African Journal of Emergency Medicine 10 (2020) 209–214

Contents lists available at ScienceDirect

African Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/afjem

Original article

Standardised management of atraumatic epistaxis for improved outcomes in an emergency department with off-site ear, nose and throat cover - A quality improvement project

Eziefa Obuseh*, Emily O'Conor

Connolly Hospital, Blancharstown, Mill road, Abbotstown, Dublin, Ireland

ARTICLE INFO

Keywords:
Epistaxis
Nosebleed
Nasal packing
Bleeding
ENT
Emergency department

ABSTRACT

Problem description: Otorhinolaryngology services are not available in all hospitals and atraumatic epistaxis is a common presentation to Emergency Departments (ED). Not all ED staff are experienced in managing epistaxis and there appeared to be a high rate of re-bleeding after treatment provided. We aimed to improve outcome for ED patients presenting with atraumatic epistaxis and staff conditions by creating a Departmental pathway outlining a management plan and ensuring all equipment needed was readily available.

Methods: A retrospective 6-month audit was done to assess current management and re-bleed percentage rates post nasal packing. A team was assembled, stocked a trolley, created an Atraumatic epistaxis ED pathway and promoted its use by staff. Repeated Plan-Do-Study-Act cycles were undertaken.

Chosen measures were (1) Reduced re-bleed rates post nasal packing from initial audit levels; (2) Increased nasal packing duration; (3) Improved qualitative feedback by ED doctors (4) 100% E.N.T. trolley stock.

Results: Audit showed minimal use of vasoconstrictor spray, a 7-hour mean nasal pack duration, a re-bleed rate post nasal packing of 39% and staff reports of difficulties accessing items required.

After introduction of the E.N.T. trolley, there was positive staff feedback regarding improved availability of treatment items and full stocking of the trolley was achieved after repeated cycles.

Following introduction of the Epistaxis pathway and staff education, average re-bleed rates post nasal packing dropped* from 39% to 20% in the first cycle; 21% in the third cycle; 25% in the fourth cycle and 14% in the fifth cycle- (*Isolated re-bleed average of 40% observed in the second cycle).

Mean nasal packing duration increased from 7 h to 9, 10, 10, 12 and 8 h in the 2-monthly cycles successively.

Conclusion: The project's aims of improving epistaxis patients' outcomes and improved convenience for ED staff were achieved.

African relevance

- This quality improvement project can be reproduced in emergency departments distant from ENT support centres.
- It can also apply to settings where terrain makes transfer of patients to such centres difficult, such as low-resourced settings.

Problem description

Ms. C.D., a 79 year old female patient attended the Emergency Department, Connolly Hospital, Blanchardstown (CHB) Dublin, Ireland in March 2016- (CHB is a public university teaching hospital in Dublin, Ireland, serving a population of over 290,000 [1] with an approximate annual ED attendance of 40,000 presentations and 1211 admitted to the ED Clinical Decision Unit (CDU)).

She complained of atraumatic epistaxis from her left nostril, ongoing for several hours. She was on an anticoagulant and had normal vital signs apart from a mildly raised blood pressure of 145/95 mmHg. She was positioned upright and her nostrils compressed while the nurse and attending Registrar tried to locate the various items required from the ED store room- a process which was delayed by several trips to and fro and queries to other staff regarding the last known location of certain items, particularly the Co-phenylcaine® spray (anaesthetic/vasoconstrictor spray). Items were eventually located and her left nostril was packed using a Rapid rhino® (RR®) posterior pack and bleeding controlled- (The Rapid rhino® is a balloon catheter with a large, low-pressure air balloon encased in a carboxymethylcellulose (CMC) mesh; it becomes slick when placed in water for 30 s, making placement easier

* Corresponding author.
E-mail address: ezynwa@gmail.com (E. Obuseh).

https://doi.org/10.1016/j.afjem.2020.07.001
Received 21 February 2020; Received in revised form 11 May 2020; Accepted 4 July 2020
Available online 13 August 2020

and upon contact with blood, the CMC fibers act to promote thrombosis). Verbal enquiry from the Registrar and other ED colleagues regarding duration of nasal packing before removal yielded varying responses ranging from 2 to 4 h, coupled with a general opinion that rebleeding was likely inevitable after which the patient would then be transferred to Beaumont Hospital, 15 km away where Ear, Nose and Throat (E.N.T.)/Otorhinolaryngology support was available. The on-call E.N.T. Registrar was phoned for advice and recommended a minimum packing duration of 6 h. Ms. C.D. was informed of this proposed treatment plan and admitted to the ED CDU for the 6-hour duration before removal of the nasal pack. She was pleased with the plan, stating that during a previous attendance in CHB ED with a nose bleed, the pack had "*no sooner been put in than it was taken out again and of course I started to bleed again so a new pack was shoved in again- and oh!- how painful those packs are going in! Then they sent me to BH to see the E.N.T. doctor but I had to wait hours in a chair and when she finally took out the pack, it had stopped bleeding- she said if only it had been left in longer, I may not have needed to come over from Connolly in the first place*".

The nasal pack was removed 7 h later with no recurrence of epistaxis. She was discharged with a prescription for Naseptin® (antiseptic/antibiotic cream) cream with verbal advice to return if bleeding recurred.

Our patient's narrative suggested that she (and reportedly the attending E.N.T. doctor in BH) attributed her re-bleeding and subsequent transfer on her previous presentation to premature removal of the nasal pack and if so, may have been subjected to an unnecessary repetition of the painful process of nasal re-packing.

Available knowledge

The process in place for epistaxis management in CHB ED was to stop bleeding using correct nose pinching techniques, adjuncts like vasoconstrictor nasal spray, cautery using Silver nitrate sticks if suitably experienced and nasal packing using RR® or other non-dissolvable nasal packing products in stock, followed by observation in the ED and discharge home if successful. Support and advice were also readily available from ED Consultants and via telephone consultation with the E.N.T. team on call in BH, with a standing arrangement for patient transfer via taxi or ambulance if management was unsuccessful in stopping epistaxis; however, there was no departmental consensus as to how long nasal packs should be left in.

A literature search was done via the online RCSI library, UpToDate, DynaMedPlus and PubMed using keywords "epistaxis", "nosebleed", "nasal packing duration"; also looking at the RR® product usage instructions and National Institute for Health and Care Excellence (NICE) Clinical Knowledge Summary on epistaxis.

This showed that, with the exception of a few small Randomized Controlled Trials (RCTs) and several systematic reviews, there were no large, placebo-controlled, randomized trials of epistaxis treatment hence most authors' recommendations were based on expert opinion [2]. The use of a vasoconstrictor spray was encouraged [3–5]; alternatively pre-treatment of the nasal cavity with cotton swabs soaked in 2% lidocaine and 1:100,000 adrenaline was considered similarly effective [6]. Non-dissolvable nasal packing such as RR®, Merocel® or alternatives as petroleum jelly gauze, Bismuth Subnitrate and Iodoform Paste (BIPP) impregnated ribbon gauze were recommended for bleeding not resolving with nasal pressure and/or cautery, with pack removal 24–48 h later [2,4,5,7,8,9]. No evidence was found for prophylactic systemic antibiotics to prevent toxic shock syndrome (TSS) with nose packing for epistaxis [10,11] – a few cases were reported after nasal surgery with packing but not with epistaxis [12]; topical antibiotics are likely sufficient [7,13]. Admission for observation after packing was recommended [5,7,12,14,15]. Floseal® had been shown in manufacturer-supported research to be subjectively more effective than packing [16].

A meeting was held with Mr. Robert Gaffney (E.N.T. Consultant, BH) in late November 2016 to discuss audit findings and establish local practice. His personal recommendations included:

1. Recommended packing durations of at least 12 h;
2. Allowing patients home with pack discouraged due to aspiration concerns; ED CDU admission preferred.
3. Cautery to be attempted only if bleeding point clearly visualized and accessible.
4. Other management options like Floseal® Haemostatic matrix available but training for proper use, cost etc. to be considered.

Rationale

It was reasoned that an epistaxis pathway would standardise the variability caused by the frequent turnover and varying experience of ED staff. An E.N.T. trolley would ensure all items needed would be easy to locate and availability of the CDU would enable staff observe patients for the recommended period. Having identified the problems, a Quality Improvement Project (QIP) involving Stakeholder and team selection, planned interventions with review of outcomes via an iterative process and to be reported using Standards for Quality Improvement Reporting Excellence (SQUIRE 2.0) Guidelines was commenced.

Methods

A retrospective audit of atraumatic epistaxis presentations between February and July 2016 (aiming for a range of 40 to 50 patients) was done to assess the frequency of such presentations, demographics of patients (including use of anticoagulants), use of vasoconstrictor nasal spray, variations in duration of nasal packing (when required) with outcome on removal and transfer rates to BH for further E.N.T. management. Audit proposal was submitted to ED Consultants with a target completion date of 31/08/2016 and approved. Using the e-Audit tool on the ED Symphony patient system, the audit was completed in early November 2016 with the following results:

- Inclusion criteria: All adult atraumatic epistaxis presentations from February 2016 to July 2016; forty (40) patients identified.
- 21/40 (52.5%) on either Antiplatelet or anticoagulant therapy or both (6- Antiplatelet, 14- Anticoagulant, 1- both) - not documented in 6 patients.
- Silver nitrate cautery attempted in 9/40 (22.5%); cautery successful in stopping epistaxis in 4/9 (44.4%).
- Vasoconstrictor spray used in 5/40 (12.5%); All 5 subsequently had nasal packing but only 1 eventually required transfer to BH E.N.T.
- Nasal packing required in 23/40 (57.5%); mean nasal pack duration **7 h**.
- No re-bleed post removal of pack in 14/23 (60.9%).
- Immediate recurrence* post removal of pack with resultant transfer to BH E.N.T. in 9/23 cases = **39%** re-bleed rate. {Nasal pack removal not attempted in 1 case prior to transfer to BH so also considered an immediate recurrence}.

(*immediate recurrence = re-bleed within 30 min to 1-hour observation time in ED post removal of pack)

- Immediate recurrence rate post nasal pack removal by duration of packing:

Duration of packing	Recurrence ratio	Recurrence rate (%)
≤4 h	5/7 immediate recurrences	71%
≥5 ≤ 8 h	3/10 immediate recurrences	30%
≥9–13 h	1/6 immediate recurrences	17%

- 6/9 re-bleeders (**67%**) on either Antiplatelet, anticoagulant therapy

or both.

Observations and inferences made from the audit findings were:

- ➢ Wide variation in chosen durations of nasal packing;
- ➢ Limited use of vasoconstrictor spray;
- ➢ Although unlikely to be statistically significant due to small sample size, epistaxis recurrence rate appeared to progressively reduce with longer durations of nasal packing time.

Further perusal of the charts/scanned notes of the patients transferred to E.N.T. in BH (8 of the 9 patients' notes were located) showed that:

- All patients were accompanied by either a Staff Nurse or health Care Assistant (HCA).
- Mean pre-transfer nasal pack duration for the 9 re-bleeders was 5 h (+4 h/−2 h 30 min) while in CHB;
- Mean waiting time for E.N.T. review with nasal pack in situ while in BH was 3 h 40 min (+5 h 26 min/−3 h 36 min), giving a total mean nasal packing duration of 8 h 40 min (+9 h 26 min/−6 h 6 min).
- There was no active bleed on pack removal in 4/8 patients (50%), 2 of whom were on anticoagulant/antiplatelet therapy. Prophylactic diathermy of prominent vessels was however done on 3 of these 4 patients.
- Active bleeding on pack removal was documented in 4/8 patients (50%), 3 of whom were on anticoagulant/antiplatelet therapy. All 4 required E.N.T. intervention using silver nitrate cautery and/or Floseal®. Floseal® is a product made of thrombin impregnated into gelatin granules which works via the topical effect of the thrombin cleaving fibrinogen in the patients' blood to fibrin and also through a pressure effect produced as the gelatin granules swell when hydrated.
- One Rapid rhino® was reportedly filled with water instead of air.
- No patient required E.N.T. admission; all discharged back to CHB with accompanying Nurse/HCA.
- Average total duration in BH pre-transfer back to CHB = 7 h 15 min (+19 h 1 min/−6 h 46 min).

Feedback was sought from the ED Doctors regarding availability of items and on the limited use of vasoconstrictor spray. Using the existing CHB ED doctors 'WhatsApp' social media group forum, the overwhelming response was that many would like to use vasoconstrictor spray but could never find the spray or nozzles when needed. A few claimed to use it but never documented in the notes. Some said nasal packs were often available but being jumbled together in the store room made selection time-consuming. Those confident to cauterise when indicated had no nasal speculae or an ideal light source to aid proper visualisation. Varying opinions and levels of prior training and experience in epistaxis management [17] were also further highlighted.

A Fish Bone/Ishikawa diagram was used to assess contributing factors identified towards the problem (Fig. 1).

Stakeholders and team selection

Considering the WIIFM ('what's in it for me') factor, the following stakeholders and their likely benefits from the project were identified:

- ED Consultants- Improved patient care, outcomes and experience times.
- ED Doctors- Guidance if inexperienced; availability of and access to needed items.
- ED Nursing staff and HCAs- Reduced episodes of escorting patients to BH.
- E.N.T. team in Beaumont Hospital- Reduced inappropriate referrals.
- Epistaxis products Representatives (RR®, Floseal®)- Continuity of product use.

The team had several meetings before a project plan was decided (e.g. Floseal® initially proposed as 1st line epistaxis treatment but not considered cost-effective at €235/unit). A 2-part plan would run simultaneously and address all the factors identified in the Fishbone diagram:

(1) Create a dedicated E.N.T. trolley to be wheeled to the patient's bedside and contain all items needed to manage epistaxis- (*Equipment and Process*).
(2) Create a departmental Atraumatic Epistaxis pathway stating an agreed adequate duration of nasal packing using available nasal pack and CDU admission- (*Policies, Manpower and Environment*).

A proposed list of contents of the E.N.T. trolley was compiled and stocking a few packs of Floseal® as a back-up plan for bleeds not controlled by nasal-packing was agreed. The initial list (Appendix B1) was submitted to all the ED Consultants for opinions and approval on 21/11/2016 with the intention of having the trolley available by December 2016. Other items useful for managing other E.N.T. presentations were suggested in feedback and the list was updated (Appendix B2).

A draft of the Atraumatic Epistaxis pathway was started, encouraging use of a vasoconstrictor-anaesthetic spray and analgesia, recommending a minimum 12-hour nasal-pack duration and CDU admission for the duration of observation- prompt CDU admission would allay concerns regarding breaching the recommended maximal 6-hour ED episode [18].

The 12-hour pack duration provided as near to suggested packing durations of 24 h or more found in the literature search while maintaining a reasonable CDU turnaround time- it also corresponded with the nasal-packing duration advised by local E.N.T. Consultant and incidentally, also yielded the lowest re-bleed rate in the initial audit.

A "Nose bleed" discharge leaflet already in use in BH would be given to patients on discharge. The draft was sent to all ED Consultants in March 2017 and the pilot pathway was introduced in July 2017 and uploaded to the hospital intranet.

Study of interventions and iterative process

The Model For improvement with simultaneous 'Plan-Do-Study-Act' (PDSA) cycles for either arm of our 2-part plan was used (Figs. 2 and 3).

Positive qualitative feedback from the doctors and 100% E.N.T. trolley stock levels were chosen as outcome and process measures respectively for this project arm. The trolley became available in February 2017 (Appendix C1). The first 'Trolley PDSA cycle' was prompted in March 2017 after feedback that the trolley was missing posterior nasal packs and nasal specula; doctors had been disposing of the specula after use, despite the notice stating otherwise in the trolley stock list- reasons included being unaware they were reusable, not knowing where to place them for sterilisation etc. The CNM confirmed that re-stocking was being done by the Health Care Assistants (HCA) but frequency had not been discussed.

The HCAs were approached and daily re-stocking of the E.N.T. trolley was agreed. New specula were purchased and speculum instructions along with the location of the Central Sterile Services Department (CSSD) container were pasted directly onto the pack of nasal specula. "DO NOT DISCARD" labels were placed on each drawer of the trolley (Appendix C2).

A second cycle was undertaken in July 2017 prior to NCHD changeover in order to obtain a continuous qualitative feedback from the same set of doctors who commented on the marked improvement in being able to locate items. A trolley check confirmed items were available but the headlamp wasn't working- it had been left on and the batteries had died. These were replaced, the trolley stock list was updated to reflect this and a "SWITCH ME OFF AFTER USE" label pasted on the

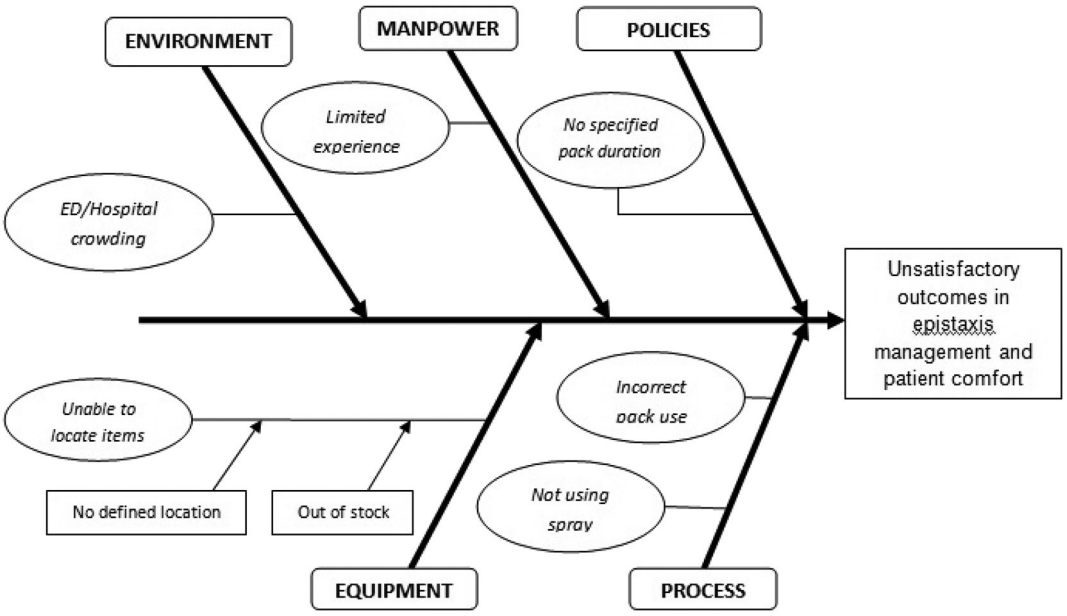


Fig. 1. Fishbone diagram.

Fig. 2. Model for improvement.

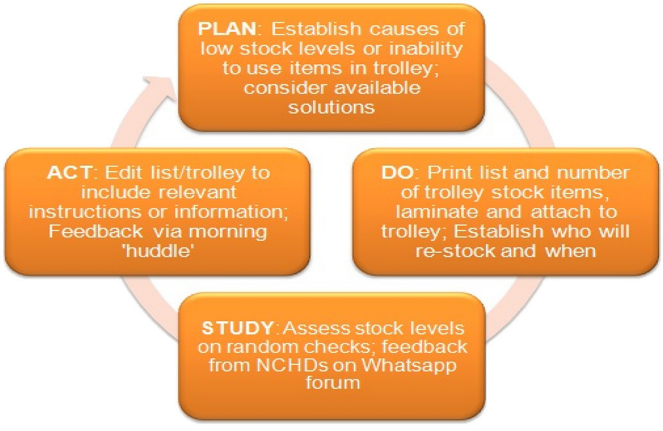


Fig. 3. E.N.T trolley PDSA.

headlamp. Staff were thanked and encouraged at handover 'huddles' for continued effort regarding the E.N.T. trolley.

A subsequent trolley review and WhatsApp feedback in May 2018 showed 100% stocking of all items but nasal specula were still being discarded. A decision was made to procure a small CSSD container which would be attached directly to the E.N.T. trolley to encourage staff to return specula for sterilisation and assess the effect of this intervention at the next cycle (Fig. 4).

Considering the frequent turnover (6-monthly to yearly) of NCHDs and varying levels of experience and exposure, the major '**DO**' of our change process was to highlight the epistaxis pathway at doctors' induction (July and January), at ED teaching sessions and via the WhatsApp group. Sessions demonstrating correct use of the nasal packs and Floseal® were also arranged.

Immediate re-bleed rate post nasal packing (within 1 h) as chosen as an **Outcome measure**, but realising that re-bleeding could be multifactorial (e.g. patients on antiplatelet or anticoagulant therapy), it was decided to simultaneously use a **Process measure** of mean durations of nasal packing every 2 months. Data would be monitored and displayed via run charts over a 10-month period.

Vasoconstrictor spray use and Patient satisfaction were considered as measures but discarded due to data gathering limitations.

The pathway (Appendix D) was edited several times during the cycles to provide clarity for issues raised such as when posterior nasal packing or Medical team involvement were indicated.

Team discussions were frequently done via email. It was also realised retrospectively that the HCAs should have been included in the

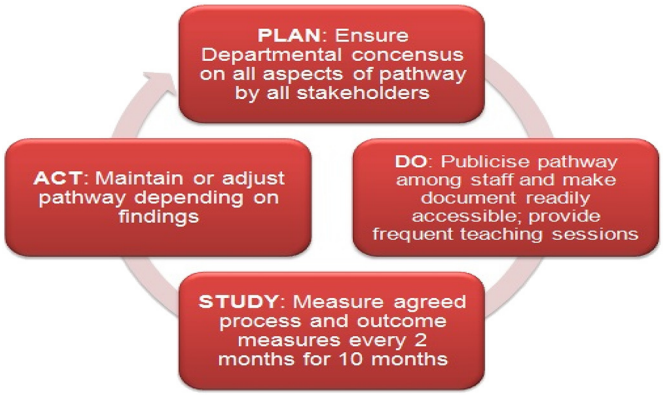
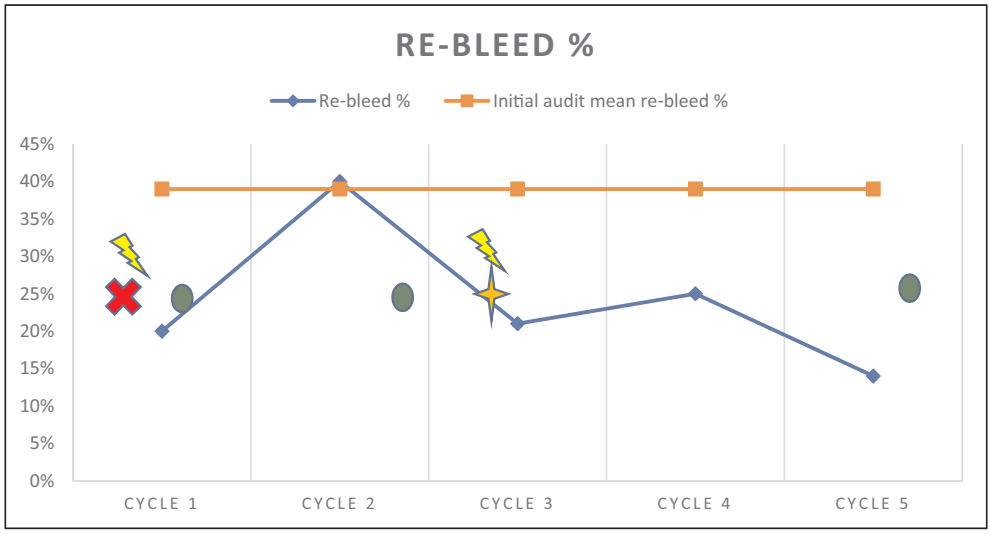


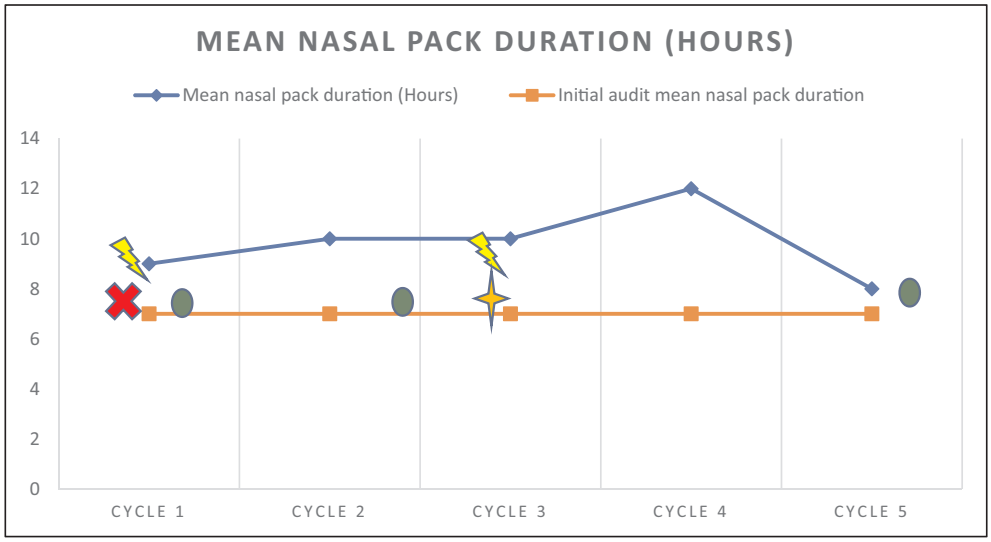
Fig. 4. ED epistaxis pathway PDSA.

Table 1
Average nasal pack durations and re-bleed rates.

Measure	Initial audit results	August/Sept. 2017 Cycle 1	Oct./Nov. 2017 Cycle 2	Dec. 2017/Jan. 2018 Cycle 3	Feb./March 2018 Cycle 4	April/May 2018 Cycle 5
Process measure (2-monthly mean nasal packing duration in hours)	7[a]	9	10	10	12	8
Number of atraumatic epistaxis patients during period requiring nasal packing	23[a]	5	5	14	8	7
Number of patients who re-bled post nasal packing	9[a]	1	2	3	2	1
(Number) and % of re-bleeders on anticoagulant/antiplatelet therapy/both	(6)[a]	(0)	(2)	(2)	(1)	(0)
	67%[a]	0%	100%	67%	50%	0%
Outcome measure (2-monthly re-bleed % rate post nasal packing)	39%[a]	20%	40%	21%	25%	14%

[a] 6-month initial audit period.





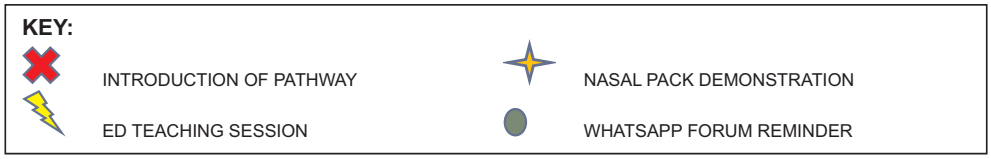


Fig. 5. Re-bleed percentage and mean nasal pack duration run charts.

team and this was corrected.

Measuring outcomes and results

- ➢ E.N.T. Trolley outcome measure = Improved (qualitative) feedback from ED doctors on WhatsApp forum.
- ➢ E.N.T. Trolley process measure = Achieving 100% E.N.T. trolley stock levels.
- ➢ Epistaxis pathway outcome measure = Reduced percentage of re-bleeds post nasal packing (2- monthly).
- ➢ Epistaxis pathway process measure = Increased nasal packing durations in hours (2- monthly mean value) (Table 1 and Fig. 5).

Summary and interpretation

The number of patients requiring nasal packing during each cycle was relatively comparable to the initial audit numbers of ~8 patients every two months, as was the number of re-bleeders on pro-bleeding medication (with the exception of the 1st and 5th cycle).

Average nasal packing durations progressively increased after pathway introduction.

Re-bleed rates generally fell below initial audit levels, particularly comparable in the 3rd cycle with a similar percentage of re-bleeders on anti-coagulant/platelet therapy; lowest rates were seen in cycles where no re-bleeders were on these medications. Also, a 1% rise in re-bleed rate was noted in the 2nd cycle when 100% of re-bleeders were on anti-coagulant/platelet therapy, suggesting that anti-coagulant/platelet therapy certainly affects re-bleed rates post nasal packing.

A missed WhatsApp reminder in early 2018 and the arrival of a small group of new ED doctors in April 2018 may have contributed to the decline in mean nasal pack time to 8 h in April/May 2018.

Limitations to generalisability

Some products used may be unavailable in other regions or expensive to procure; however, literature suggests that locally available alternatives are similarly effective [6,9].

EDs without an observation ward would find it difficult to monitor patients for hours.

Internal validity of the back-up plan using Floseal® cannot be ascertained as no demonstration on its use by the company could be arranged, raising concerns of the ability of staff to use the product correctly if needed; commitment from such stakeholders needs to be established at the planning stage.

Conclusion

This project was embarked upon to improve experiences and outcomes for ED patients presenting with atraumatic epistaxis as well as for staff managing them in a hospital with external E.N.T. cover and can be reproduced in other similar centres.

Observed measures suggest a positive effect due to changes made. It is expected that some epistaxis cases will inevitably re-bleed and require transfer for E.N.T. intervention, particularly those on Antiplatelet/anticoagulant therapy and staff should not hesitate to seek E.N.T. advice or transfer. It is hoped that these improvements will be sustained for continued positive outcomes for both patients and staff and next steps would include moving into the 'Standardise-Do-Study-Act' cycle (SDSA).

Dissemination of results

Results and recommendations from this Quality Improvement Project were shared with staff members at the data collection site as a formal presentation on two occasions during their regularly scheduled departmental teaching sessions. The results were also sent to the E.N.T department in the collaborating Specialist hospital.

Authors' contribution

Authors contributed as follow to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; drafting the work or revising it critically for important intellectual content; and final approval of the version to be published: EO contributed 60% and EO'C 40%. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Declaration of competing interest

The authors declare no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.afjem.2020.07.001.

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