Human Fibrin Sealant: Effective Hemostasis in Otolaryngologic Surgeries

Sanjiv Badhwar¹

Received: 26 April 2016 / Accepted: 6 January 2017 / Published online: 9 January 2017
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Abstract In otolaryngologic surgeries, achieving hemostasis is of paramount importance for reducing associated morbidities. Topical hemostatic agents have been studied mainly in endonasal operations. Its use in other surgeries has been minimally reported. In this “real world data” study, we retrospectively evaluated the surgeries between June 2014 and December 2014, where topical hemostatic agent—Evicel® (Ethicon BioSurgery, US) was used to achieve hemostasis. All the patients were followed till 15 day post operation. The data on Evicel® preparation time, intraoperative blood loss, hemostasis time, length of hospital stay, blood transfusion given, and complications were evaluated. The quality of life was assessed by using discomfort score and it was statistically analyzed for patients underwent surgery for chronic rhinosinusitis and chronic otitis media. The surgical clinical data of 103 patients (63 males and 40 females) were considered for the analysis. In all patients, hemostasis was achieved in less than 1 min. The intraoperative blood loss was between 23 and 99 ml for all surgeries. No postoperative bleeding was reported and blood transfusion was not required for any patients. The hospital stay was 1–2 days. In endonasal surgeries, nasal packing was not required in 36.9% of patients. The discomfort score was statistically improved in patients underwent surgery for chronic rhinosinusitis and chronic otitis media ($p < 0.001$). No complications were reported till day 15 postoperatively. Evicel®, a topical human fibrin sealant found to be effective in achieving

hemostasis and for better clinical outcome in various otolaryngologic surgical procedures.

Keywords Otolaryngologic surgeries · Hemostasis · Human fibrin sealant

Introduction

In otolaryngologic procedures, the surgeon usually operates in narrow cavities where achieving hemostasis is sometimes a challenge. However, it is utmost important for better clinical outcomes and to reduce associated morbidities. Otherwise, ineffective management may lead to persistent bleeding, delayed wound healing and infection [1]. Adequate surgical hemostasis is critical to avoid blood transfusion and other bleeding-related complications. It may also increase the operative time [2–4]. It is critical in head and neck surgery, mainly in cancer resection surgeries [5].

Hemostasis could be achieved through mechanical, thermal or chemical methods. However, the applicability of mechanical methods such as direct pressure and ligature or suture ligation are labor intensive procedures and may increase the duration of surgery. Thermal procedures (e.g. unipolar or bipolar cauterization) have limited use due to thermal injury leading to tissue necrosis and impaired wound healing process. These conventional methods could not be of use for hemorrhage from un-accessible anatomical location [1, 6].

The ideal topical hemostatic agent should mimic natural hemostasis process through fibrin formation. Some of other characteristics are potent hemostatic action, action independent of patient factors, insignificant tissue reactivity, non-antigenicity, in vivo biodegradable, and suitability to

✉ Sanjiv Badhwar
sanjiv.badhwar@relianceada.com

¹ Kokilaben Dhirubhai Ambani Hospital, Four Banglows, Andheri (W), Mumbai 400 053, India

specific surgery [1, 7]. Other listed topical hemostatic agents which could be used in otolaryngology procedures are bone wax, silver nitrate, cocaine, gelatine based hemostats, collagen based hemostats, and cellulose based hemostats [1]. Fibrin based hemostatic agents are latest in the armamentarium to control hemostasis. Fibrin sealant (Evicel[®], Ethicon, US/Quixil, OMRIX biopharmaceuticals, Isreal) has been successfully used in other surgeries in vascular, orthopedics, liver, ophthalmic surgical indications [8–11].

In this “real world data”, we have retrospectively evaluated the clinical performance of topical fibrin sealant (Evicel[®]) in various otolaryngologic surgical indications to control hemostasis and improving the quality of life.

Materials and Methods

The study was retrospective in design and “real world data” collected as a part of standard operating procedure at Ear, Nose and Throat department in a tertiary care hospital, Mumbai. All the surgical cases where Evicel[®] (Ethicon Biosurgery, US) was used were considered for evaluation. All the patients were followed up till day 15 post surgery. Following data points were collected at the baseline and during follow up visits. (1) Demographic data (age, sex), (2) Baseline data on History, comorbid conditions, blood parameters, (3) Surgery details—Indication for surgery, duration of surgeries, Evicel[®] preparation time, anatomical location where Evicel[®] applied, hemostasis time, packing given, intraoperative blood loss, (4) Quality of life evaluation for discomfort—at 48 h and 15 days, (5) Length of hospital stay, and (6) Post-operative bleeding, blood transfusion, any other hemostatic agents used. Discomfort scale on 0–10, (0 as no discomfort and 10 as severe discomfort) was used. Statistical significance for change in discomfort score was tested for patients with chronic rhinosinusitis and chronic otitis media using Wilcoxon Sign Rank Test. SPSS version 10.0 was used for statistical analysis. Continuous variables and categorical values were given in summary statistics and by using frequencies and percentages respectively.

Evicel[®] was provided as single use kit containing two components; Human fibrinogen and human thrombin. A package containing one vial each of BAC2 (fibrinogen) and Thrombin 35 (800–1200 IU/ml human thrombin) had frozen solutions. It is all human protein derived, bovine free topical hemostatic agent. Two components of Evicel[®] (BAC2 and Thrombin) were thawed before use. By using modular spray device, Evicel[®] Fibrin Sealant (Human) sprayed onto the tissue in short bursts to produce a thin, even layer at the bleeder point or area.

Results

The clinical data was collected from 103 patients (63 males and 40 females) who were operated between June 2014 and December 2014. The mean age was 36.83 years. 26.2% patients had other co-morbidities such as diabetes and hypertension. The profile of surgical indications was given in Table 1 and the mean duration of surgery is given in Table 2. Chronic sinusitis was the most common surgical indication followed by chronic otitis media and sinonasal polyposis. The mean intraoperative blood loss was between 23 and 99 ml for all surgeries (Table 2). Evicel[®] was

Table 1 Profile of surgical indications

Indication for surgery	(N = 103)	%
Adenoid hypertrophy	04	03.9
Adenoid hypertrophy + chronic rhinosinusitis	04	03.9
Adeno-tonsillectomy	02	01.9
Carcinoma thyroid	03	02.9
Chronic otitis media	15	14.6
Chronic rhinosinusitis	22	21.4
Chronic tonsillitis	06	05.8
CSF rhinorrhea	04	03.9
Deviated nasal septum	04	03.9
Deviated nasal septum + chronic tonsillitis	04	03.9
Goiter	05	04.9
Sinonasal polyposis	07	06.8
Adenoid hypertrophy with bilateral SOM	01	01.0
Deviated nasal septum + chronic rhinosinusitis	01	01.0
Branchial cyst—neck	01	01.0
Carcinoma tonsil	01	01.0
Chronic adenotonsillitis	01	01.0
Chronic dacrocystitis	01	01.0
Hashimoto's thyroiditis	01	01.0
Left nerve sheath tumor	01	01.0
Lipoma—neck	01	01.0
Lymph node biopsy	01	01.0
Meningoencephalocele	01	01.0
Naopharyngeal angiofibroma	01	01.0
Obstructive sleep apnea	01	01.0
Otosclerosis	01	01.0
Parathyroid adenoma	01	01.0
Paratid tumor	01	01.0
Sinonasal carcinoma	01	01.0
Submandibular adenitis	01	01.0
Supra tonsillar cyst	01	01.0
Supraglottic tumor	01	01.0
Tongue haemangioma	01	01.0
Tongue tie	01	01.0

Table 2 Duration of surgery and intraoperative blood loss

Indication for surgery	N	Mean duration of surgery ($\pm$ SD) (min)	Mean intraoperative blood loss (ml) ($\pm$ SD)	Mean hemostasis time ($\pm$ SD)	Mean length of hospital stay ($\pm$ SD)
Adenoid hypertrophy	04	37.50 $\pm$ 19.36	23.75 $\pm$ 11.81	0.56 $\pm$ 0.38	2.33 $\pm$ 1.53
Adenoid hypertrophy + chronic rhinosinusitis	04	61.25 $\pm$ 06.29	60.00 $\pm$ 35.59	0.77 $\pm$ 0.35	1.00 $\pm$ 0.00
Adenotonsillectomy	02	50.00 $\pm$ 14.14	50.00 $\pm$ 00.00	0.24 $\pm$ 0.01	1.50 $\pm$ 0.71
Carcinoma thyroid	03	70.00 $\pm$ 05.00	48.33 $\pm$ 02.89	0.34 $\pm$ 0.14	2.00 $\pm$ 0.00
Chronic otitis media	15	71.00 $\pm$ 25.09	37.33 $\pm$ 18.50	0.50 $\pm$ 0.31	1.14 $\pm$ 0.36
Chronic rhinosinusitis	22	52.27 $\pm$ 20.69	98.27 $\pm$ 186.60	0.71 $\pm$ 0.64	1.10 $\pm$ 0.31
Chronic tonsillitis	06	54.17 $\pm$ 27.28	44.17 $\pm$ 20.60	0.58 $\pm$ 0.34	1.50 $\pm$ 1.22
CSF rhinorrhea	04	65.00 $\pm$ 37.19	66.25 $\pm$ 29.26	0.55 $\pm$ 0.32	2.33 $\pm$ 1.53
Deviated nasal septum	04	37.50 $\pm$ 06.45	28.75 $\pm$ 11.09	0.83 $\pm$ 0.79	1.00 $\pm$ 0.00
Deviated nasal septum + chronic tonsillitis	04	75.00 $\pm$ 23.80	52.50 $\pm$ 32.02	0.46 $\pm$ 0.31	1.33 $\pm$ 0.58
Goiter	05	94.00 $\pm$ 33.43	38.00 $\pm$ 17.18	0.55 $\pm$ 0.29	1.75 $\pm$ 0.50
Sinonasal polypsis	07	59.29 $\pm$ 09.76	60.71 $\pm$ 29.07	0.46 $\pm$ 0.31	1.00 $\pm$ 0.00

Table 3 Quality of life—change in discomfort score

Indication for surgery	N	Mean discomfort score $\pm$ SD		
		Baseline	48 hr	15 days
Adenoid hypertrophy	04	3.50 $\pm$ 0.71	2.00 $\pm$ 1.00	1.67 $\pm$ 1.15
Adenoid hypertrophy + chronic rhinosinusitis	04	3.25 $\pm$ 0.96	2.50 $\pm$ 0.58	1.33 $\pm$ 1.15
Adenotonsillectomy	02	2.50 $\pm$ 0.71	3.00 $\pm$ 1.41	1.50 $\pm$ 0.71
Carcinoma thyroid	03	3.00 $\pm$ 1.41	2.67 $\pm$ 0.58	1.33 $\pm$ 1.15
Chronic otitis media	15	3.21 $\pm$ 0.70	2.50 $\pm$ 0.85	1.43 $\pm$ 1.45*
Chronic rhinosinusitis	22	3.15 $\pm$ 1.09	2.35 $\pm$ 1.14	1.30 $\pm$ 1.42*
Chronic tonsillitis	06	4.00 $\pm$ 1.00	2.83 $\pm$ 0.98	1.33 $\pm$ 1.97
CSF rhinorrhea	04	2.67 $\pm$ 1.15	3.00 $\pm$ 0.00	1.67 $\pm$ 0.58
Deviated nasal septum	04	3.50 $\pm$ 1.00	3.00 $\pm$ 0.00	1.00 $\pm$ 1.00
Deviated nasal septum + chronic tonsillitis	04	3.00 $\pm$ 0.00	1.67 $\pm$ 0.58	0.33 $\pm$ 0.58
Goiter	05	3.20 $\pm$ 0.84	2.40 $\pm$ 0.55	2.00 $\pm$ 1.00
Sinonasal polypsis	07	2.83 $\pm$ 1.60	2.00 $\pm$ 0.89	1.33 $\pm$ 1.21

* $p < 0.001$

prepared in less than 50 s. Hemostasis was achieved in all the patients in less than 1 min (Table 2). None of the patients required blood transfusion. The packing was given in 65.1% patients post-surgery. The mean hospital stay was 1–2 days for most of the surgeries performed. Discomfort score was reduced for all surgeries. It was statistically improved in patients underwent surgery for chronic rhinosinusitis and chronic otitis media ($p < 0.001$) (Table 3). No postoperative bleeding episodes were reported from none of the patients. Although nasal packing was required, it was given in some patients for the wound support and to prevent postoperative bleeding. Nasal packing was not required in 36.9% of total patients. No complications (local

or systemic) were reported. No hematoma, swelling, or atrophic changes or adhesions, no septal displacement or synechia, were found.

Discussion

The role of fibrin sealants to achieve effective hemostasis and to reduce postoperative bleeding has been well established. Our results suggested the usefulness of fibrin sealant (Evicel®) in various otolaryngologic procedures. The study results were similar to earlier studies published. The study conducted by Vaiman M et al. [12] showed that fibrin sealant

was more effective than nasal packing in endoscopic nasal surgeries. It also showed a decrease in antibiotic usage. We also found that all the patients were discharged from the hospital immediately postoperatively due to no complications. The requirement for nasal packing was reduced due to decrease in the postoperative bleeding. We also found that significant reduction in pain and discomfort.

Other studies in conducted in septoplasty and conchotomy, fibrin sealant found to be effective in stopping nasal bleeding and seal intranasal flaps [13, 14]. We have used Evicel® in one case of deviated nasal septum with chronic rhinosinusitis. The effectiveness of Evicel® was similar to earlier studies have reported. In another study, fibrin sealant significantly reduced bruising and swelling from the osteotomy site [15]. These studies also highlighted the ease of application due to its two port facility for application helps achieving the good hemostasis in inaccessible areas.

We have used fibrin sealant in four cases where endoscopic septoplasty and coblation tonsillectomy were performed. No complications such as postoperative bleeding or pain. These results were contrary to earlier published results for fibrin glue in tonsillectomy [16, 17].

The hemostatic effect of fibrin sealant in trans-oral robotic surgery for sleep apnea was found to be useful. In this procedure, tongue based reduction uvulo-palatoplasty and inferior turbinate reduction was done. The risk of bleeding is very high in this complex surgery. Another practical issue is to access the bleeder point to control hemorrhage. Due to unique applicator available for Evicel®, we have achieved hemostasis without any difficulty. Similarly for the complex surgeries such as tracheal resection anastomosis, robotic thyroidectomy, transphenoid pituitary excision, CSF rhinorrhea repair and stapedectomy, fibrin sealant human played a critical role in achieving the hemostasis and subsequent, better clinical outcome.

ENT surgery today is complex and ranges from skull base to various head neck procedures to implant surgeries. Due to various anatomical complexities and at times difficult areas of access, topical hemostatic agents/sealants comes into be very useful to control bleeding.

We found the encouraging results for fibrin sealant in various otolaryngologic surgeries. The benefits of faster hemostasis, shorter length of hospital stay, minimal pain/discomfort, reduced nasal packing gives a better clinical outcome. We know the shortcomings of the retrospective study analysis and hence, well designed randomized controlled study is required for various otolaryngologic surgical procedures.

Compliance with Ethical Standards

Conflict of interest Authors have no conflict of interest to declare both financial & non-financial.

Ethical Standard All procedures performed in the study were in accordance with the ethical standards of the hospital and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained as per the hospital standard operating protocol from all individuals before the surgery and privacy of participants were observed.

References

1. Acar B, Babademez M, Karabulut H (2010) Topical hemostatic agents in otolaryngologic surgery. *Kulak Burun Bogaz Ihtis Derg* 20(2):100–109
2. Jackson MR (2001) Fibrin sealants in surgical practice: an overview. *Am J Surg* 182:1S–7S
3. Mankad PS (2001) The role of fibrin sealants in hemostasis. *Am J Surg* 182:21S–28S
4. Dhillon S (2011) Fibrin sealant (Evicel® [Quixil®/Crosseal™]) ar of its use as supportive treatment for haemostasis in surgery. *Drugs* 71(14):1893–1915
5. Dulguerov P, Quinodoz D, Allal A, Tassonyi E, Beris P (1998) Blood transfusion requirements in otolaryngology-head and neck surgery. *Acta Otolaryngol* 118(5):744–747
6. Levy ML, Amar AP (1998) The use of oxidized regenerated cellulose in neurosurgical procedures. *Surg Technol Int* 7:467–471
7. Landry JR, Kanat IO (1985) Considerations in topical hemostasis. *J Am Podiatr Med Assoc* 75:581–585
8. Chalmers RTA, Darling RC III, Wingard JT et al (2010) Randomized clinical trial of tranexamic acid-free fibrin sealant during vascular surgical procedures. *Br J Surg* 97(12):1784–1789 **discussion 1790**
9. Greenberg R, Kashtan H, Skornik Y, Werbin N (2004) Treatment of pilonidal sinus disease using fibrin glue as sealant. *Tech Coloproctol* 8(2):95–98
10. Giakoustidis E, Drosinopoulos P, Agouridakis K, Galanis N (1985) Surgical treatment of liver injuries by application of fibrin glue. *World J Surg* 9:144–148
11. Kajiwarra K (1990) Repair of leaking bleb with fibrin glue. *Am J Ophthalmol* 109:599–601
12. Vaiman M, Sarfaty S, Shlamkovich N, Segal S, Eviatar E (2005) Fibrin sealant: alternative to nasal packing in endonasal operations—a prospective randomized study. *IMAJ* 7:571–574
13. Vaiman M, Sarfaty S, Eviatar E (2009) The use of fibrin sealant as a glue for septoplasty and conchotomy. *Rhinology* 47:297–300
14. Vaiman M, Eviatar E, Shlamkovich N, Segal S (2005) Use of fibrin glue as a hemostatic in endoscopic sinus surgery. *Ann Otol Rhinol Laryngol* 114(3):237–241
15. Pryor S, Sykes J, Tollefson T (2008) Efficacy of fibrin sealant (Human) (Evicel) in rhinoplasty. a prospective, randomized, single-blind trial of the use of fibrin sealant in lateral osteotomy. *Arch Facial Plast Surg* 10(5):339–344
16. Segal N, Puterman M, Rotem E, Niv A, Kaplan D, Kraus M, Brenner H, Nash M, Tal A, Leiberman A (2008) A prospective randomized double-blind trial of fibrin glue for reducing pain and bleeding after tonsillectomy. *Int J Pediatr Otorhinolaryngol* 72:469–473
17. Stoeckli S, Moe K, Huber A, Schmid S (1999) A prospective randomized double-blind trial of fibrin glue for pain and bleeding after tonsillectomy. *Laryngoscope* 109:652–655