ORIGINAL ARTICLE

Treatment of hemangiomas in children using an Nd – YAG laser in conjunction with ice cooling of the epidermis. Techniques and results

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Abstract

Background: Hemangiomas are the most common type of congenital anomaly in childhood. Although many resolve spontaneously, intervention is required when their growth could damage vital adjacent structures. Various therapeutic approaches to childhood hemangiomas with different types of laser have been described previously. **Objective**: To determine whether the cooling of the epidermis during irradiation of hemangiomas with an Nd–YAG laser prevents thermal damage and decreases the number of sessions required treat of these lesions. **Setting**: Teaching hospital, Greece. **Patients and Methods**: Between 1994 and 2001, 110 patients aged 3 months to 4 years, with cutaneous hemangiomas were treated with an Nd – YAG laser. The lesion was cooled with ice, prior to, during and after the irradiation. During each session the laser beam passed through the pieces of ice. The laser power was between 35-45 Watts with a pulse length of 2-10 seconds. **Results**: After 6 months of follow-up, from the first session of laser treatment, total resolution was obtained in 80 (72.7%) patients. In the remaining 30 (27.3%) patients, treatment was repeated due to insufficient size reduction of the lesion. Complications were seen in nine patients. One patient had postoperative bleeding which stopped spontaneously, while atrophic scars occurred in six (5.5%) patients, and hypertrophic scars in two (1.8%) patients. **Conclusions**: Nd – YAG laser irradiation in conjunction with ice protection of the epidermis produces good cosmetic results for the treatment of cutaneous hemangiomas in children, and decrease the number of sessions for treatment of these lesions

Key words: Children, Hemangioma, Nd – YAG Laser

Introduction

A hemangioma is a benign congenital vascular malformation and the most common type of tumor in infancy. It has been reported that 1.1 - 2.6% of newborns suffer from this vascular lesion, and this number increases to 10.1% by 12 months of age [1]. They are usually absent at birth but appear and enlarge during the first 6 months of life, and often continue to grow until 12 months of age. After this proliferative phase, slow involution follows in most cases, with almost complete disappearance by 5^{th}-10^{th} years of age [2,3,4]. However, in 10 - 20% of cases with cutaneous hemangioma, complications appear such as ulceration and bleeding, and the involvement of important functions such as vision, respiration, hearing, or feeding. These complications, along with cosmetic disfigurement, are a clear indication for treatment and should immediately lead to a suitable therapy [4,5,6,7,8]. Although laser irradiation has been used to induce photo-thermal destruction of hemangiomas, thermal damage to the epidermis remains a concern [6,9,10]. The objective of this study was to determine the efficacy of combining Nd–YAG photocoagulation with the protective use of ice for definitive treatment of hemangiomas in the pediatric population.

Patients and Methods

From January 1993 to December 2001, 110 patients with cutaneous hemangiomas were treated in our department with an Nd–YAG laser. Eight-two (74.5%) were female, and 28 (25.5%) were male, and their ages ranged from 3 months to 4 years with a mean age of 9-months. In all cases the diagnosis of hemangiomas was confirmed clinically. The anatomic location of the hemangiomas varied, such as on the cheek, flank, scalp, torso, shoulder, lip, forehead, eyelid, eyebrow, and nose. Preoperative evaluation in all 110 patients included medical history, a complete physical examination, and blood count (i.e., hematocrit, and platelet count). The indications for treatment were as follows: in 72 (65.5%) patients the hemangioma had affected a vital function such as, vision, respiration, hearing, or feeding; in 25 (22,.7%) patients there was recurrent ulceration and hemorrhage; and in 13 (11.8%) patients significant cosmetic disfigurement and psychological problems related to appearance were present. Each hemangiomas was categorized after measuring its length, width, and height. On the basis of area (length x width) they were divided into three categories: (a) 1 to 4 cm^2, (b) 4 to 10 cm^2, and (c) greater than 10 cm^2; on the basis of height was divided into three

categories: (A) 1 to 2 cm, (B) 2 to 3 cm, and (C) greater than 3 cm. Table 1 shows the patient allocation on these base.

All patients were treated under general anesthesia. Our technique consists of the following procedures in: The surface of the lesion was cooled by application of broken pieces of ice for, 10 – 15 minutes prior to irradiation with an Nd–YAG laser. The laser-induced coagulation was performed in a repetitive manner with the hand-piece, of irradiation delivery system, being held perpendicular to the skin with the lesion at its focal point. The laser beam was guided through a piece of ice that was in direct contact with the skin in order to protect the epidermis from the thermal damage of irradiation. Moreover, compressing the tissue with this piece of ice can increase the depth of penetration of the laser beam. The laser power was between 35-45 W, with a pulse length of 2-10 seconds. Laser energy was delivered to all areas of the vascular lesion. The average time for the laser photocoagulation procedure varied from 15 to 30 minutes depending on the extent of the lesion. The session lasted until edema appeared in the lesion, and its consistency became hard. After radiation the lesion was protected with continuous application of ice for 5–10 minutes. In all cases the patients wore protective eye covering. A topical application of antibiotic ointment was all that was necessary for the treated area. The treatment results were assessed by measuring the change in size of the lesion. In cases where the lesion remained lesion after the first session of therapy, a second or third session of therapy followed. Postoperatively, the patients were seen at 3 weeks, 6 weeks, 3 months, 6 months, 1 year and yearly thereafter.

Results

The postoperative hospital stay for all patients ranged from 1 to 2 days. Three weeks after treatment all lesions appeared with edema and with a slightly hard consistency. The size of the lesions had decreased only slightly. At the 6^{th} week follow-up edema was no longer present, and all lesions had decreased in size so as not to interfere with vital functions. At the 6^{th} month follow-up the results were clinically evident (see Table 2). A second session followed in the 30 patients in which, the initial results were good, moderate, or poor. Six months after the second session 24 of these patients had excellent results and six patients had moderate results. A third session followed for these six patients. Six months after the third session the results were good in all 110 patients. Complications were encountered in nine

(8.1%) patients. One patient had postoperative bleeding, which stopped spontaneously within 1 hour, atrophic scars occurred in six (5.5%) patients and a hypertrophic scar in two (1.8%) patients.

Discussion

Most hemangiomas do not require treatment, but some complications are indications for therapy. A number of treatment modalities have been proposed for the treatment of hemangiomas; so systemic therapy with corticosteroids, interferon-*a*2a surgical procedures compression sclerosis treatment embolization**,** intralesional injection of corticosteroids, and cryotherapy were described [6], [11], [12], [13], [14], [15]. One of the most significant advances in the treatment of hemangiomas has been the advent of laser technology, and its clinical application in pediatric surgery at the end of nine-teen-sixty decade [16]. Since then, there have been many reports of the treatment of these lesions using different types laser, including the argon, CO_2, the Nd–YAG laser and the flash lamp-pumped pulsed dye laser (FPDL) [17]. The argon laser is recommended for treatment of patients with port-wine stains and superficial skin teleangiectasia [18]. The restricted effective depth (of only1-2 mm), and the rather non–specific coagulation of vascular lesions associated, with a risk of scaring limits, the use of the argon laser is in children [19]. Landthaler et al. reported a series of hemangiomas treated with different types of laser. They observed that in the superficial hemangiomas the results with the FPDL were excellent or good, but in the deep part of the lesion was not influenced by the FPDL [7]. The same authors observed reductions in the sizes of hemangiomas treated with an Nd–YAG laser [3,5]. We have chosen the Nd – YAG laser as a therapeutic modality because its radiation penetration approximately 8 mm into soft tissue, and the scattering in the tissue effects deep photocoagulation. In our special therapeutic technique we used ice to prevent laser-induced thermal injury to the epidermis, but modified the methods of other authors, who cooling the lesions only during actual irradiation [20,21]. Our cooling of the surface of the lesion with application of broken pieces of ice prior to irradiation, provoked vasoconstriction of epidermal vessels with consequent diminution of blood in these, which in turn helped to diminish the absorption of laser beam, and minimized adverse thermal effects on the skin. During irradiation we used a piece of ice to protect the epidermis and compress the lesion, which helped the beam to penetrate and induce

photocoagulation in the deep layers of the lesion, thus producing even better results. Also, immediately after irradiation we protected the surface of lesion with ice because the increased residual temperature can provoke, thermal damage. Our use of ice produced excellent clinical and cosmetic results in the treatment of hemangiomas with Nd–YAG laser, in contrast to Landthaler et al. who observed superficial scarring in all patients who treated by an Nd–YAG laser [7]. Our results clearly demonstrate the ability of the Nd–YAG laser to successfully treat cutaneous hemangiomas of various sizes. In small hemangiomas we have obtained excellent results after only one session of laser treatment. Larger hemangiomas were reduced by approximattely 50% during the first session, while for the residual lesion a second or third session was needed to achieve excellent results, contrasting the results of Clymer et al. who reported an average of approximately five treatments to achieve the final result [3].

We conclude that use of the Nd – YAG laser in conjunction with ice protection of the epidermis is a very useful instrument in the treatment of massive and deep hemangiomas in childhood, in terms of minimizing the adverse thermal effects on the skin, and decreasing the number of sessions required to treat these lesions.

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Tables

Table 1

	Height			
Area		**A** (1-2 cm)	**B** (2-3 cm)	**C** (>3 cm)
	a (1-4 cm^2)	72	8	-
	b (4-10 cm^2)	18	2	2
	c (> 10 cm^2)	-	4	4

Table 2

Results	Height				
			A	**B**	**C**
			(1-2 cm)	(2-3 cm)	(>3 cm)
Area	**a**	(1-4 cm^2)			
		Excellent	72 (100%)		
		Good		8 (100%)	
	b	(4-10 cm^2)			
		Good	15 (83,33%)	1 (50%)	
		Moderate	3 (16,67%)	1 (50%)	1 (50%)
		Poor			1 (50%)
	c	(>10 cm^2)			
		Moderate		2 (50%)	2 (50%)
		Poor		2 (50%)	2 (50%)

Excellent: 90 to 100 percent reduction. Good: 50 to 89 percent reduction.

Moderate: 20 to 49 percent reduction. Poor: 0 to 19 percent reduction.