Nodular Classic Kaposi's Sarcoma Treated With Neodymium-Doped Yttrium Aluminum Garnet Laser Delivered Through a Tilted Angle: Outcome and 12-Month Follow Up

Maria Rita Nasca, MD PhD, Ivano Luppino, MD, Alessio Spurio Catena, MD, and Giuseppe Micali, MD*
Dermatology Clinic, University of Catania, Catania, Italy

Background and Objectives: Classic Kaposi's sarcoma (KS) is a multifocal angioproliferative disorder with a long and indolent course typically affecting the lower extremities of elderly men. Multiple nodules with a rapid growth may sometimes develop, causing pain, bleeding, and discomfort on walking. In such cases, immediate intervention using different methods, including laser therapy, is advisable. We report our experience in classic KS patients with the use of neodymium-doped yttrium aluminum garnet (Nd:YAG) laser delivered through a tilted angle.

Study Design/Materials and Methods: A total of 81 KS nodules (0.5–3 cm size) located in the feet or lower limbs of nine patients (mean age: 78.8 years; age range: 64–86 years) were selected for treatment with Nd:YAG laser (5–7 mm spot, 140–200 J/cm^2 fluence, 5 ms triple pulse with 10 ms delay). The laser beam was delivered at the periphery of each nodule using a tilted angle of 30° to 60° according to lesion size in order to better target the feeding vessels located in the inner and basal depth of the lesion and minimize tissue damage. The treatment outcome was evaluated by clinical photograph, videodermatoscopy, and ultrasound scanning performed before and after treatment, and at each monthly follow-up visit.

Results: All treated patients showed full recovery, with negligible scarring, no residual hyperpigmentation, and complete regression of pain. Treatment discomfort was minimal and use of topical anesthetics was not needed. No recurrences were observed at 12-month follow up.

Conclusions: Long-pulse Nd:YAG laser delivered using a tilted angle is a fast, easy, effective, comfortable, and safe treatment option available to promptly shrink bulky, painful, or bleeding nodules with minimal discomfort and gives excellent functional and cosmetic results. Lasers Surg. Med. © 2020 Wiley Periodicals, Inc.

Key words: classic Kaposi's sarcoma; laser treatment; Nd:YAG

INTRODUCTION

Classic Kaposi's sarcoma (KS) is a multifocal angioproliferative disorder associated with herpes virus 8 (HSV8) infection, not uncommon in the Mediterranean area. The disease usually runs a long indolent course, with lymphatic edema, vascular plaques, and nodules relentlessly developing mostly on the extremities of elderly men, who eventually experience visceral involvement in the later stages. Patients are advised to undergo careful periodical follow-up visits in order to promptly switch from a watchful waiting to an active management whenever necessary and required. Aggressive treatment such as systemic chemotherapy usually required for rapidly evolving KS, is better avoided in the elderly and frail with early stage classic KS, unless a fast progression to worsening is observed. Elastocompression represents an effective measure to control the progression of peripheral lymphedema and the new development of nodules and plaques in the lower extremities. Such lesions are often asymptomatic but sometimes may cause bothersome bleeding and occasionally can become painful causing discomfort or hampering deambulation. In such cases, immediate intervention may be required using either laser therapy or, alternatively, chemical cauterization with silver nitrate, curettage followed by oxygen peroxide application, surgical excision, cryotherapy, radiation therapy, photodynamic therapy, and intralesional infiltration of chemotherapeutic agents [1–4]. We report our experience with the use of neodymium-doped yttrium aluminum garnet (Nd:YAG) laser delivered through a tilted angle for the management of multiple nodular symptomatic nodules located in the lower extremities of KS patients not eligible for a systemic treatment.

MATERIALS AND METHODS

A total of 81 lesions out of 9 enrolled patients with biopsy-proven classic KS were selected for treatment.

Conflict of Interest Disclosures: All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none were reported.
*Correspondence to: Giuseppe Micali, MD, Dermatology Clinic, University of Catania, A.O.U. Policlinico-Vittorio Emanuele, P.O. G. Rodolico, Via S. Sofia 78, Catania I-95123, Italy.
E-mail: cldermct@gmail.com
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Inclusion criteria were the presence of single or multiple nodules ranging in size from 0.5 to 3 cm located in the feet or lower limbs. Exclusion criteria were any additional regional or systemic treatment performed concurrently or in the past 3 months for KS management. All patients signed an informed consent before entering the study, which had been approved by local institutional review board. Clinical photograph, videodermatoscopy, and ultrasound scanning were performed before treatment and at each follow-up visit. Lesions located in plantar areas and deeply encased under hyperkeratotic skin were pretreated with topical keratolytics containing 20% salicylic acid for 2 weeks before laser therapy in order to facilitate dermal vessel targeting. Each lesion underwent a single Nd:YAG laser treatment session (Synchro FT®; DEKA-Mela, Calenzano, FI, Italy) focused as a 5–7 mm spot (depending on lesion size), with a fluence of 140–200 J/cm^2 and a triple pulse duration of 5 milliseconds each with a delay of 10 milliseconds. This low fluence enhanced tolerability and allowed the treatment without anesthetic agents. Each lesion was treated circumferentially at its periphery in four opposite directions fixed at 90°, with the fiber obliquely and tangentially oriented using a tilted angle of 30° to 60° according to lesion size, in order to optimize the selective targeting of deeper feeding vessels located in the inner and basal depth of the lesion and minimize damage to the surrounding healthy tissue (Fig. 1). Each patient was reevaluated at a 4-week follow up. At that time, if the nodule had not turned into a brownish crust and evidence of vascular perfusion was still detectable, a new laser session was performed with the same modalities.

RESULTS

Demographics of treated patients are summarized in Table 1. Patients underwent treatment of at least two lesions with a maximum of 36 lesions. Nodules ranged in size from 0.5 to 3 cm and were in most cases located in the feet or lower legs. One single session showed to be effective, with only two patients affected by more deeply encased nodules requiring two treatments. Treatment discomfort was minimal, and use of topical anesthetics was not needed. All patients reported full recovery and complete regression of pain following disappearance of the symptomatic nodules. In all cases, excellent results with minimal scarring and no residual hyperpigmentation were obtained (Figs. 2–4). In one patient a reduction of lymphedema was also observed. At 12-month follow up, all patients showed no recurrences. Two patients, who eventually experienced disease progression, with rapid onset of new cutaneous and visceral lesions, were sent to oncology referral.

DISCUSSION

Treatment of classic KS includes several therapeutic options; however, none provides a definitive cure, and the major goal of KS therapy remains symptom palliation in order to improve quality of life. When classic KS asymptomatic lesions are restricted to the extremities, if disease progression is slow and functional activity is not impaired, prescription of tailored elastic compression stockings with periodic follow-up visits are usually the golden rule to prevent the onset of new lesions. Localized and/or symptomatic lesions may be approached with targeted treatments such as topical 9-*cis*-retinoic acid, intralesional vinblastine injections, cryotherapy, laser therapy, radiation therapy, and surgical excision [5,6]. However, topical 9-*cis*-retinoic acid has limited efficacy and is not available in many countries. Also, low dose intralesional vinblastine and radiation therapy, though effective, may raise safety concerns and may be not readily feasible in an office outpatient setting. In addition, surgical excision requires local anesthetic injection and may cause scarring and, unless histological examination is necessary, should be better avoided. Laser therapy, instead, has shown in skilled hands to promptly shrink

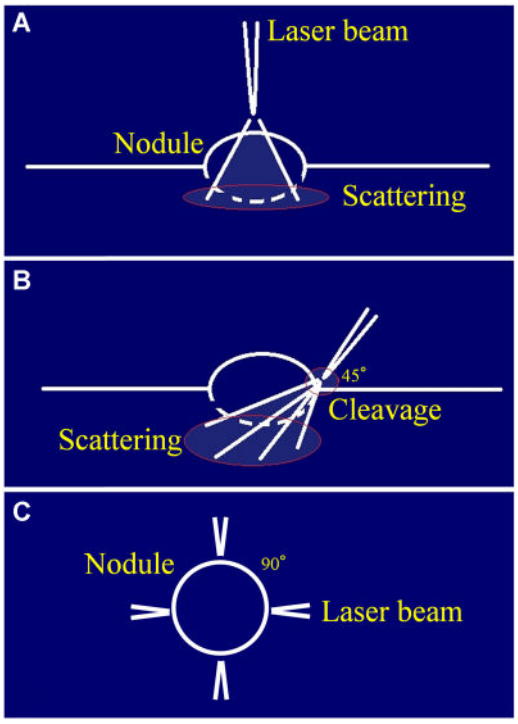

Fig. 1. Description of neodymium-doped yttrium aluminum garnet (Nd:YAG) laser therapy delivered through a tilted angle. **(A)** Traditional approach with laser beam centrally delivered at 90°: Scattering of photonic energy amplifies superficial tissue damage and provides less proficient targeting of deep lesional tissue. **(B)** New technique with laser beam delivered tangentially through an angle of ~45°: Better focusing of photonic energy minimizes superficial tissue damage and allows targeted clotting of deeply located feeding vessels; manual adjustment of tilted laser beam during the procedure according to lesion size (~30° for smaller lesions and ~60° for larger lesions) may address optimal targeting. **(C)** New technique with laser beam delivered tangentially at ~45° at the periphery of the lesion: Top view showing circumferential application of the laser beam in four opposite directions fixed at 90°.

TABLE 1. Demographic data and clinical presentation of nine patients (mean age: 78.8 years; age range: 64–86 years) with classic Kaposi's sarcoma nodular lesions treated with neodymium-doped yttrium aluminum garnet (Nd:YAG) laser therapy delivered through a tilted angle

Patient no.	Age (years)/ gender	Number of lesions	Location	Disease duration (years)	Number of treatment sessions
1	83/M	4	Left ankle, left foot arch, right sole	2	1
2	84/F	6	Left heel, left 1st toe	1	2
3	82/M	2	Left lateral malleolus, right medial malleolus	1	1
4	83/M	36	Left and right leg, left and right knee	3	2
5	84/M	9	Left and right leg	2	1
6	86/F	17	Left and right foot (multiple sites), left and right knee	2	
7	80/M	2	Left elbow	1	1
8	64/M	3	Left foot arch	0.5	1
9	64/M	2	Right foot	0.5	1

bulky, painful, or bleeding nodules with excellent functional and cosmetic results [7,8].

Intravascular clotting induced by Nd:YAG laser therapy yields a prompt remedy for bleeding and painful nodules with no bleeding or tissue damage, and it is especially valuable for lesions located in skin areas, such as the plantar skin or overlying bony prominences, where tissue repair is often difficult. The potential benefits of such treatment in the management of KS have been confirmed by several studies, not only with a positive outcome in the cosmetic management of disfiguring lesions located in sensitive areas in HIV-related disease [8], but also showing a consistent efficacy in relieving symptoms of nodular classic KS [7].

One of the limitations of laser therapy in KS that may be considered is its high rate of recurrences, resulting

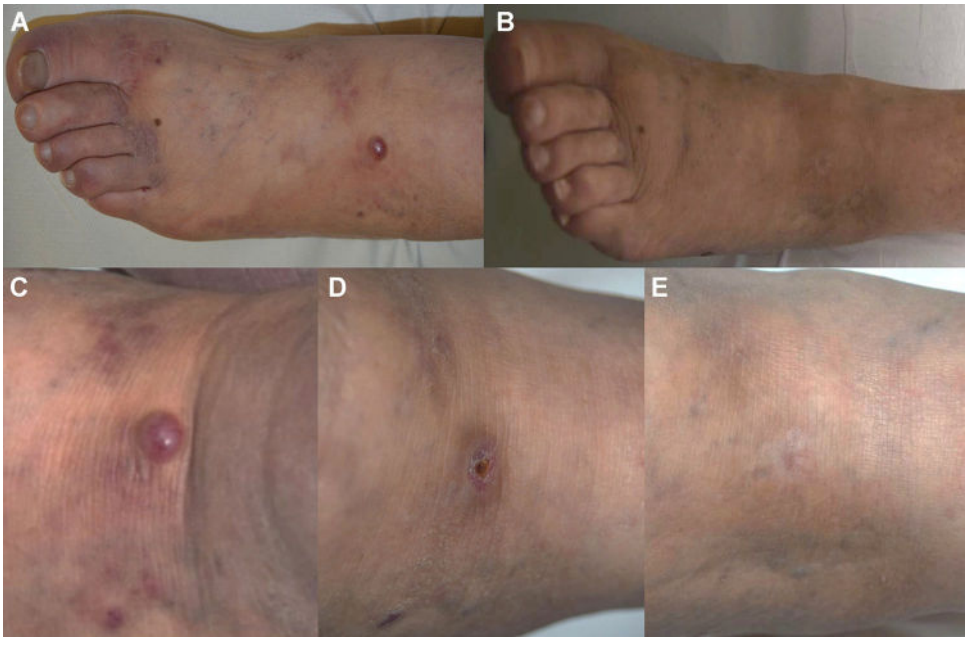

Fig. 2. Treatment outcome of the lesion located in the left ankle in Patient #1. Clinical features at baseline (**A**) and 4 months after treatment. (**B**) Complete recovery of treated lesion with negligible scarring and concurrent improvement of distal lymphatic edema; close-up of the same lesion at baseline (**C**), 1 month (**D**), and 4 months (**E**) after treatment.

Fig. 3. Treatment outcome of two lesions located in the left plantar arch in patient #1. Clinical features at baseline (**A**) and 4 months after treatment (**B**); close-up of the larger of the two lesions at baseline (**C**), 1 month (**D**), and 4 months (**E**) after treatment.

from an inadequate deep dermal penetration of the laser beam. On the other hand, the long-pulse Nd:YAG laser, with its 1,064 nm wavelength and its high scattering, is capable of substantial photocoagulative damage to surrounding tissues depending upon how it is applied. Pretreatment with keratolytics, when needed to reduce epithelial thickness, and simple technical strategies, such as laser application using a tilted angle, may heighten treatment efficacy by focusing the beam on a cleavage level extending just below the nodules, thus maximizing the results by targeting deep feeding vessels. In addition, triple pulse sequencing may further boost efficacy as a result of a more controlled heat dissipation into deeper tissues.

In our study, none of our patients showed significant scarring in the treated areas. In addition, all treated patients reported a consistent and long-term improvement of their quality of life after resuming their walking ability and daily activities. Interestingly, a few months after laser treatment, a consistent reduction of lymphedema was also observed in one case, a finding that has previously been reported [7] and that so far remains unexplained. At a 12-month follow up, four patients were still in complete remission, with no local recurrence of treated nodules.

Our findings suggest that Nd:YAG laser treatment may yield long-lasting results and provide considerable benefit in patients with stable disease, providing a definitive cure

Fig. 4. Treatment outcome of the lesion located in the first left toe of patient #2. Clinical features at baseline (**A**), 1 month (**B**), and 4 months (**C**) after treatment.

for bothering nodules with rapid overgrowth and/or located in sensitive areas.

CONCLUSIONS

When using a tilted angle, long-pulse Nd:YAG laser is a fast, easy, effective, comfortable, and safe treatment option with no serious complications. Its use is valuable, especially in KS patients with symptomatic local disease and a slow rate of progression, where other treatment options may be relatively troublesome.

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