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The combination of suprakeloidal flap and pulsed light heat energy in keloid management: A case report

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ABSTRACT

Yohanes Widodo Wirohadidjojo, Kristiana Etnawati, and Dwi Retno Adiwinarni - ***The combination of suprakeloidal flap and pulsed light heat energy in keloid management: A case report***

The role of chronic tissue hypoxia in the keloid patho-mechanism has been widely accepted. Whereas, the pulsed-light heat energy (LHE) has been developed which has the capacity to generate reactive oxygen species on exposed skin. Although the suprakeloidal flap technique has a high recurrence rate, it was used because of its capacity to prevent suturing hypoxia, thereby the formation of lager recurrent keloid after surgery.
The combination of suprakeloidal flap and pulsed light heat energy was done I the treatment of post-varicella keloid on the right ear lobe of a 9 year old girl. The keloid was excised two times a year ago, but observation one month after the surgery showed a recurrent larger keloid. The performance of suprakeloidal technique followed by pulsed-light heat energy treatment in dose 2.5 J/cm^2, was administered on day 3rd, day 5th, days 7th, days 9th and day 14th. The flap healed well, attested by the absence of recurrent keloid after forty-five days of observation.
It is concluded that the combination of suprakeloidal flap with pulsed-light energy may be used in keloid management. However, advanced research using better data is needed to reach conclusive evidence.

Key words: keloid - suprakeloidal flap - pulsed-light heat energy - hypoxia

ABSTRAK

Yohanes Widodo Wirohadidjojo, Kristiana Etnawati, and Dwi Retno Adiwinarni – ***Kombinasi flap suprakeloidal dan pulsed light heat energy pada pengobatan keloid: Laporan kasus***

Para ahli sependapat bahwa hipoksia kronis berperan penting pada patofisiologi keloid. Di sisi lain, *pulsed light heat energy* (LHE) merupakan teknik penyinaran yang mampu melepaskan spesies oksigen reaktif dalam jaringan. Para ahli menyarankan operasi flap suprakeloidal pada pengobatan keloid agar hipoksia di tepi jahitan dapat diminimalisasi, sekaligus untuk mencegah keloid kambuhan yang berukuran lebih besar. Seorang anak perempuan berumur 9 tahun menderita keloid paska varisela pada telinga kanan, pernah dioperasi dua kali, keloid kambuh pada bulan pertama pasca-operasi, dan berukuran lebih besar meskipun telah disuntik steroid intralesi. Berdasarkan temuan tersebut, diputuskan pengangkatan keloid dengan teknik flap suprakeloidal diikuti dengan penyinaran LHE sebesar 2,5 J/cm^2 pada hari ke-3, 5, 7, 9 dan ke-14 pasca-operasi. Hasil tindakan menunjukkan bahwa luka operasi sembuh hamper sempurna dan keloid kambuhan tidak dijumpai meskipun pengamatan telah dilakukan pada hari ke 45.
Disimpulkan gabungan flap suprakeloidal dan terapi menggunakan LHE dapat dikembangkan sebagai salah satu cara pengobatan untuk keloid, meskipun perlu dilakukan penelitian lebih lanjut.

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INTRODUCTION

Various methods have been developed to treat keloid; they include medicinal treatment, such as: triamcinolone, retinoic acid, imiquimod, bleomycine, 5 flourourasil[1], veraprmail[2,3], tamoxypen[4], and several modalities, such as: tumor excision, cryosurgery, LASER, pressure and bandage, silica gel and UVA phototherapy, either in a single modality or in a combined treatment. All of these have unsatisfactory results[1,5]. The keloid flattening is susceptible to high recurrence rates; post excision recurrences were between 45% to 100%[1,6]. The recurrent keloids in the aftermath of excision are usually larger than those prior to surgery.

In order to prevent the emergence of larger size keloid after operation, many authors recommend performing various techniques based on intra-keloidal incision such as: W plasty, multiple Z plasty, or M plasty[7]. To prevent the hypoxia caused by skin tension, excessive *undermining* should be performed[7,8] Adam and Gloster (2002) introduced the suprakeloidal flap technique for treating keloid especially on the ear areas. Based on this technique, skin tension can be avoided and a bigger size recurrent keloid can be prevented[9].

Pulsed-Light Heat Energy (LHE) is visible light heat energy (400-1200 nm) generated by flash lamp. Atsumi *et al*. (2007) reported the capability of visible light to generate the reactive oxygen species (ROS) of irradiated chromophores[10]. These ROS might have the cytotoxic effects as is shown on permanent hair removal effects[11] or in the psoriasis treatment[12]. The effect of LHE on the prevention of keloid recurrences has never been studied.

CASE REPORT

A nine years old girl was admitted to Dr. Sardjito Dermato-Venereology's Clinic suffering from keloid formation on the right ear, one month after varicella infection. The lesion was excised two times and the aftermath of the above procedures merely led to the formation of recurrent larger keloid. This was the case despite subjecting the patient to several times of intralesional triamcinolone injections following each operation. On undergoing dermatologic examination, the patient was declared healthy but on the upper side of her right ear, a 3x2x1.5 cm3 of keloid with pseudopodia appearance was observed (FIGURE 1). Right in the middle surface of the keloid, a linear sutured scar was also observe, an indication that a simple excision had been performed in the former operation.

After conducting a short discussion, the patient and her mother agreed to the suggestion of undergoing dermatologic surgery, in which the lesion was to be operated using the suprakeloidal flap technique followed by light heat emission therapy.

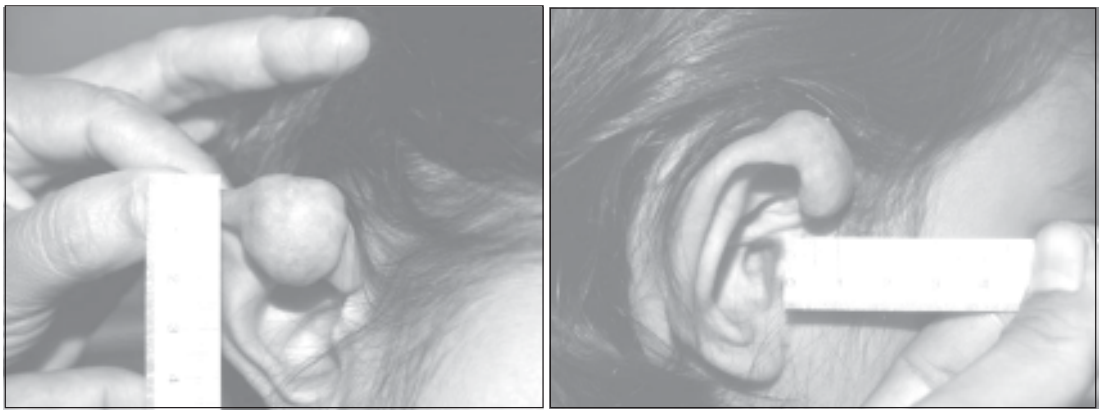

FIGURE 1. Preoperative Condition

a. Operation techniques

After the measurement of the flap sizes was done and marked basing on the flattened diameter of keloid minus the length of keloid thickness, the area to be operated was disinfected using 10% povidone iodine followed by alcohol 70%. Subsequently, Tumescent local anesthetic was administered, followed by incision of the keloid acme, candidate flap, which was then weakened by semicircular cutting which as made as thin as possible to maintenance nutrition flows. The fibrous material, the depth of adipose tissue on the keloid fringe contraaterally against the flap base was then excised and removed. The attachment of the flap was performed using 6.0 nylon interrupted sutures (FIGURE 2).

b. LHE treatment

The 2.5 J/cm^2 LHE treatment was administered in concurrence with the schedule of changing the bandage on day three, five, seven, nine, and fourteen (3rd, 5th, 7th, 9th, and 14th).

RESULT

On day three (3) after the operation, some bluish and dark clotting was oberseved on the flap edges, but on the day five, hypoxia signs could no longer be seen. On day 14, the sutures were removed and skin flap was taken perfectly, without any signs of infection. Until day 45 after operation, the recurrent keloid was not observed as depicted in the FIGURE 3.

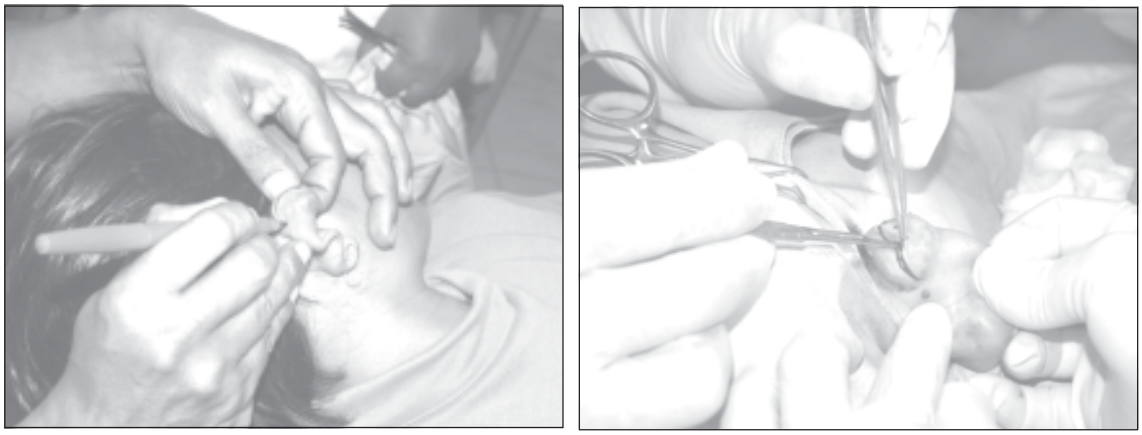

FIGURE 2. Flap Design

FIGURE 3. Post operative Observation

DISCUSSION

The histological appearance of keloid showed that except for fibroblasts hyper proliferations, the heavy collagen bundles and glycosaminoglicans accumulations were observed in fibrous tissue materials. In normal tissue remodeling, collagen degradation occurred because of collagenase activities which are activated by plasminogen activators. On keloid tissues, observed collagenase accumulation showed feeble activity. The feebleness may due to keloid fibroblasts (KFs) producing plasminogen activator inhibitors (PAI) synthesized under the stimulation of vascular endothelial growth factor-VEGF[13], one of the prominent growth factor synthesized by KFs[14]. VEGF itself was synthesized under hypoxia condition through the binding of hypoxia inducible factor (HIF) on VEGF targeted genes. If hypoxia condition was restored, HIF was perhaps released from VEGF genes and VEGF synthesis stopped.

In a study of Atsumi *et al*. (2007), LHE was found to generate ROS[10]. The factor underling the healing of the recurrent keloid in this case becomes clear. ROS generated by LHE in combination with suprakeloidal technique, weakened the sutures, preventing VEGF as well as PAI synthesis in the process. This made the remodeling processes to run effectively. In this case, the effect of LHE on the hypoxia condition was observable exactly from day three, to day seven, attested by replacement of the bluish color of the flap with the fresh red color (FIGURE 3).

In vitro study, it became evident that keloid fibroblasts produced more noticeable type I procollagen than normal fibroblasts (NFs). Previous studies indicated that type III procollagen didn't replace this procollagen as shown among NFs. Lubart *et al*. (2007) study, found that visible light might stimulate fibroblast to synthesize new collagen especially type III procollagen[15]. LHE induced new type of collagen synthesis may serve as another explanation of the no recurrent keloid in this case, even though similar findings have ever been reported among KFs.

A number of studies showed that KFs was resistant to Fas induced apoptosis[16] and ceramide stimulation, due to an increase of insulin like growth factor receptor expression[17].The alteration of KFs might induce KKs to stimulate KFs to produce Bcl-2, ERK, and IP3, which have anti-apoptotic effects[18]. Although visible light penetration is limited on the epidermal surface, the visible light may stimulate of epidermal keratinocytes apoptosis as shown by Lascaratos et al. (2007) on rat retinal cells[19]. The death of KKs may affect KFs resistance to apoptosis, and as a result, KFs proliferation may be inhibited and new keloid formation can be prevented.

Based on the above explanation, together with a successful treatment of a single case of keloid, a conclusion is drawn that a combination of suprakeloidal technique together and LHE treatment can be used to treat keloid. However, more research on the subject is needed.

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