Dye laser treatment for hemorrhagic vascular lesions

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Background and aims: It is generally thought that bleeding from a hemangioma is difficult to stop. With development of the long pulse dye laser (LPDL), it has become possible to treat hemangioma with a large blood vessel diameter. Thus, it is effective in treating infantile hemangioma and pyogenic granuloma.

Materials and methods: Five patients who visited our hospital from July 2015 to July 2017 due to hemorrhagic hemangioma were treated using a flash lamp excitation pulse dye laser with parameters of 7 mm spot size, 3 msec pulse width, fluence 12-14 J/cm², DCD 30 msec, and delay 30 msec.

Results: The bleeding not only stopped, but the raised lesion was flattened in all cases.

Conclusions: LPDL is effective for both infantile hemangioma and pyogenic granuloma. It not only stops bleeding, but also treats the vascular lesions.

Key words: hemorrhagic · hemangioma · infantile hemangioma · pyogenic granuloma · flash lamp excitation pulse dye laser

Introduction

Bleeding from a hemorrhagic vascular lesion is difficult to treat, although it can be temporarily stopped by compression or coagulation. It is usually managed by resection or with a carbon dioxide gas laser. These are simple methods, but there is a high probability of scarring. Here, we report good results using flash lamp excitation pulse dye laser for a wide range of cases that are difficult to treat with resection or a carbon dioxide laser.

Materials and Methods

Five patients who visited our department from July 2015 to July 2017 due to a hemorrhagic vascular lesion were included in this study. We used a flash lamp excitation pulse dye laser (Vbeam[®]; Syneron *Candela*, Wayland, MA), with parameters of 7 mm spot size, 3 msec pulse width, fluence 12-14 J/cm², dynamic cooling device 30 msec, and delay 30 msec. The irradiation interval was 2-4 weeks, depending on the growth rate.

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Results

Patients were 2 males and 3 females, aged 3 months to 36 years old (median 4 years). The lesion was located on the face in 3 patients, on the ring finger in 1 patient, and on the abdomen in 1 patient. The diagnosis for 4 patients was pyogenic granuloma, while 1 patient was diagnosed with infantile hemangioma. The number of treatments ranged from 2 to 15 times (average 6 times). The treatment interval was 2 weeks for 1 patient and 1 month for 4 patients. In all cases, bleeding stopped, and flattening of the elevated lesion and normalization of color tone were observed (**Figure 1AB, 2AB**).

Discussion

Pyogenic granuloma, which was reported first by Poncet and Dor¹⁾ in 1897, is considered to be an acquired hemangioma caused by trauma and infection. In the 2017 classification of the International Society for the Study of Vascular Anomalies (ISSVA), pyogenic granuloma is classified as a benign vascular tumor. Histopathologically, vascular endothelial cell proliferation is initially observed, followed by dilation and expansion of capillary vessels.

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It is classified into three types: endothelial cell proliferation type, capillary dilatation type, and mixed type. The histologic appearance is of a lobular capillary hemangioma. The appearance is similar to infantile angioma, tufted angioma, and bacillary angiomatosis. A tufted angioma is differentiated by the cannonball pattern and the presence of a semicircular type lymph duct expanded around the lobe of the body. Bacillary angiomatosis is differentiated as it is caused by infection with Rickettsia's *Bartonella henselae*, and the agglomeration of bacilli is Warthin-Starry stain-positive.

Infantile hemangioma is also classified as a benign vascular tumor. It is distinguished from congenital hemangioma as it consists of glucose transporter-1 (GLUT-1)-positive cells, similar to the cells constituting the microvessels of the placental chorion. GLUT-1 is a group of membrane proteins that facilitate the transport of glucose over a plasma membrane and a 12-pass transmembrane (membrane cytoplasmic side of both N-terminus and C-terminus). It is part of a membrane protein family also called solute carrier family 2 (SLC 2). It has a molecular weight of about 492 aa, 54 kDa, encoded by the SLC2A1 gene of 1p34.2. It is expressed in most tissues including fetal tissues, brain, kidney, cancerous tissues, depending on the glycolysis system. However, it is expressed most frequently in erythrocytes and occupies 5% of the erythrocyte membrane protein. Therefore, in acute inflammation, GLUT-1 does not become positive. However, it can be positive in vasodilatory granulomas with angiogenesis, when epithelialization is hindered by external stimulation, even after treatment. The diagnosis is easier over the course of time, minimizing misdiagnosis.

While pyogenic granuloma may occur at any age, infantile hemangioma is seen within a few weeks of life. It is characterized by a rapidly growing proliferative phase, then a decay and disappearance phase. Redness

typically disappears at about 5 years old. It is seen in 10% in Caucasians, but in only 0.8% of Japanese. It is more common in women, with a male/female ratio of 1:3. Eighty percent of cases involve only one site, while 20% occur in multiple sites. Infantile hemangiomas may occur in the head and neck (60%), body/trunk (20%) and extremities (15%). A subcutaneous type has also been described (Type 3). This classification does not include hemorrhagic lesions. A case of infantile hemangioma that we encountered in our department involved protuberant small masses. The epidermis was thin and edematous, with pyogenic granulomatoid findings. Bleeding from hemangioma arises because the skin surface on the hemangioma is vulnerable in infantile hemangioma or epithelization is delayed in pyogenic granuloma. Increased abnormal vessels under the surface of the tumors disturbed the epithelization. That is the reason why dye laser treatment is reasonable in accompanying bleeding.

The first report of pulse dye laser treatment for pyogenic granulomas was by Goldberg et al.²⁾ in 1994, followed by Abd-El-Raheem et al.³⁾ in 1997, Tay et al.⁴⁾ in 2004, Pagliai et al.⁵⁾ in 2009, Sud et al.⁶⁾ in 2011, and Lee et al.⁷⁾ in 2011 (**Table 1**). In the reports describing the use of conventional pulse dye laser, the recurrence rate ranged from 0% to 33% after 1 to 6 treatments, except in Sud et al.'s report. Abd-El-Raheem et al. reported 2 cases where surgery was needed after laser treatment due to a lack of response. Lee et al. reported only 10% (7/69) of cases with a lack of response. Recent reports showed greater effectivity than older reports.

Flash lamp excitation pulse dye lasers are typically used for lesions composed of blood vessels with diameters less than 300 μm , so it has been said that these are less effective for infantile hemangioma and pyogenic granuloma with larger vessel diameter. However, its range of treatment has expanded due to the Vbeam® laser,

Figure 1A: A case of infantile hemangioma before treatment **1B:** After treatment

Figure 2A: A case of pyogenic granuloma before treatment **2B:** After treatment

which can change the width of the pulse. In Sud et al.'s report,⁶⁾ only one case out of 40 (2.5%) showed no response. Pagliai et al.⁶⁾ compared the recurrence rate with electrocauterization, punch excision, CO₂ laser irradiation, and a pulse dye laser and found the CO₂ laser had a 100% recurrence rate, while the pulse dye laser had a 33% recurrence rate. In contrast, Lee et al.⁷⁾ reported similar recurrence rates for both treatments, 4.85% with the CO₂ laser and 4.35% with the pulse dye laser. The pulse dye laser had half the recurrence rate of liquid nitrogen therapy (8.1%) (**Table 2**). These results show that pulse dye laser treatment is effective compared with other treatments.

There are many reports on the use of pulse dye laser treatment for infantile hemangioma. Batta et al. and Kessels et al.^{8,9)} compared the results of observation versus pulse dye laser treatment, and Kono et al.¹⁰⁾ compared the complications of pulse dye laser versus long pulse dye laser (LPDL). Kessels et al. noted a significant difference in color tone between observation and the pulse dye laser. However, there was no significant difference in the change in lesion thickness. Batta et al.⁹⁾ showed that skin atrophy and depigmentation were observed more frequently with the pulse dye laser than with observation, but bleeding was reduced with the pulse dye laser. Kono et al.¹⁰⁾ stated that LPDL is superior to the

Table1: Comparison of recurrence between pulse dye laser and the other method for pyogenic granuloma.(page6) In our case there is no recurrence using LPDL.

	case	laser	fluence	spot size	treatment	recurrence	no respond
Goldberg 1991	3	PDL	6.75-7.5		1	0	0
Abd-El-Raheen 1994	2	PDL	6-7		2	0	2 excision
Tay 1997	22	PDL	6-7	5	1-6	0	2 excision
Paglal 2003	9	PDL				3	scar4
Sud 2009	40	Photogenica V® Vbeam®	5.3-9.4 15	7 7	1-5		1
Lee 2011	69	PDL				3	7
Our case	3	Vbeam®	12-14	7	2-4(13)	0	0

Table2: Recurrence rate of treatment on infantile hamangioma comparing each therapy reported by Pagliai and Lee.(page6)

	Recurrence/case Pagliai	Recurrence/case Lee
Ex&electrectomy	0/58	38/751(5%)
Punch excision	0/1	0/2
CO2 laser ablation	3/3 (100%)	5/103(4.85%)
Liquid nitrogen	0/1	15/185(8.1%)
observation	0/4	2/4(50%)
Pulse dye laser	3/9(33%)	3/69(4.35%)

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conventional pulse dye laser due to fewer complications such as depigmented plaques, pigmentation, and changes in skin properties. (Table 3)

We have reported on the early treatment in patients under 1 year of age of infantile hemangioma (then Ichigo hemangioma) at the Japan Laser Medical Association. LPDL was effective in improving lesion properties and thickness. Hemorrhagic infantile hemangioma differs in phenotype from common infantile hemangioma. It bleeds due to scratching. The surface is thin and has a small granular appearance with a diameter of 2-5 mm. Pathological examination is difficult to carry out, even with age, and a definitive diagnosis is impossible. If only a small part of the surface of the infantile hemangioma proliferates, the mechanism is considered to be due to

only some part of the tissues becoming weakened, resulting in vulnerability to bleeding, similar to a pyogenic granuloma.

Conclusions

- 1: Five patients with hemorrhagic hemangioma were treated using flash lamp excitation long pulse dye laser.
- 2: The diagnoses were infantile hemangioma and pyogenic granuloma, which have similar pathologies.
- 3: Bleeding was successfully stopped in all patients.
- 4: The long pulse dye laser worked well because the pulse width can be changed to fit the wide diameter of the capillary vessels.

Table3: Reports on complications of dye laser treatment for infantile hamangioma comparing only observation and using PDS or LPDS(Vbeam).(page6) LPDL shows better results than only observation and PDL.

	observe	Vbeam ^R	PDL
Batta	Clearance 3(5%) Skin atrophy 5(8%) Hypopigmentation9(15%) Ulceration4(7%) Bleeding 4(7%)		18(30%) 17(28%) 27(45%) 4(7%) 2(3%)
Kono	Hypopigmentation Hyperpigmentation Texture change Ulcer formation Pigmentation	3 2 1 0 2	8 4 6 1 4
Kessel	Color < better Depth =	7mmspot 0.45-40ms 7-15J/cm2 DCD30/10 40/10	

References

- 1: Poncet er Dor (1893) :Ann de Derm, 9:89
- 2: Goldberg DJ, Sciales CW (1991): Pyogenic Granuloma in Children. J Dermatol Surg Oncol, 17:960-962
- 3: Abd-El-Raheem TA, Hohenleutner U, Landthaler M (1994): Granuloma pyogenicum as a Complication of Flashlamp-Pumped Pulsed Dye. Laser, Dermatology, 189:283-285
- 4: Tay YK,Weston WL, Morelli JG (1997):Treatment of pyogenic granuloma in children with flashlamp-pumped pulsed dye laser. Pediatrics, 99:368-70
- 5: Pagliai KA, Cohen BA(2003): Pyogenic granuloma in children. Pediatr Dermatol, 21:10-3
- 6: Sud AR,Tan ST(2010):Pyogenic granulomaa-treatment by shave-excision and/or pulsed-dye laser. J Plast Reconstr Surg, 63:1364-1368
- 7: Lee J, Sinno H, Tahiri Y, Gilardino MS(2011): Treatment op-
- tions for cutaneous pyogenic granulomas: A review. J Plast Reconstr Surg, 64:1216-1220
- 8 Kessels JP,Hamens ET,Ostertag JU. (2013): Superficial hemangioma:pulsed dye laser versus wait-and-see. Dermatol Surg, Mar; 39(3Pt1):414-21
- 9: Batta K, Goodyear HM, Moss C, Williams HC, Hiller L, Wattera R. (2002): Randomised controlled study of early pulsed dye laser treatment of uncomplicated childhood hemangiomas: results of a 1-year analysis. Lancet, Aug 17, 360(9332):521-7
- 10: Kono T,Sakurai H,Groff WF,Chan HH, Takeuchi M,Yamaki T, Soejima IC, Nozaki M. (2006):Comparison study of a traditional pulsed dye laser versus a long-pulsed dye laser in the treatment of early childhood hemangiomas. Lasers Surg Mod, Feb; 38(2):112-5