The Journal of Laryngology and Otology
June 1986. Vol. **100.** pp. 641–647

Pneumatic nasal catheters:
Advantages and drawbacks

by

SAMY ELWANY*, M.D., TAREK KAMEL†, M.D., and ANIS MEKHAMER‡, M.D.

Introduction

Several clinical studies have associated nasal packing in the treatment of epistaxis with a number of complications that range in severity from being an uncomfortable nuisance to causing a life-threatening hypoxia. (Giammanco and Binns, 1970; Slocum *et al.*, 1976; Stemm, 1981; Issa and Sulivan, 1983; Barbour *et al.*, 1984). Dissatisfaction with conventional nasal packing led to the development of pneumatic nasal catheters or balloons which it was hoped would be associated with increased efficacy and fewer disadvantages (Gottschalk, 1974; Steiner and Masing, 1976). The present work aims to evalue the efficacy and safety of pneumatic nasal catheters in patients being treated for epistaxis.

Materials and methods

The study has been conducted on 52 patients in whom it was possible to control epistaxis with an Epistat^{R} nasal catheter which is a dual-cuff silicone catheter with a central airway, and two independently inflatable balloons. There were 33 males and 19 females, and their ages ranged between 29 and 65 years. None of the patients had any clinical history or objective findings related to diseases which may affect the blood gases or acid-base balance. All patients accepted participation in this research. In 34 patients the catheters were introduced after spraying the nasal mucosa with Xylocaine^{R} (4% lidocaine hydrochloride) solution (group I). The remaining patients needed general endotracheal anaesthesia (group II). The patients were allocated into 4 groups, according to the type of anaesthesia and tamponade, as shown in Table (I).

Arterial blood samples were taken before and 24 hours after tamponade, the samples being taken by arterial puncture in the radial or femoral arteries, using a B-109 blood sampler; the blood was then heparinized and immediately analyzed on an ABL-II Copenhagen radiometer, taking into account the body temperature. The data obtained

TABLE I
DISTRIBUTION OF PATIENTS

Group	Anaesthesia	Type of tamponade	No.
Ia	Local	Unilateral	25
Ib	Local	Bilateral	9
IIa	General Endotracheal	Unilateral	11
IIb	General Endotracheal	Bilateral	7

From the Departments of Otolaryngology and Anaesthesia; Alexandria,* Cairo† and El-Azhar‡ Universities (Egypt), and Dr Fakhry Hospital, AlKhobar (Saudi Arabia).

https://doi.org/10.1017/S0022215100099837 Published online by Cambridge University Press

TABLE II
ARTERIAL BLOOD ANALYSIS (GROUP Ia)

Data	Test condition	Mean value	Range	Statistical significance[1]
PO2	before tamponade	94.05±1.52	83.8 –98.1	—
	after tamponade	92.12±1.89	82.3 –96.7	—
PCO2	before tamponade	39.91±0.46	35.8 –40.2	—
	after tamponade	38.99±0.62	34.9 –40.8	—
PH	before tamponade	7.38±0.02	7.28– 7.39	—
	after tamponade	7.39±0.01	7.31– 7.41	—
HCO3	before tamponade	19.32±0.43	16.2 –21.8	—
	after tamponade	18.91±0.50	16.3 –21.1	—
Hb (gm%)	before tamponade	13.28±0.25	11.3 –15.2	—
	after tamponade	12.70±0.38	11.1 –14.9	—

[1] The difference is considered significant (+) if P is less than 0.05, and insignificant (−) if P is greater than 0.05.

TABLE III
ARTERIAL BLOOD ANALYSIS (GROUP Ib)

Data	Test condition	Mean value	Range	Statistical significance[1]
PO2	before tamponade	92.15±1.35	84.1 –97.2	—
	after tamponade	93.03±1.41	83.7 –99.1	—
PCO2	before tamponade	40.01±0.31	36.2 –40.5	—
	after tamponade	39.85±0.88	37.5 –40.6	—
PH	before tamponade	7.38±0.02	7.29– 7.40	—
	after tamponade	7.38±0.04	7.29– 7.39	—
HCO3	before tamponade	18.88±0.51	15.9 –20.9	—
	after tamponade	12.8 ±0.28	11.2 –14.9	—
Hb (gm%)	before tamponade	12.8 ±0.28	11.2 –14.9	—
	after tamponade	12.9 ±0.11	11.9 –14.8	—

[1] The difference is considered significant (+) if P is less than 0.05, and insignificant (−) if P is greater than 0.05.

from the blood sample included: partial oxygen pressure (PO2), partial carbon dioxide pressure (PCO2), HCO3, PH, and Hb. The results were statistically analyzed using the critical ratio test. The nasal mucosa was carefully inspected after removal of the catheter, and the patients were followed up weekly for one to two months.

All patients were interviewed 6–24 hours after the introduction of the balloon, using a questionnaire which evaluated the frequency and severity of patients' discomfort and headache. Patients' responses were graded on a 0–3 scale, as follows:

0=no discomfort or headache.
1=moderate discomfort, no headache, no analgesics used.
2=moderate headache needing non-narcotic

https://doi.org/10.1017/S0022215100099837 Published online by Cambridge University Press

TABLE IV
ARTERIAL BLOOD ANALYSIS (GROUP IIa)

Data	Test condition	Mean value	Range	Statistical significance[1]
PO2	before tamponade	93.7 ±1.09	85.2 –94.2	—
	after tamponade	94.1 ±1.05	86.1 –93.9	—
PCO2	before tamponade	40.02±0.28	37.1 –40.7	—
	after tamponade	40.01±0.30	37.3 –40.6	—
PH	before tamponade	7.38±0.01	7.28– 7.38	—
	after tamponade	7.39±0.01	7.29– 7.37	—
HCO3	before tamponade	19.3 ±0.21	16.1 –20.7	—
	after tamponade	19.1 ±0.32	16.2 –20.8	—
Hb (gm%)	before tamponade	12.8 ±0.13	11.3 –14.6	—
	after tamponade	12.7 ±0.18	11.5 –14.9	—

[1] The difference is considered significant (+) if P is less than 0.05, and insignificant (−) if P is greater than 0.05.

TABLE V
ARTERIAL BLOOD ANALYSIS (GROUP Hb)

Data	Test condition	Mean value	Range	Statistical significance[1]
PO2	before tamponade	94.03±1.34	86.2 –94.4	—
	after tamponade	94.12±1.51	86.4 –94.3	—
PCO2	before tamponade	39.23±0.39	36.6 –40.2	—
	after tamponade	39.11±0.67	36.9 –40.6	—
PH	before tamponade	7.38±0.01	7.30– 7.39	—
	after tamponade	7.38±0.03	7.25– 7.35	—
HCO3	before tamponade	18.89±0.41	15.8 –20.7	—
	after tamponade	19.01±0.42	16.2 –21.0	—
Hb (gm%)	before tamponade	13.39±0.25	11.5 –14.7	—
	after tamponade	13.38±0.36	11.9 –14.3	—

[1] The difference is considered significant (+) if P is less than 0.05, and insignificant (−) if P is greater than 0.05.

(minor) analgesics (Rogers and Spector, 1980).

3=Severe headache needing narcotic analgesics (Rogers and Spector, 1980).

The Chi-square test was used in comparing the frequency of complaints. The Mann Whitney test was used to compare the average score as an expression of severity of sore throat. $P<0.05$ was regarded as statistically significant.

Results

Bleeding was successfully controlled in 27 patients by keeping the cuffs inflated for 24 hours. For the remaining patients, reinflation of the cuffs for another 24–48 hours was necessary before the epistaxis was finally stopped.

Results of blood analysis:

The mean, standard deviation, and range of

https://doi.org/10.1017/S0022215100099837 Published online by Cambridge University Press

TABLE VI
FREQUENCY AND SEVERITY OF DISCOMFORT AND HEADACHE AFTER PNEUMATIC PACKING

Group	Average score	Frequency 0 (%)	1 (%)	2 (%)	3 (%)
Ia	0.49	44	52	4	0
Ib	0.58	45	34	22	0
IIa	0.51	35	54	1	0
IIb	0.59	29	43	28	0

PO2, PCO2, HCO3, PH and Hb as well as the results of the statistical analysis for the various groups are listed in Tables II–V. The study clearly showed that the use of pneumatic nasal catheters did not have any statistically significant effect on arterial blood gases or acid-base balance ($P<0.05$) in any of the patients groups.

Post-packing discomfort and headache:

Although the frequency of discomfort and headache was significantly greater when bilateral tamponade was used, the average score expressing the severity of the patients' complaints did not reveal statistically significant differences between the four groups (Table VI). Only 12% of patients needed minor analgesics and none of them required narcotic analgesics.

Nasal complications:

The local complications encountered in this series are listed in Table VII. Fig. 1 illustrates a large septal perforation, presumably due to pressure necrosis. The study showed that the incidence of local complications increases when:

1. Bilateral tamponade is required (pressure necrosis).
2. Duration of cuff inflation is more than 24 hours (pressure necrosis).
3. Posterior cuff is inflated (eustachian tube obstruction).

Discussion

Anterior and posterior nasal packing has gained wide acceptance as a means of treating epistaxis. However, it has the potential for creating several local and systemic complications (Kuhn, 1955; Buchalter and Yanagisawa, 1968; Herzon, 1971). One of the most serious complications of nasal packing is arterial hypoxia and hypercapnia (Cassisi *et al.*, 1971; Cvetnic *et al.*, 1979), which has been attributed to hyperventilation (Lin and Orkin, 1979; Cvetnic *et al.*, 1981); to sedation and aspiration (Jackobs *et al.*, 1981) and to changes in pulmonary mechanics with increased pulmonary resistance and reduced lung compliance (nasopulmonary reflex) (Ogura *et al.*, 1973). In the present study, our findings indicated that pneumatic nasal catheters did not have any clinically important effects on arterial blood gases or acid-base balance. These results agree with the findings of Larsen and Juel (1982), who did not find changes in alveolar ventilation when they used similar pneumatic packs. The absence of hypoxia and hypercapnia, when the nasal airway is preserved, suggests that the role of the nasopulmonary reflex in this problem would

TABLE VII
LOCAL COMPLICATIONS OF BALLON TAMPONADE

Complication	Total number	Tamponade		Inflated cuff		Duration of cuff inflation
		Unilateral	Bilateral	Anterior	Posterior	
Pressure necrosis: Septal perforation	I	–	+	+	–	48 hours
Mucosal necrosis	I	–	+	+	–	36 hours
Eustachian tube obstruction	I	+	–	+	+	24 hours

https://doi.org/10.1017/S0022215100099837 Published online by Cambridge University Press

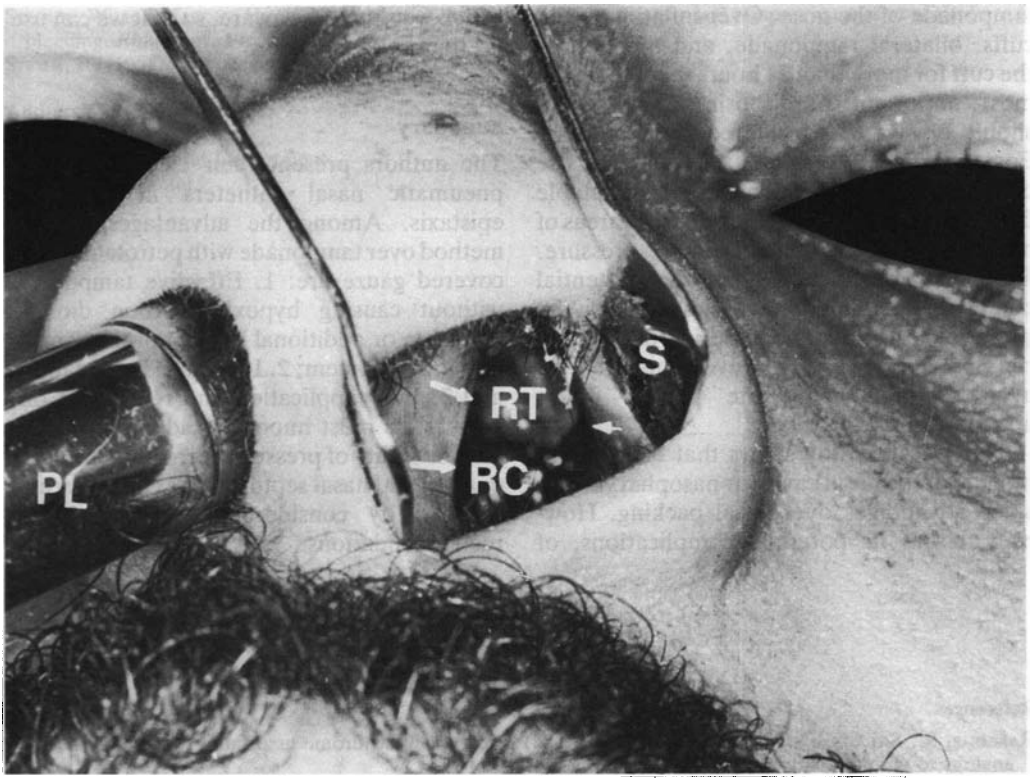


Fig. 1.
A left anterior rhinoscopy, showing a large septal perforation (arrows) due to pressure necrosis of the cartilaginous septum. The right nasal cavity (RC) and right inferior turbinate (RT) could be clearly seen through the perforation. A penlight (PL) is inserted into the right nostril, and a nasal speculum (S) is used to dilate the left nostril.

appear to be a minor one, while hypoventilation and oversedation appear to be the primary causes of changes in the arterial blood gases experienced with patients treated with nasal packing. Preservation of normal blood gas tensions and PH is undoubtedly the major advantage of pneumatic nasal catheters. In this context, their use is especially recommended for elderly patients with coexistent cardiovascular or pulmonary disease.

Conventional nasal packing necessarily obstructs the nasal air flow and eventually causes a dry sore throat through constant mouth breathing. Moreover, bilateral nasal obstruction frequently increases the discomfort of the patient and the need for strong sedation which may contribute to the problem of potential aspiration. Deglutition may also be difficult owing to the mass effect of a posterior pack (Stemm, 1981). On the other hand, the use of pneumatic catheters with central airways obviously avoids these seemingly inevitable complications of nasal packing and effectively decreases the discomfort of the patient and the need for sedation. The reduced need for analgesia and sedation has been verified in this work, since only 12% of patients needed non-narcotic analgesia.

Pressure necrosis of the cartilaginous nasal septum and nasal mucosa and the possible formation of intranasal adhesions are the most important local complications of balloon

https://doi.org/10.1017/S0022215100099837 Published online by Cambridge University Press

tamponade of the nose. Over-inflation of the cuffs, bilateral tamponade, and inflation of the cuff for more than 24 hours seem to be the most important predisposing factors and should always be considered in every case. For the same reason it is advisable to use catheters with two independently inflatable cuffs, in order to avoid exposing large areas of nasal mucosa to unnecessary pressure. Eustachian obstruction is another potential complication of balloon tamponade when the posterior cuff is inflated. Superimposed bacterial infection can, however, usually be avoided by keeping the patient under adequate antibiotic cover.

The present study shows that ballon tamponade of the nasal cavity or nasopharynx has some advantages over nasal packing. However, it has its potential complications, of which we should be aware, so that we can use it effectively and safely.

Summary

The authors present their experience with pneumatic nasal catheters in cases of epistaxis. Among the advantages of this method over tamponade with petroleum jelly-covered gauze are: 1. Effective tamponade without causing hypoxia, carbon dioxide retention or additional loading of the cardiopulmonary system; 2. Less need for sedation; and 3. Easy application and removal. Conversely, its most important adverse effect is the possibility of pressure necrosis of the nasal mucosa and nasal septum. This can be greatly reduced by considering a few technical recommendations.

References

BARBOUR, S., SHLAOS, D. H. and GUERTIN, S. (1984) Toxic shock syndrome associated with nasal packing: analogy to tampon-associated illness. *Pediatrics,* **73:** 163–165.

BUCHALTER, D. and YANAGISAWA, E. (1968) Carbon dioxide narcosis, an unusual complication of postnasal packing. *Archives of Otolaryngology,* **87:** 165–166.

CASSISI, M., BILLER, H. and OGURA, J. (1971) Changes in arterial oxygen tension and pulmonary mechanics with the use of posterior nasal pack. *Laryngoscope,* **81:** 1261–1266.

CVETNIC, V., CVETNIC, S. and GRBAC, I. (1979) Comparison of the gas quantities in the blood of patients with nasal packing for epistaxis, after nasal surgery, and experimentally. *Rhinology,* **17:** 257–264.

CVETNIC, V., CVETNIC, S. and GRBAC, I. (1981) Temporary artificial obstruction of the nose and changes in gas exchange in the blood. *Laryngoscope,* **91:** 1001–1009.

GIAMMANCO, P. and BINNS, P. (1970) Temporary blindness and opthalmoplegia from nasal packing. *Journal of Laryngology and Otology,* **84:** 631–635.

GOTTSCHALK, G. (1974) The treatment of epistaxis with nasostat. *Transactions of the American Academy of Opthalmology and Otolaryngology,* **78:** 274–275.

HERZON, F. (1971) Bacteremia and local infections with nasal packing. *Archives of Otolaryngology,* **94:** 317–320.

ISSA, F. and SULIVAN, C. (1983) Arousal and breathing responses to airway occlusion in healthy sleeping adults. *Journal of Applied Physiology,* **55:** 1113–1119.

JACKOBS, J., LAURENCE, A., DAVIS, H., LE FRAK, S., DRUCK, N. and OGURA, J. (1981) Posterior packs and the nasopulmonary reflex. *Laryngoscope,* **91:** 279–283.

KUHN, A. (1955) Complications of postnasal packing for epistaxis. *Archives of Otolaryngology,* **62:** 62–65.

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

LIN, Y and ORKIN, L. (1979) Arterial hypoxia in patients with anterior and posterior packings. *Laryngoscope,* **89:** 140–144.

OGURA, J., SUEMITSU, M., NELSON, R. and KAWAMOTO, S. (1973) Relationship between pulmonary resistance and changes in arterial blood gas tension in dogs with nasal obstruction and partial laryngeal obstruction. *Annals of Otology, Rhinology and Laryngology,* **82:** 668–683.

ROGERS, H., and SPECTOR, R. (1980) In *Aids to Pharmacology, first edition,* Churchill Livingstone, London, pp 86–94.

SLOCUM, C., MAISEL, R. and CANTRELL, R. (1976) Arterial blood gas determination in patients with anterior packing. *Laryngoscope,* **86:** 869–873.

https://doi.org/10.1017/S0022215100099837 Published online by Cambridge University Press

STEINER, W. and MASING, H. (1976) Experience with the new pneumatic nasal tampon in cases of critical nasal bleeding. *Rhinology,* **14:** 117–120.
STEMM, R. (1981) Complications of nasal packing. *Ear, Nose and Throat Journal,* **60:** 461–462

Address for correspondence:
Samy Elwany, M.D.,
Ear, Nose and Throat Department,
Dr. Fakhry Hospital,
P.O. Box 251,
AlKhobar,
Saudi Arabia.

https://doi.org/10.1017/S0022215100099837 Published online by Cambridge University Press

https://doi.org/10.1017/S0022215100099837 Published online by Cambridge University Press