The impact of septodermoplasty and potassium-titanyl-phosphate (KTP) laser therapy in the treatment of hereditary hemorrhagic telangiectasia-related epistaxis

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ABSTRACT

Background: *A variety of modalities are available for the control of recurrent epistaxis in hereditary hemorrhagic telangiectasia (HHT). Laser ablation, in particular potassium-titanyl-phosphate (KTP), has gained popularity as it coagulates the telangiectasia with minimal peripheral tissue injury. Septodermoplasty (SDP) also can be performed in the day surgery setting. Telangiectasia recurred, necessitating repeated treatments. The frequency and interval between procedures is not well documented. The purpose of this study was to describe the frequency of surgical interventions for HHT patients and the impact of SDP.*

Methods: *A retrospective review was undertaken of procedures performed in a tertiary hospital unit during a 60-month period for HHT. The incidence of KTP laser and SDP, days between treatments, total number of interventions and perioperative hemoglobin (Hb) were audited. Patient groups were identified as definite or possible HHT according to the Curaçao criteria. All suffered from epistaxis sufficient to seek medical treatment.*

Results: *Three hundred one procedures were performed on 131 patients during the study period. In total, 33 SDPs and 268 KTP laser treatments were performed; 78.3% of patients required three or less procedures. The mean time interval between treatments was 473 (±515 days) days. The rate of KTP after an SDP decreased from 1.83 (±1.99) to 0.78 (±0.85; $p = 0.012$). Hb level was not associated with treatments required.*

Conclusion: *Surgical interventions with laser and SDP in HHT are always time limited as recurrence of telangiectasia is inevitable. This study discusses the expectations of therapy, mainly frequency and duration of effect, along with the impact of SDP. The outcomes assist in better management of patient expectations.*

(Am J Rhinol 22, 182–187, 2008; doi: 10.2500/ajr.2008.22.3145)

Key words: Dermoplasty, epistaxis, hereditary hemorrhagic telangiectasia, KTP laser, Osler-Weber-Rendu, septodermoplasty, skin graft

The clinical course for hereditary hemorrhagic telangiectasia (HHT), or Osler-Weber-Rendu disease, usually is dominated by their epistaxis.[1–3] The underlying genetic abnormalities result in large endothelial-lined vascular lakes and dilated vessels. These vessels usually lack either muscular or elastic tissue support.[4] Localized mucosal trauma within the nose often results in rupture of these telangiectasia. Despite normal platelet and coagulation factors, the subsequent bleeding often is profuse because of the inability of vessels to retract or undergo vasospasm. The feeding arteriole continues to bleed unabated and subsequent attempts to cauterize the area often further exacerbate the situation by opening other channels. Nasal packing, although often performed for acute bleeds, usually results in significant trauma to other nasal telangiectasia and the bleeding cycle is perpetuated.

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Presented at the fall meeting of the American Rhinologic Society, Washington, D.C., September 15, 2007

This research was not supported by an external funding source; Prof. Lund is a consultant and speaker for Schering Plough and GlaxoSmithKlein; Dr. Harvey and Dr. Kanagalingham have no financial interests to declare

IRB Statement: Approval for this study was conducted under provisions provided by the Institutional Review Board of the Royal Free NHS Trust

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Quality of life for HHT suffers is significantly affected by their epistaxis.[5] Although, greater morbidity and mortality may result from pulmonary, brain, or liver arteriovenous malformations,[6,7] it is the epistaxis that interferes on a near daily basis for many patients.[8] A variety of treatment options are available for managing the recurrent epistaxis. Epistaxis can be managed by topical therapies[9]; hormonal therapy with estrogens[10]; and argon,[11] Nd:YAG,[3,12,13] potassium-titanyl-phosphate (KTP),[14] and pulse dye[15] laser coagulation. More severe epistaxis has been treated with varying success using embolization,[16] surgical arterial ligation,[17] septodermoplasty (SDP),[18,19] and nasal closure.[9,20] With the exception of nasal closure, most treatments, at best, reduce frequency and severity of bleeding. Eventually, telangiectasia reforms and after SDP occurs at the edge of grafts (Fig. 1) or rarely regrows through the graft. A 7-year retrospective review found that most patients received more than three treatments with Nd:YAG over the study period[12] and a similar multitude of therapies with pulse dye laser also have been reported.[15]

Many centers with large HHT cohorts often use these treatments concurrently in patient care[4,9] and follow a less hierarchical strategy often described in the literature.[21] There still is uncertainty regarding the expected treatment benefit from various interventions and ambiguity surrounding the clinical indications for a more aggressive management plan. This article describes the intervention patterns for HHT patients over a 5-year period, in particular, the impact of SDP on the need for subsequent treatments and the usefulness of hemo-

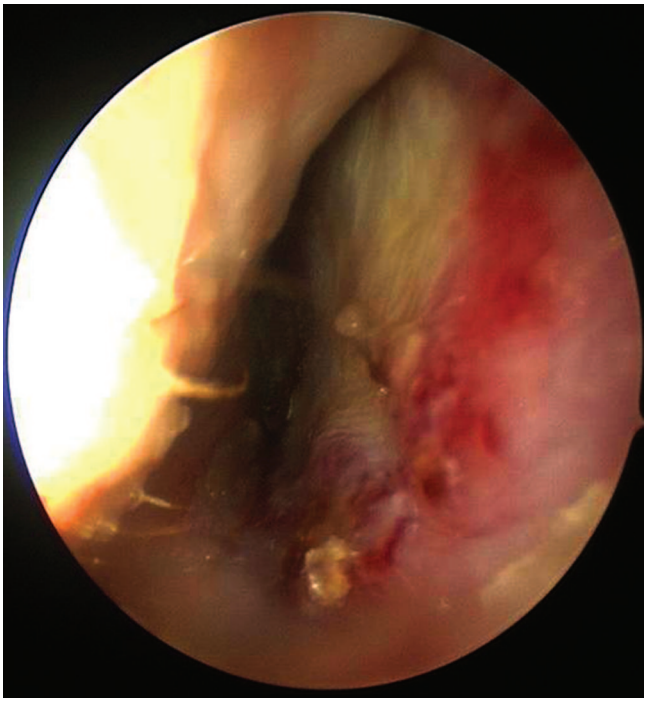

Figure 1. *Recurrent telangiectasia forming at the edge of a right SDP. Telangiectasia can reform at the junction of the dermal graft and vestibular skin.*

globin (Hb) as a marker for those patients requiring greater health resources.

METHODS

Patient Population

A retrospective review of patients treated in the day surgical unit of a tertiary referral center in London, United Kingdom, for epistaxis from HHT was performed. The study included patients treated during the period of January 2002 to December 2006 (5 years). Inclusion in the study required patients to meet the Curaçao criteria (Table 1)[22] for a definite or probable clinical diagnosis of HHT. Progress notes, operative reports, and laboratory databases were reviewed. The data extracted from the patients' charts included date of presentation, clinical features, Hb levels, transfusion requirements, and medical and surgical interventions. The interval between surgical interventions was recorded. Patient Hb data where recent blood transfusion was recently given were excluded from the database.

Indication for Intervention

Currently, there are >180 definite HHT patients who are managed within the Rhinology Research Unit. One hundred thirty-one of these patients received surgical care in the day surgery center over the study period. Attempts have been made to classify the severity of epistaxis and the need for intervention.[23] In our experience, patients with HHT initially seek surgical interventions for epistaxis, which are easily precipitated thus causing social interference, rather than for frequency and volume. Subsequently, interventions are patient driven, rather than physician directed, through regular outpatient and telephone contact.

Table 1 **Curacao criteria**

The HHT diagnosis is
- ″Definite″ if three criteria are present
- ″Possible″ if two criteria are present
- ″Unlikely″ if fewer than two criteria are present

1. Epistaxis: Spontaneous, recurrent nose bleeds
2. Telangiectases multiple, at characteristic sites:
   - Lips
   - Oral cavity
   - Fingers
   - Nose
3. Visceral lesions such as
   - Gastrointestinal telangiectasia (with or without bleeding)
   - Pulmonary AVM
   - Hepatic AVM
   - Cerebral AVM
   - Spinal AVM
4. Family history of a first-degree relative with HHT according to these criteria

AVM = arteriovenous malformation.

SURGICAL TECHNIQUE

Septodermoplasty

The procedure is performed under general endotracheal anesthesia. The anterior nasal cavity is prepared with topical 1:1000 epinephrine-soaked cottonoid pledgets. The anterior septum is injected with 1% lidocaine with 1:100,000 epinephrine bilaterally. While the local vasoconstriction is taking effect, a skin graft is harvested from the right lateral thigh, using a Zimmer air dermatome. An appropriate-sized graft is taken, usually of the order of 5 × 3 × 0.05 cm. Telfa with a Kerlix-wrapped dressing are applied on completion of split-thickness skin harvest. This is covered with an OpSite and then a 6-in. crepe bandage. The graft is placed on a Jelonet mesh and preserved in saline-soaked gauze.

The SDP is performed endoscopically. A no. 15 scalpel blade is used to define the limits of the septum, nasal roof, and floor to be grafted. Posterior incisions are made first, to prevent bleeding from obscuring the area to be defined. The lateral nasal wall is not grafted with this technique. The incision is brought forward to the mucoepidermal junction on the septum and inferior nasal cavity. Sharp dissection in a submucosal/supraperichondrial plane is performed anterior to posterior to remove the mucosa in one piece, attempting to preserve as much mucoperichondrium/periosteum as possible to receive the graft. Then, the Jelonet/graft complex is used to deliver the graft to the donor site, the Jelonet is carefully removed, and the skin graft is fixed in place with a few drops of fibrin glue on the edges of the graft. Sutures are not used to secure the graft. Gel foam is used to cover the graft and using a nasal speculum, a Whitehead's pack is applied

laterally. This prevents the graft being from being pulled out when the packing is removed under endoscopic guidance 5–7 days later in the outpatient clinic. An oral broad-spectrum antibiotic is given while the pack is in place. If a bilateral SDP was planned, then a 3-month interval was scheduled before completing the contralateral side.

KTP Laser

Laser therapy was performed with a 585-nm KTP laser. The laser coagulation was under general anesthesia. The nasal mucosa was carefully prepared by the surgeon with topical 1:1000 epinephrine or Moffat's solution (cocaine, epinephrine, and bicarbonate) soaked cottonoid pledgets. The procedure was performed endoscopically. An appropriate green light filter was used between endoscope and camera. KTP laser light was delivered *via* a 0.6-mm fiberoptic channel placed within a Frazier nasal suction. Antibiotic impregnated ointment was applied postoperatively.

Statistical Analysis

Statistical analysis was performed using SPSS for windows release 15.0 (SPSS, Inc., Chicago, IL). Multigroup assessments of intervals between treatments were tested with a Kruskal-Wallis algorithm. ANOVA analysis was applied to Hb assessment after testing for the normality of distribution of serum Hb results. Mann-Whitney *U* tests were applied in testing the laser intervention frequency in the pre– and post–SDP-treated groups.

RESULTS

One hundred thirty-one patients were treated during the study period. The group was comprised of 80% definite HHT patients by the classification of Curaçao criteria. However, the remaining 20% had probable HHT based on telangiectasia affecting the nose and another area, usually in the upper respiratory tract. Female/male ratio was 1:0.93. In this group of 131 patients, 301 procedures were performed in the 60 months of review. This included 268 laser treatments and 33 SDPs. The number of patients requiring multiple treatment sessions is shown in Fig. 2. The majority of patients required three or less interventions (83% [109 patients]), over the 5-year period.

The number of days between treatments was not influenced by the eventual number of lasers or SDPs required. The mean intervals between interventions ranged from 141 to 295 days for those who required more than one treatment in the 1826 days of the study period. There was no statistical difference between mean intervals for any of the patients who received multiple treatments (Fig. 3). Low numbers in some of the higher groups, such as the single patient requiring 11 procedures, may not be representative of those needing many procedures. However, such patients generate more data and still remained nonsignificant (Fig. 3).

On average, a patient receiving SDP as part of their treatment plan experienced a 57% reduction in the need for subsequent laser treatments within the 60-month study period. There was a statistically significant decrease ($p = 0.012$) in laser frequency pre-SDP (1.83 [±1.99]) compared with post-SDP (0.78 [±0.85]; Fig. 4). Bilateral SDP was performed in four patients. A 3-month interval was scheduled between sides and no patient suffered septal perforation.

Lower mean perioperative Hb generally was not associated with those requiring multiple procedures (Fig. 5). There was a statistically significant shift toward a lower Hb in patients requiring more than three procedures. However, as a diagnostic marker for these patients, it reached a maximum likelihood ratio of 2.1, representing a sensitivity of 76% and specificity of 63% (at Hb of 11.75g/dL). This represents poor diagnostic value in identifying patients in need of more than three procedures.

DISCUSSION

Managing Patient Expectations

HHT represents a condition that is widely underreported, associated with known genetic defects, and has a significant potential to impact the quality of life. The prevalence of HHT in the community may be as high as 1 in 5000.[6] This can

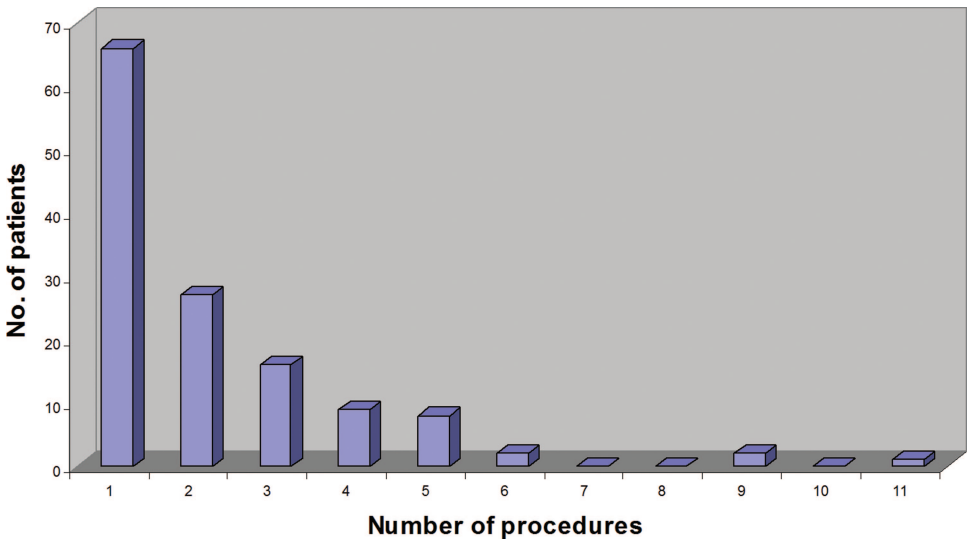

Figure 2. *Number of patients by frequency of surgical intervention.*

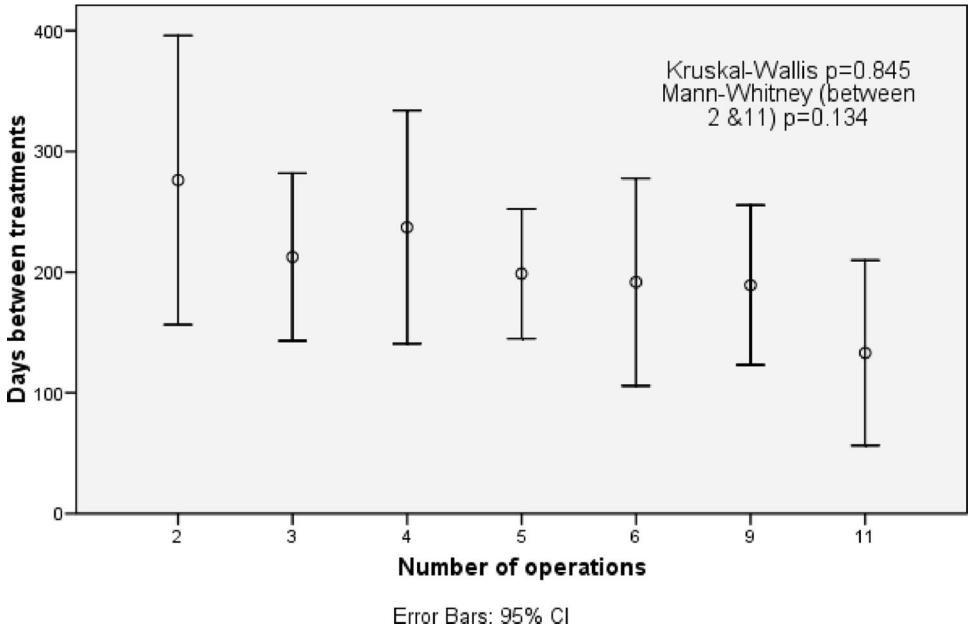

Figure 3. *Mean days between treatments for those patients requiring multiple procedures.*

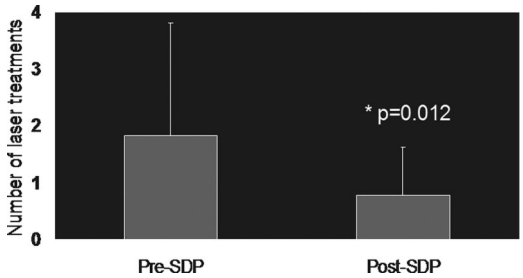

Figure 4. *Laser therapy frequency before and after SDP.*

potentially generate a large group of recurrent and refractory epistaxis sufferers. The treatment strategies available for this group generally are based on a low level of evidence.[6] HHT presents a chronic and recurring condition in which nasal interventions are directed toward a reduction rather than cessation of nasal bleeding episodes. The duration of treatment effect, in our group, was slightly longer than a year and the majority of patients required three procedures over a five-year period for the treatments described. This is comparable with other estimates in the literature.[12,24] Importantly, there is a significant drop in the need for epistaxis control after day surgery SDP. The need for laser therapy interventions may be required only every 10–18 months for the average HHT patient but for some it can be <6 months on a regular basis. For many patients, the potential risks of SDP often have been a deterrent for undertaking further surgical intervention. The risk of septal perforation, increased crusting, decreased cessation of airflow, loss of olfaction, and the precipitation of atrophic rhinitis need to be weighed against the expected benefit (in this study a 57% decrease in laser interventions post-SDP). Those patients with <6 months of epistaxis control after an initial three laser treatments might be better served by the addition of SDP. We describe a limited SDP. However, even in aggressive nasal resurfacing or septectomy, such as those described by Ross *et al.*, the impact of nasal dysfunction appears to be less of an impact than previously speculated.[18,25,26] Even with aggressive SDP, 26% (15/57) of patients required additional treatments in the 2-year mean follow-up.[25] The impact of SDP appears to be well tolerated by the majority of patients although the impact on general quality of life as measured by SF36 is less clear.[20] A summary of SDP case series is presented in Table 2.

Epistaxis Scoring

The definition of perceived benefit by the patient might be broad. Reduction in frequency and volume are commonly quoted. However, the need for blood transfusions and socially problematic bleeding that occurs during eating or exercise may be given similar weight by the patient in their interpretation of perceived benefit. Attempts have been made to categorize the degree of epistaxis as mild, moderate, or severe based on frequency and need for transfusions.[23] In our series, the Hb was a poor a marker for disease severity. When identifying patients with greater health care needs, Hb had little diagnostic value. This adds further weight to our clinical experience that suggests HHT patients require interventions based on other constructs of epistaxis rather than just frequency and volume. The ease with which hemostasis can be achieved and types of triggering events may have equal weight when HHT patients judge the severity of epistaxis. The development of a validated epistaxis questionnaire within a cohort of HHT patients would greatly assist the objective evaluation of treatment options. This is a project that is currently being funded by the International HHT Foundation, Inc.

CONCLUSIONS

Laser therapy and SDP remain useful tools in the management strategy of epistaxis within HHT patients. Treatment is often multifactorial with the concurrent use of topical medi-

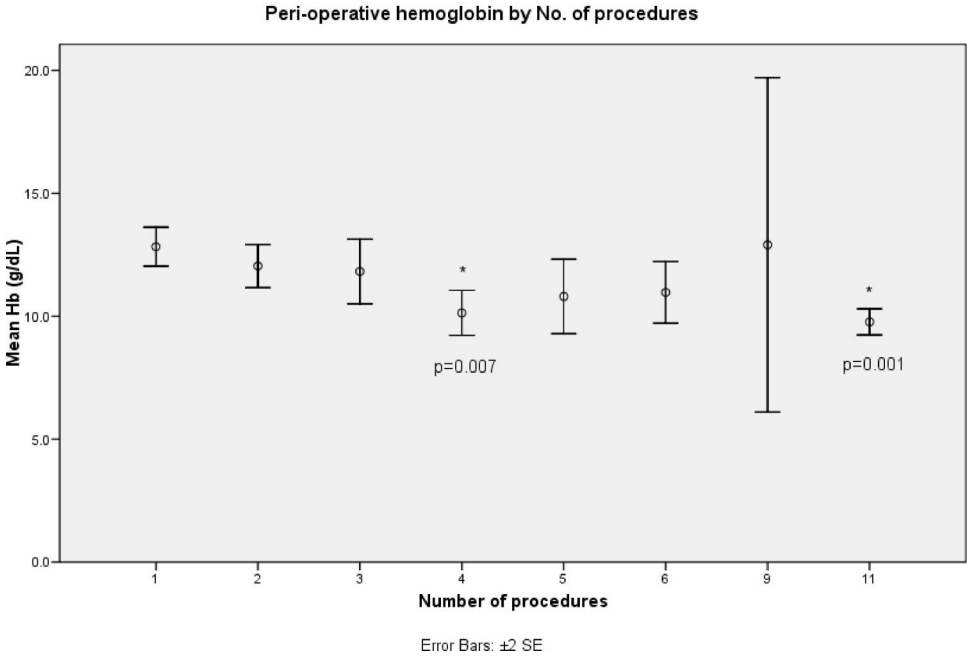

Figure 5. *Mean serum Hb by intervention frequency groups.*

Table 2 **Summary of major SDP case series in the literature**

Study	Year	Patients (those with follow-up)	Lateral Wall Grafted	Improvement/Months of Follow-Up	Reported Graft Failure
Saunders[19]	1964	Original Published Case-Series: Data Not Available			
McCaffrey[27]	1977	22	No	59%/6 mo	N/A
Ulso[28]	1983	18 (14)	No	79%/120 mo	44%
Bridger[29]	1992	11	Yes	N/A	18%
Ross[18]	2004	7	Yes	100%/6 mo	N/A
Fiorella[25]	2005	67 (57)	Yes	93%/24 mo	9%
Ichimura[30]	2006	15 (8)	Yes	80%/N/A	0%

cations, laser, and SDP. Limited SDP can be performed in a day surgery setting and may have a significant impact on the need for additional treatments. The comparison of different treatment modalities is difficult. Patients suffering from epistaxis, especially those with HHT, use other psychosocial factors other than frequency or transfusion requirements to judge the severity of their bleeding. The development and wide acceptance of a validated epistaxis questionnaire, currently in development by the International HHT Foundation, will greatly contribute to identifying the optimal treatment choices.

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