



Improving efficiency in epistaxis transfers in a large health system: Analyzing emergency department treatment variability as pretext for a clinical care pathway[☆]

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ABSTRACT

Introduction: Epistaxis is a common condition with an estimated \$100 million in health care costs annually. A significant portion of this stems from Emergency Department (ED) management and hospital transfers. Currently there is no data in the literature clearly depicting the differences in treatment of epistaxis between Emergency Medicine (EM) physicians and Otolaryngologists. Clinical care pathways (CCP) are a way to standardize care and increase efficiency. Our goal was to evaluate the variability in epistaxis management between EM and Otolaryngology physicians in order to determine the potential impact of a system wide clinical care pathway.

Materials and methods: A retrospective case study was conducted of all patients transferred between emergency departments for epistaxis over an 18-month period. Exclusion criteria comprised patients under 18 years old, recent sinonasal surgery, bleeding disorders, and recent facial trauma.

Results: 73 patients met inclusion criteria. EM physicians used nasal cautery in 8%, absorbable packing in 1% and non-absorbable packing in 92% (with 33% being bilateral). In comparison, Otolaryngologists used nasal cautery in 37%, absorbable packing in 34%, and non-absorbable packing in 23%. Eighty percent of patients treated by an Otolaryngology physician required less invasive intervention than previously performed by EM physicians prior to transfer.

Conclusions: Epistaxis management varied significantly between Emergency Medicine and Otolaryngology physicians. Numerous patients were treated immediately with non-absorbable packing. On post-transfer Otolaryngology evaluation, many of these patients required less invasive interventions. This study highlights the variability of epistaxis treatment within our hospital system and warrants the need for a standardized care pathway.

1. Introduction

Epistaxis is a common condition which affects more than half of the U.S. population in their lifetime, costing hospital systems an estimated \$100 million dollars annually for management [1]. A significant portion of this cost stems from inpatient management, Emergency Department (ED) visits, and hospital transfers. The varying comfort levels and unfamiliarity with standard of care of the Emergency Medicine (EM) physicians, who often function as first line practitioners, leaves epistaxis treatment largely up to practitioner preference. This in turn

leads to a wide array of treatments for an initial event of epistaxis, which may or may not be appropriate and effective.

There are many different ways to manage epistaxis in an ED setting, with escalating levels of invasiveness. Typically, first line therapy is pressure with or without concurrent application of topical vasoconstrictors such as neosynephrine or oxymetazoline. These medications work to reduce overall blood flow to the nasal mucosa and have been shown to be effective in primary management of anterior epistaxis in up to 65% of patients [2]. If an identifiable source is found, cautery can be applied either in the form of chemical cautery with silver nitrate or

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electrocautery, which may additionally control up to 50% of epistaxis cases refractory to vasoconstrictors alone [2,3]. For persistent bleeding, or if no identifiable source is found, numerous types of absorbable and nonabsorbable and packing are available and efficacious, including oxidized regenerated cellulose (Surgicel®) [4,5], topical thrombin (Recothrom®, FloSeal hemostatic matrix®) [6–8], Merocel® sponges [7,9,10], nasal tampons (Rhino Rocket®, Rapid Rhino®) [7,9,10], and nasal catheters (Foley catheter, Epistat®) [11].

In our experience at a multi-institutional health system, we frequently encounter patients who are transferred from either satellite or outside hospitals to our academic tertiary care center for management of epistaxis. Many of these patients have resolution of their symptoms by time of transfer, or present after having up-front invasive procedures such as placement of non-absorbable nasal packing. Within the fields of General Surgery, Neurosurgery, and Pediatric Emergency Medicine, literature shows that a vast majority of hospital-to-hospital transfers are unnecessary and can be managed at the transferring facility or as an inpatient [12–14]. These studies display the consequences of inefficient care including millions of dollars and numerous hours wasted. There is currently limited data on hospital transfers within Otolaryngology literature. There is no literature detailing difference in management between Emergency Medicine and Otolaryngology physicians and how this may contribute to transfers.

Clinical care pathways are a way to standardize treatment for specific medical conditions, reduce inappropriate interventions, and lower cost [15]. Our institution implements clinical care pathways for many conditions, but currently there is not one in place for epistaxis. The aim of this study was to evaluate the variability in management between Emergency Medicine and Otolaryngology physicians, and in doing so determine the potential impact of implementing an epistaxis clinical care pathway.

2. Materials and methods

Approval for the study was obtained from the Institutional Review Board of University Hospitals. Our electronic medical record database was queried for all patients presenting as transfers to University Hospitals Cleveland Medical Center between January 2016 and June 2017. Search was narrowed among these patients to charts containing ICD-10 codes for “epistaxis”, “nosebleed”, and “nasal hemorrhage.” Patients were excluded if they were under 18 years old, if they underwent sinonasal surgery within the past 30 days, if they sustained a facial trauma within the past 30 days, if they had a documented bleeding disorder, if they were an ED to floor transfer (and therefore not treated in our ED), or if they had incomplete records.

Data collected from chart review included demographic information, past medical and surgical history, social history, laterality of epistaxis, anticoagulation use, vital signs from initial presentation to the ED, and labs collected while in the ED. Data was also collected regarding intervention for epistaxis, both by pre-transfer EM physicians and post-transfer Otolaryngology physicians. ED interventions were performed by Emergency Medicine physicians at 20 different satellites or outside hospitals, and Otolaryngology interventions were performed by an on-call second or third year Otolaryngology resident.

Specific procedure data included methods and types of treatment performed including clearing the nose of blood clots and use of proper equipment (headlight or flashlight and nasal speculum) escalating to interventions such as vasoconstrictors, cautery, placement of absorbable and non-absorbable packing, and operative intervention.

SPSS software was used for all statistical analyses (version 22; IBM Corp). Means and associated standard deviations were calculated to determine data distribution and uniformity on demographic data. Chi-squares were used to determine statistically significant relationships between variables of interest. A p-value of < 0.05 was established *a priori* to be statistically significant.

Table 1

Demographic data for patients (n = 73) transferred to our tertiary care center Emergency Department for epistaxis.

	Number of patients (n total = 73)	Percentage
Gender		
Male	37	50.7
Female	36	49.3
Medical comorbidities		
Hypertension	60	82.2
Atrial fibrillation	29	39.7
Coronary artery disease	22	30.1
Congestive heart failure	20	27.4
Diabetes mellitus type 2	14	19.2
Stroke	6	8.2
Social history considerations		
Current Tobacco Smoker	12	16.4
Former Tobacco Smoker	23	31.5
Alcohol abuse	6	8.2
Anticoagulation medication		
Aspirin	36	49.3
Warfarin (Coumadin)	23	31.5
Clopidogrel (Plavix)	9	12.3
Apixaban (Eliquis)	4	5.5
Ticagrelor (Brillinta)	4	5.5
Rivaroxiban (Xarelto)	1	1.4

3. Results

A total of 132 patients were transferred to University Hospitals Cleveland Medical Center for epistaxis within the selected 18-month time frame. Four were excluded for age under 18 years old, 10 due to recent sinonasal surgery, 4 due to recent facial trauma, 14 due to comorbid bleeding disorders, 11 due to ED to floor transfers, and 16 due to incomplete records. After exclusion criteria were applied, a total of 73 patients remained. Every patient transferred to the tertiary care facility received an Otolaryngology consult in the Emergency Department.

A summary of patient data is presented in Table 1.

Gender distribution between male and female was equal, and the mean age was 74. Common medical comorbidities included hypertension (82%), atrial fibrillation (40%), coronary artery disease (30%), congestive heart failure (27%), diabetes type 2 (19%), and transient ischemic attack or stroke (8%). 55% had three or more major medical comorbidities, and 29% had five or more. A percentage of patients were current (16%) or former (32%) smokers, but heavy alcohol consumption was far less common. 67% of patients endorsed a history of prior nosebleeds, and 20% required interventions in the past, unrelated to their current visit. Anticoagulation therapy was common (68%), with the most frequent being aspirin (49%) and warfarin (32%).

Vital signs data collected on presentation to the ED revealed 68% of patients met criteria for hypertension (systolic blood pressure > 140 mm Hg or diastolic blood pressure > 90 mm Hg) and 36% met criteria for severe hypertension (> 160 mm Hg or > 100 mm Hg). Eighteen percent were tachycardic over 100 beats per minute. Labs were collected on 92% of patients, showing 11% of patients to have a supratherapeutic INR > 3. Hemoglobin and hematocrit were below normal levels in 43% and 52% of patients, respectively.

Procedure data between Emergency Medicine and Otolaryngology physicians varied dramatically (Fig. 1).

In assessing documented procedure data, no EM physicians report clearing the nose of blood clots, or using direct visualization with a headlight and nasal speculum, whereas this was initial standard of care for every patient seen by an Otolaryngology physician. Prior to packing, topical vasoconstrictors and pressure were utilized during initial treatment attempt by 58% of EM physicians, and a second time after

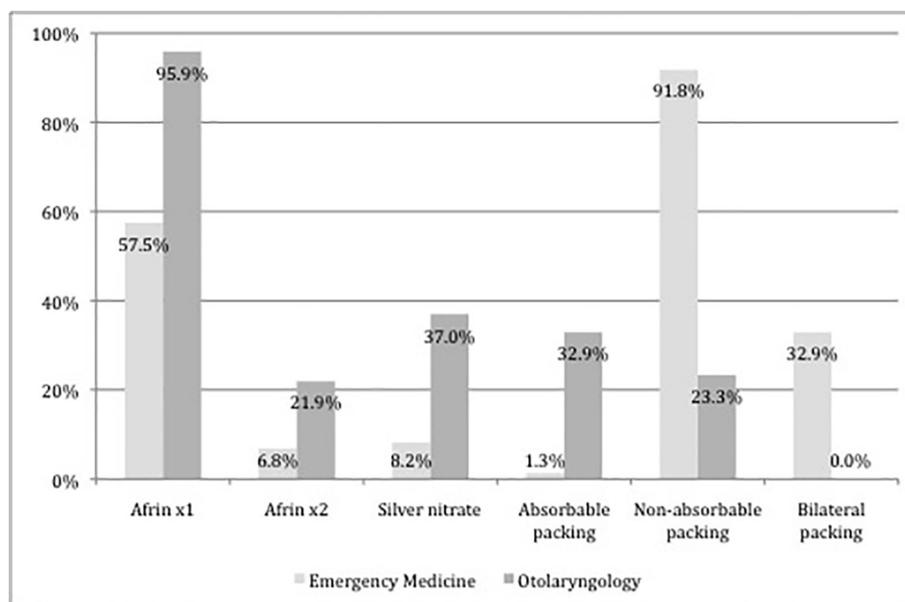


Fig. 1. Summary of differences in interventions utilized for treatment of epistaxis by Emergency Medicine and Otolaryngology physicians.

Table 2

Detailed differences in interventions utilized for treatment of epistaxis by Emergency Medicine and Otolaryngology physicians.

	Emergency medicine n = 73	Otolaryngology n = 73	p value
Afrin and pressure once			
Yes	42 (57.5)	70 (95.9)	< 0.001
No	31 (42.5)	3 (4.1)	
Afrin and pressure twice			
Yes	5 (6.8)	16 (21.9)	0.009
No	68 (93.2)	57 (78.1)	
Silver nitrate			
Yes	6 (8.2)	27 (37)	< 0.001
No	67 (91.8)	46 (63)	
Absorbable packing			
Yes	1 (1.4)	24 (32.9)	< 0.001
No	72 (98.6)	49 (67.1)	
Non-absorbable packing			
Yes	67 (91.8)	17 (23.3)	< 0.001
No	6 (8.2)	56 (76.7)	
Bilateral packing			
Yes	24 (32.9)	0 (0)	< 0.001
No	49 (67.1)	73 (100)	

failure of the first effort by 7%. Otolaryngology physicians used vasoconstrictors 96% of the time once and 22% twice prior to escalating treatment ($p < 0.001$ and $p = 0.009$, respectively). Regarding more invasive measures, EM physicians used nasal cautery in 8%, while Otolaryngology physicians used it in 37% ($p < 0.001$). Absorbable packing was used in 1% and non-absorbable packing in 92% by EM physicians, and in 34% and 23% by Otolaryngologists ($p < 0.001$ and $p < 0.001$). 33% of EM physicians utilized bilateral nonabsorbable packing, an intervention that was not used by any Otolaryngology physicians ($p < 0.001$). A detailed summary of intervention differences can be seen in Table 2.

Of the included patients, 30 of 73 (41%) were admitted to the hospital with the average length of stay being 4.4 days. 17% of admitted patients (7% overall) required operative intervention, either with embolism or nasal endoscopy with cautery and/or sphenopalatine artery ligation. There were no mortalities among patients seen during this time period.

4. Discussion

This study shows significant differences in the way epistaxis is treated between emergency department providers and consultant otolaryngology physicians. There was a lack of systematic management in our Emergency Department, which is often the front line for epistaxis treatment. Starting with a common, initial step, only 11% of EM physicians reported examining the nose to identify a potential source of bleeding, and none documented using standard and readily available equipment such as headlight and nasal speculum. Topical vasoconstrictors, which are proven beneficial upfront adjuncts to initial management [2], were only used by EM physicians 58% of the time. While there is no standardized recommendation for duration of pressure, either with or without the use of vasoconstrictors, a review by Iqbal et al. in 2018 showed that most studies describe at least 30 min between conservative measures and nasal packing, and some up to 2 h [8]. One study by Singer et al. specifically recommends 15 min of continuous pressure, followed by another 15 min if bleeding continues [10].

Our data also illustrates how infrequently measures such as nasal cautery or nonabsorbable packing are utilized in initial Emergency Department epistaxis treatment. Cautery was only attempted in by 8% of EM Physicians, while Otolaryngology physicians used this in 37% of patients, with it being a definitive treatment in nearly all of these cases. Other studies have shown cautery to be superior to nonabsorbable packing, having a 33–34% lower failure rate [16,17]. Absorbable packing was by far the least attempted intervention by EM at 1%, but was used one third (34%) of the time by Otolaryngology physicians. While there are no studies directly comparing different absorbable packing materials, the most commonly used materials in our tertiary care center (Surgicel®, topical thrombin, or FloSeal®) have separately been shown to be beneficial in treating epistaxis, in some cases more so than nonabsorbable packing [4–8].

A majority of patients in this study (92%) were treated initially in the ED with non-absorbable packing, yet continued to have bleeding after placement and were, therefore, transferred. No documentation was present specifying how long patients were observed for slowing or resolution of bleeding after placement of nonabsorbable packing, and none describe any further conservative adjuncts, such as pressure or vasoconstrictors. On arrival at our tertiary care medical center, 80% of patients transferred for intractable epistaxis were subsequently treated with much more conservative measures by Otolaryngology physicians.

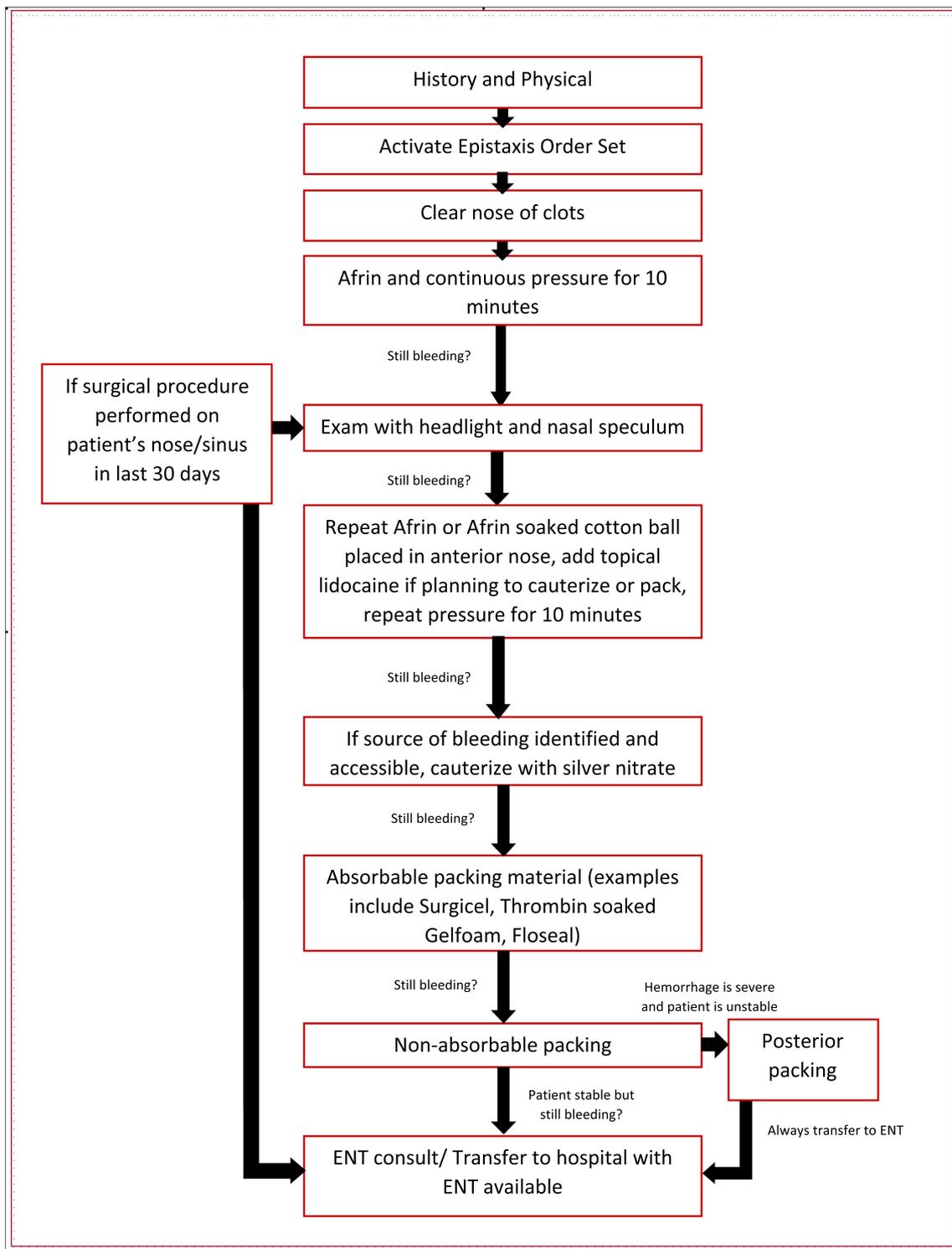


Fig. 2. Proposed standardized Epistaxis Care Pathway for initial treatment of epistaxis in the Emergency Department.

Were similar resources utilized at the primary site of presentation, many of these transfers may have been avoided. Seven percent of patients transferred did require surgery or embolization to control their epistaxis, but this is consistent with other reports in the literature, which describe rates of 8.1–11% [18,19].

We do acknowledge that in focusing specifically on hospital transfers, we may have selected for patients with more complicated cases of epistaxis. However, of the 73 patients studied, we found demographic trends consistent with those reported in the literature for all epistaxis

cases, not just for inter-hospital transfers [20,21]. The average age was 74 years old, with only 13 patients in our cohort (17%) being below the age of 60. Many of these patients had multiple medical comorbidities, which may have contributed to more severe presentations. By far the most common comorbidity was hypertension, which was seen in 82% of patients. The role of hypertension in epistaxis has been hotly debated, but has been reported by many to be present in a significant number of patients presenting to Emergency Departments for this condition [21–25]. Heart disease and atrial fibrillation were also prevalent, which

Villwock et al. also describe as being frequent in patients admitted to the hospital for epistaxis in their study of epistaxis trends across the U.S. [18] In addition, 68% of patients were on oral anticoagulation therapy, which has also been well reported to play a role in persistence of epistaxis [26,27]. Regardless of these additional factors, our data shows that these patients can still be treated successfully with conservative measures.

Several reasons likely exist for the discrepancies in epistaxis management between EM and Otolaryngology physicians. Many EM physicians treating these patients may be younger, more junior residents or faculty who are less experienced with epistaxis overall [28]. If not familiar with fundamental steps, such as use of proper lighting and equipment, proper treatment may be hindered from the beginning. Additionally, use of improper technique, especially when considering invasive measures such as nonabsorbable packing, may result in additional utilization of resources. A study by Evans et al. showed that patients packed or cauterized by EM physicians were more likely to require further treatment than those undergoing similar measures by Otolaryngologists [29]. Another likely factor is the lack of time and ability of the EM physicians to devote to identifying and localizing the source of the bleed, something necessary for cautery attempts and preferred prior to placement of non-absorbable packing. The final contributing factor is almost certainly the lack of familiarity with options for epistaxis treatment, and the risks and benefits of each. Without a standardized pathway or guidelines in place, treatment is largely left up to physician preference, which understandably differs among individual providers.

Irrespective of cause, this extreme variability in epistaxis care has several implications. From a patient standpoint, conservative measures such as vasoconstrictors and cautery have been demonstrated to be far less painful and cause less distress than nonabsorbable packing [1,8]. There have been no studies specifically looking at the discomfort caused by application of absorbable packing materials, but it can be reasonably assumed that these would fall in a similar category as other conservative measures.

From a hospital quality standpoint, properly performed conservative measures can improve patient satisfaction, reduce admission rates, and decrease costs [1]. Nikolaou et al. showed that nonabsorbable packing on average was less cost effective than conservative measures such as cautery for anterior epistaxis [30]. Patients treated definitively with cautery or absorbable packing require admission much less frequently than those with nonabsorbable packing, and do not require specialized follow up for removal, which additionally reduces costs [8]. The average cost of a 3 day epistaxis admission in 2005 was calculated by Goddard et al. at \$7616, and up to \$17,517 for those requiring surgery or embolization [31]. Goljo et al. showed similar results in 2015 with a three day admission costing an average of \$6925 [1]. On top of treatment and admission costs are costs incurred by unnecessary transfers, which, although unavailable for epistaxis specifically, have been estimated by other specialties to cost a single hospital system between half a million to 1.5 million dollars per year [12–14].

There have been several proposed algorithms for treatment of initial presentation of epistaxis. Upile et al. described a pathway involving pressure, cautery, and nonabsorbable packing in escalating order, but did not include topical vasoconstrictors or absorbable packing materials [28]. Shargorodsky et al. reported treating patients with chemical cautery, nonabsorbable packing, or surgical vascular control [17]. They reported a higher success rate with cautery than with nonabsorbable packing in patients with anterior epistaxis. Leung et al. also proposed an algorithm for treatment of epistaxis, but focused instead on posterior bleeding requiring packing or operative intervention [19]. Neither of these studies included more conservative measures such as topical vasoconstriction or absorbable packing.

After studying treatment data from both Emergency Medicine and Otolaryngology, along with reviewing the literature regarding efficacy and benefit of each treatment, we developed a standard epistaxis care

pathway. This algorithm incorporates each step, and organizes them in a stepwise fashion from most conservative to most invasive (Fig. 2). Our ultimate goal is to institute this pathway as an educational and quality improvement resource within our tertiary institution and its satellite campuses.

5. Conclusion

This study demonstrates that epistaxis management varies significantly between Emergency Medicine and Otolaryngology physicians. A significant number of patients were treated immediately with non-absorbable packing prior to transfer, but on post-transfer Otolaryngology evaluation, 80% of these patients were successfully treated with less invasive interventions. This discrepancy highlights the variability of epistaxis treatment within our hospital system, which may in turn lead to decreased patient satisfaction and increased transfer and health care costs. Treating epistaxis in a consistent and evidence-based fashion among all physicians, EM and Otolaryngology alike would have benefits both for the patient and for the health system to which the patient presents. A clinical care pathway based on stepwise, evidence-based approaches to treating epistaxis is a potential solution to standardize treatment.

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