advance or anticipation) was 15 ms before and 15 ms after the laser pulse. This allowed for a safe delivery of higher energy fluences by restricting the cooling to the epidermis, while leaving vessel temperature unchanged. The resulting anesthetic effect limits the need for additional topical, local or general anesthetic [10]. Generally, 10 to 30 ms are necessary prior to each laser pulse. This epidermal cooling minimizes risks of adverse effects, such as hyperpigmentation (23% without the cooling method), hypopigmentation, and scars [6, 10].

## RESULTS

A test was made in an upper area of necrobiosis lipoidica on the right leg, with a decrease of telangiectasias and erythema after the two-month follow up. Just after treatment a purpuric appearance was observed (Fig. 2). There was a very deep ulceration with surinfection (Fig. 3). A long-standing skin breakdown, only of the left leg one week after laser session, required two months' dressing with hydrocolloids. An improvement was noted on the two legs after this single treatment. The lesion showed a major color improvement at the 6-month follow up. A cosmetic improvement was achieved, with a decrease of erythema and significant telangiectasias on the edges and stabilization in terms of progression (size), with no modification of atrophy or pigmentary changes at the center of pretibial necrobiosis lipoidica plaque (Figs. 4a,b). But we have some erosions or superficial ulcerations centrally. At 2 years follow up however, an extension of the lesions was observed, with a relapse of peripheral telangiectasis and erythema border (Fig. 5).



Fig. (2). Purpuric appearance just after treatment: left leg.

## DISCUSSION

The first report of laser being used in treatment of necrobiosis lipoidica in early infancy involved the use of an argon laser (wavelength:  $\lambda=488$  and 514 nm). The pulsed dye laser is not effective on skin atrophy and hypopigmentation [7, 8].



**Fig. (3).** Long-standing skin breakdown, and deep ulceration with surinfection of the right leg one week after laser session.

(a)



(b)



**Fig. (4).** Left leg (a), right leg (b) decrease of erythema and telangiectasia, and stabilization in terms of progression (size), 2 months after laser treatment.

The only objective measure of resolution that improved with pulsed dye laser treatment was necrobiosis lipoidica redness. Therefore at this time, pulsed dye laser 595 nm treatment in uncomplicated necrobiosis lipoidica seems to be no more

efficacious than a wait-and-see policy. The 585 nm flashlamp-pumped pulsed dye laser was the chosen therapy; nevertheless it may give rise to complications: mainly ulceration and infection. The double-frequency Nd:YAG laser could be recommended in the progression phase of necrobiosis lipoidica in order to optimize the cosmetic appearance but with pain and a burning risk. For young children, we prefer the 595 nm flashlamp-pumped pulsed dye laser with a low incidence of side effects and pain as a result of the wavelength and dynamic skin cooling system (Spray). At present, however, the 595-nm flashlamp-pumped pulsed dye laser appears to show no advantage over the second generation 585 nm laser. Perhaps, the methods we used here may not have been ideal. Did the cryogen spray contribute to ulcerations or protect the lesion from further injury? We don't think that the cryogen spray alone can contribute to the improvement. Treatment with 10% overlap, could have contributed to the complications.



**Fig. (5).** Erosions and superficial ulcerations centrally at 2 years, extension, relapse of the peripheral telangiectasia and erythema border.

Only two case treated by pulsed dye laser has been reported. A 23-year-old woman with long-standing insulin dependent diabetes suffered from necrobiosis lipoidica [8]. She was particularly troubled by the telangiectatic element of the lesion and therefore underwent trial treatment with a pulsed dye laser 585-nm wavelength. At low fluences ( $6 \text{ J/cm}^2$ ; 5-mm spot size, and 0,5 ms pulse duration) a minimal therapeutic effect was achieved, and at higher fluences, skin breakdown occurred. This was resolved through conservative management. For this reason, a spot test should always be made at different energy fluences: 6.0, 6.5 and  $7.0 \text{ J/cm}^2$ ; with the optimal energy fluence being selected after a 2-month postoperative evaluation [7]. The patient received three treatment sessions with a fluence of  $6.5 \text{ J/cm}^2$ , 585-nm wavelength pulsed dye laser, 5-mm spot size, and 0,45 ms pulse duration at 8-week intervals. The patient was given routine skin care advice with emollient cream and sunscreen until the following session. Overall cosmetic improvement was achieved, with a decrease in erythema and telangiectasia, and stabilization in terms of progression (size)

in the left half of the lesion, with no modification of atrophy or pigmentary changes. The right upper quadrant of the lesion showed an erythematous peripheral halo with minimal reduction in the erythema and telangiectasia, and moderate size increase.

The beam limited the depth of penetration which did not exceed 0.7 mm [6], but is still sufficient in necrobiosis lipoidica to give rise to significant side effects. Atrophy is associated with ulceration which is very slow to heal. Ulceration is initially treated with regular dressings, but in the case of non-healing ulcers skin grafting may be required.

## CONCLUSION

In conclusion, the 595 nm flashlamp-pumped pulsed dye laser with contact cryotherapy is not an effective method in treatment of superficial necrobiosis lipoidica in infancy due to risks of side effects. There are probably even higher risks and contraindications with ulcerated necrobiosis lipoidica. Pulsed dye laser may only improve the telangiectasia and erythematous component of necrobiosis lipoidica. It therefore appears that caution is necessary when attempting to treat necrobiosis lipoidica with laser. A spot test is always recommended which must be performed on a border and central area in order to evaluate ulceration risks. We recommend the use of a collagen remodeling pulsed dye laser, which appears to be a more efficacious option. The 585 nm collagen remodeling, double flashlamp excited pumped dye laser has a spot size with a 5 mm diameter, an energy density of from 2 to 4 J/cm<sup>2</sup>, and a short pulse duration of 250 µsec. The advantage of a collagen remodeling pulsed dye laser is the absence of pain, due to its short pulse duration (half that

of a normal pulsed dye laser), and the use of low fluence (less than 4 J/cm<sup>2</sup>), which probably limits a risk of ulceration.

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