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The use of balloon catheters in the treatment of epistaxis

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Abstract

Inflatable balloon catheters are widely used in the treatment of severe epistaxis and are designed to be filled either with air or liquid. A postal survey revealed that 87 per cent of respondents used an inflatant which was deemed inappropriate by the manufacturer. When balloons designed for water or saline were filled with air, they deflated rapidly, in some cases being virtually empty after 24 hours. Better and more accessible instruction leaflets are required if the balloons are to be used as intended.

Foley catheters are frequently used as nasopharyngeal packs, in conjunction with anterior nasal packs. Paraffin in the commonly used anterior packs damages the rubber of the catheter, resulting in the balloon bursting. This should be recognized by clinicians as a possible cause of rebleeding.

Key words: Epistaxis

Introduction

Epistaxis is a common complaint and fortunately the majority of cases are self-limiting or respond to simple first aid measures such as compressing the nostrils and applying ice packs (Stell, 1977; White and Blair, 1986). However, if bleeding persists, further measures such as nasal packing may be required to arrest the haemorrhage. A variety of packing materials can be used, including gauze impregnated with BIPP (bismuth iodoform paraffin paste), alginate wool and inflatable balloons, Beck (1917) described the use of balloon catheters in the nose but the basic principle is considerably older and such a device was patented in 1849 (US Patent No 6796). Modern balloon catheters are popular among junior medical staff: they are quick and easy to insert, are thought to be less traumatic than gauze packs and cause less discomfort to the patient (Elwany *et al.*, 1986; Stevens, 1936). Also, conventional nasal packing completely obstructs the nasal airway when bilateral packs are needed, which can result in serious hypoxia (Elwany *et al.*, 1986; Larson and Juul, 1982). Some patterns of balloon catheter are manufactured with a hollow stem which allows the patient to continue nasal respiration, obviating this problem.

Balloon catheters sometimes fail to control bleeding and one problem is that the balloons tend to deflate spontaneously. Previous workers have suggested that water or saline, rather than air should be used to inflate the balloons (White and Blair, 1986), but this advice is not universally followed in clinical practice.

This study attempts to determine the current pattern and method of usage of balloon catheters and measures their rates of spontaneous deflation.

Materials and methods

Survey

Thirty six questionnaires were sent to junior medical staff in eight hospitals in the south of England. Four basic types of balloon catheter were identified:

single balloon for use in the nasal fossa (e.g. Simpson's);
single balloon for use in the post-nasal space (e.g. Foley);
twin balloons fixed relative to each other (e.g. Epistat);
twin balloons movable relative to each other (e.g. Brighton).

The manufacturers suggest that water or saline be used for inflating the Foley and Epistat balloons. Air is recommended for the other two types. The respondents were asked which, if any, of these patterns of balloon they used, what substance they used for inflating the balloon and their reasons for this choice. Those who used Foley catheters in the nasopharynx were also asked if they used an additional anterior nasal pack and, if so, what type of pack.

Physical measurements

Random samples of each type of balloon were obtained from stock. In all cases the balloons were from recent stock and were being used within the lifespan suggested by the manufacturer.

Each balloon was inflated with air to the maximum volume suggested by the manufacturer and left in an area of equable temperature, out of direct sunlight. Using a 20 ml syringe, the volume of air remaining in the balloon was measured and recorded at various times after initial inflation. The tests were then repeated with only a single terminal measurement at 48 hours, to ensure that any loss of volume was due to a genuine loss from the balloon and was not an artefact of the sampling technique. The balloons were then re-inflated with sterile water and the test was repeated. Several samples of each type of balloon were tested in the above way.

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Most balloons are disposable items, with a new balloon for each patient. However, the Epistat catheter is approximately four times more expensive than its nearest rival in this survey. The manufacturers of this balloon suggest that it should be resterilised and reused, which would help to offset its higher initial cost. Therefore, a sample of this balloon was sterilized in accordance with the manufacturers instructions and retested.

One of the possible sources of air loss from a balloon is the valve by which it is inflated. Three basic types of valve were identified in these catheters. Two samples of each catheter were inflated with air. One sample was then measured in the manner previously described. The second catheter had an artery clip applied adjacent to the valve, isolating the valve from the balloon. At intervals the clip was removed, the remaining volume measured and the clip replaced.

Foley catheters inserted into the post-nasal space usually have a pack placed in the nasal fossa, to prevent bleeding from the anterior nares and to help locate the catheter in position (Bell *et al.* 1974; Cook *et al.* 1985; Gray, 1958). These catheters include instructions that only water based lubricants should be used and that petroleum derived products should be avoided. However, BIPP impregnated gauze is the most commonly used pack, which, containing paraffin, contravenes the manufacturers advice. Therefore the tests were repeated by inflating the balloons with air or water and then loosely wrapping them with a standard 2.5 cm BIPP pack. Measurements were taken in the previously described fashion.

Results

Survey

Thirty completed questionnaires were returned, representing an 83 per cent response rate. All respondents had used balloon catheters for the treatment of some cases of epistaxis. The pattern of distribution of the various types of catheter (Table I) demonstrates the widespread use of Foley catheters as nasopharyngeal packs. The other catheters were used in a pattern that varied from unit to unit rather than between individual doctors. This may represent treatment strategies in particular units or simply the purchasing policy at different hospitals.

Only four (13 per cent) of the respondents always used the inflatant suggested by the manufacturer and, of these, only one claimed to have made his choice after reading the manufacturers' instructions. The other 87 per cent of respondents gave a variety of reasons for their choices (Table II).

Of the twenty five doctors using Foley catheters in the post-nasal space, twenty three (92 per cent) use the catheter in conjunction with the anterior BIPP pack.

TABLE I

RELATIVE USAGE OF THE DIFFERENT TYPES OF BALLOON CATHETER IN THE TREATMENT OF EPISTAXIS

Type of balloon	% of respondents
Any type	100
Single balloon in nasal fossa	23
Single balloon in nasopharynx	83
Twin balloons fixed relative to each other	50
Twin balloons movable relative to each aother	43

TABLE II

REASONS GIVEN FOR USING AIR AS INFLATANT, DESPITE RECOMMENDATION OF WATER OR SALINE BY MANUFACTURER

Reasons given for choice	% of respondents
Risk of aspiration if balloon burst	58
Thought to be more comfortable if air used	27
Thought to cause less mucosal trauma if air used	8
Ease of obtaining air	23

Physical measurements

(1) Single balloon for the nasal fossa (Simpson's).
There was no significant air or water loss from this pattern of balloon during the test period.

(2) Single balloon for the post-nasal space (Foley).
There was no measureable loss of water from these balloons. However, when air was used, there was an appreciable decrease in volume during the test (Fig. 1). Juxtaposing a BIPP pack to the balloon did not affect the rate of loss of air. However, it did cause the premature failure of eight out of twenty (40 per cent) samples tested this way, manifest by bursting of the balloons. Even those which did not burst had visible damage to the rubber.

(3) Twin balloons fixed relative to each other (Epistat).
There was no significant loss when water was used. However, this pattern of catheter showed a dramatic loss of volume when inflated with air (Fig. 2). Both balloons were empty within 36 hours, with the smaller posterior balloon deflating faster than the anterior one. Autoclaving the catheter once increased the rate of deflation by a small amount. A further sterilization cycle caused failure of the anterior balloon, with it losing all its air within one hour. This appeared to be due to failure of the valve, as the loss could be slowed by applying a clamp to the catheter between the valve and the balloon.

(4) Twin balloons, movable relative to each other (Brighton).
With water there was no significant loss. When air was used, the loss was greater from the smaller balloon which is situated anteriorly in this pattern of catheter (Fig. 3).

(5) Valves.
Isolating the valves from the remainder of the catheters made no measureable difference to the rate of deflation of the balloons. All three types of valve were satisfactory in this respect when used for the first time, though, as previously described, autoclaving caused the Epistat valve to deteriorate.

Discussion

The above experiments provide purely physical measurements and do not necessarily have any relation to an individual balloon's efficacy in arresting epistaxis. Some of the balloons which had poor test performances were being used in contravention of the manufacturers' instructions: the information from the manufacturers of both the Foley and Epistat catheters suggest that water or saline should be used and when this advice was followed the balloons performed adequately. One reason why the maker's advice is not followed may be that in most cases the instruction sheet is put inside the sterile packaging containing the catheter. Therefore there is no opportunity for the operator to familiarize himself with the instruc-

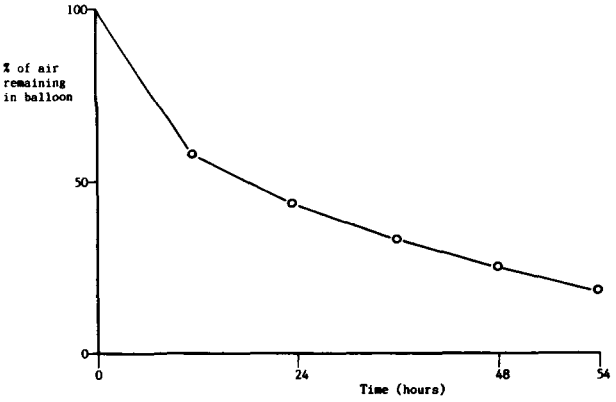

FIG. 1

The rate of deflation of a Foley catheter, when filled with air.

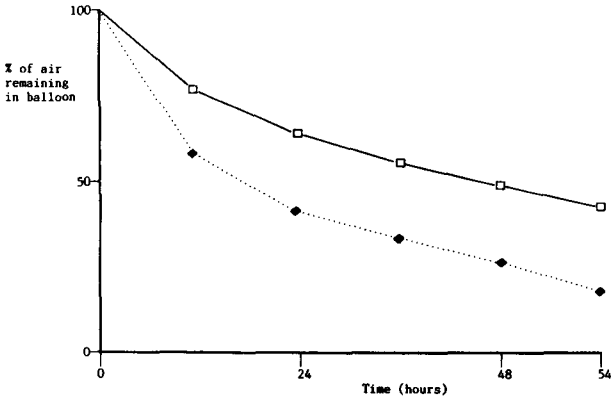

FIG. 3

The rate of deflation of a Brighton balloon catheter, when filled with air. ----◆---- Anterior balloon; —□— Posterior balloon.

tions prior to opening the pack for usage. This is a criticism that can be levelled against many items of medical equipment, not only epistaxis balloons. It might be more helpful if the manufacturers printed the instructions on the outside of the sterile packaging. For products with extensive, complicated instructions, it should still be possible to print an abbreviated version of the more salient details.

Spontaneous deflation could be regarded as being therapeutic in that maximum pressure against the nasal mucosa is required during the initial haemorrhage. Once this is controlled, a gradual reduction of pressure would be beneficial as it would limit the trauma to the mucosa. However, in a previous study by Elwany *et al.* (1986), 48 per cent of patients with epistaxis treated using Epistat catheters required packing for between 48 and 72 hours. In the current study, at 48 hours, Epistat catheters initially inflated with air would be completely empty and therefore ineffective. Foley catheters would have only 25 per cent of original inflatant remaining, whereas the anterior and posterior balloons of a Brighton balloon would have 25 per cent and 50 per cent respectively. It could be argued that this is clinically unimportant, as it is easy to reinflate the balloons, but when the balloon deflates, the catheter tends to extrude from the nose. This necessitates reinsertion: this is uncomfortable and distressing for the patient and runs the risk of causing trauma to the nose. Also, if posterior bleeding restarts with a catheter in situ, it may be difficult to determine whether the balloon has burst or deflated, without removing it for inspection.

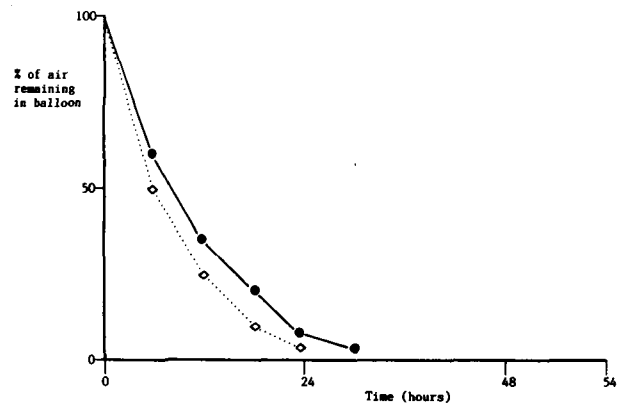

FIG. 2

The rate of deflation of an Epistat balloon catheter, when filled with air. —●— Anterior balloon; ----◇---- Posterior balloon.

Juxtaposing BIPP packs to the Foley catheters damaged the material of the balloons, resulting in the bursting of 40 per cent of the trial sample. If liquid is used as the inflatant, there is a risk of it suddenly entering the pharynx, causing alarm to the patient and a risk of aspiration. Many of the doctors who responded to the questionnaire felt that this was the most important reason for avoiding water or saline, especially as the patient might be sedated and hence have depressed laryngeal reflexes. However, the quantity of fluid is small and no literature report was found of patients suffering as the result of a nasal balloon bursting. Therefore, this risk seems to be a theoretical risk rather than a genuine problem.

The Simpson's balloon has a small pilot balloon at the exterior end of the catheter, adjacent to the valve. This enables the operator to judge the level of inflation of the balloon and to some extent to gauge the pressure it is exerting against the nasal mucosa. It seems to be a useful feature, and one that could, perhaps, be incorporated into other types of catheter.

Conclusion

Balloon catheters are widely used in the treatment of epistaxis but in many cases are used in an inappropriate, suboptimal fashion. This is due partly to bad design and packaging of instruction leaflets by the manufacturers and partly to some commonly held misconceptions among medical staff. Such problems should be surmountable by improving the quality and accessibility of instructions for these devices.

References

Beck, A. L. (1917) An inflatable rubber bag for intranasal use. *American Journal of Surgery* **31:** 77–79.

Bell M., Hawk, M., Jahan, A. (1974) New device for the management of post-nasal epistaxis by balloon tamponade. *Archives of Otolaryngology* **99:** 372–374.

Cook, P. R., Renner, G., Williams, F. (1985) A comparison of nasal balloons and posterior gauze for posterior epistaxis. *Ear Nose and Throat Journal* **64:** 78–82.

Elwany, S., Kamel, T., Mekhamer, A. (1986) Pneumatic nasal catheters: advantages and drawbacks. *Journal of Laryngology and Otology* **100:** 641–647.

Gray, L. (1958) A simple method of controlling nasal haemorrhage. *The Journal of the Indiana State Medical Association* **51:** 70.

Larsen, K., Juul, A. (1982) Arterial blood gases and pneumatic nasal packing in epistaxis. *Laryngoscope* **92:** 586–588.

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Stell, P. M. (1977) Epistaxis. *Clinical Otolaryngology* **2:** 263–273.
Stevens, R. W. (1936) Improved intranasal packing. A rubber pneumatic pack. *Archives of Otolaryngology* **23:** 232–235.
White, J. A., Blair, P. A. (1986) The non-surgical management of adult epistaxis. *Journal of the Louisiana State Medical Society* **138[9]:** 13–17.

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