

ORIGINAL RESEARCH

To Evaluate the Effect of Nasal Packing on Blood Oxygen Saturation

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ABSTRACT

Objective: To study the effect of nasal packing on blood oxygen saturation.

Materials and methods: Study was conducted on 30 patients of deviated nasal septum, who underwent septoplasty under local anesthesia followed by anterior nasal packing. The pulse oximetry was carried out three times on each patient to record the blood oxygen saturation (SpO₂) by using digital pulse oximeter. The first reading of SpO₂ was taken before nasal packing, second after 24 hours of nasal packing and third 3 weeks after surgery. Statistical analysis was done by Chi-square test and paired t-test.

Results: A total of 33.3% patients were below 20 years of age, whereas 60% were between 20 and 30 years of age and 6.7% were above 30 years. Males were 80%. It was observed that preoperative mean SpO₂ was 98.3 ± 0.794%, after 24 hours of nasal packing was 97.17 ± 1.744% and 3 weeks after surgery was 98.87 ± 0.629%. On statistical analysis, the difference in SpO₂ was highly significant (p < 0.001).

Conclusion: The application of nasal packs can be risky in old patients, more so having cardiopulmonary disease. The use of packs with airflow is recommended in these patients who should ideally be monitored with pulse oximetry.

Keywords: Nasal packing, Pulse oximetry, Septoplasty, SpO₂.

How to cite this article: Singh S, Singh J, Kakkar V, Yadav SPS, Bishnoi A, Kathuria B, Gulati A, Sharma C. To Evaluate the Effect of Nasal Packing on Blood Oxygen Saturation. *Int J Otorhinolaryngol Clin* 2015;7(2):41-44.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Nasal packing is primarily used to control bleeding in epistaxis as well as after nasal surgery, such as septoplasty, turbinatoplasty and paranasal sinus surgery. It

is also used for internal stabilization after operations involving the cartilaginous and bony skeleton of the nose like rhinoplasty and nasal fractures. Apart from hemostasis, packing prevents intranasal synechiae particularly after a surgery.¹ There is no general consensus regarding the use of material for nasal packing and how long it should be kept in place. Many surgeons do not use packing due to the low incidence of heavy bleeding following septoplasty. Of those who use packing, some remove it 1 to 2 days after surgery and others may keep it longer. Commonly used nasal packing materials are Telfa, paraffin, vaseline, bismuth iodoform paraffin paste (BIPP) and antibiotic impregnated gauze; glove fingers, oxycel, surgicel, gelfoam, merocel and pneumatic balloons. A non-adherent pack is preferable, however, septum splints or special suturing techniques have also been used.^{1,2}

Rhinologists are well aware of local effects of nasal packing, whereas, the systemic effects are not that well understood. Systemic complications induced by nasal packing include poor sleep quality, respiratory difficulty, decreased oxygen saturation, circulatory system problems and toxic shock syndrome.³ Nasal packing compromises respiration leading to hypoxemia. Aspiration of blood, sedation and exaggeration of pulmonary dysfunction especially in the aged patients are the primary causes of such hypoxemia. When these factors are complicated by acute anemia of blood loss, they can lead to serious tissue hypoxia, which may sometimes prove fatal. Another factor that could lead to hypoxia is a bulky postnasal pack that overfills the nasopharynx and depresses the soft palate, thereby further compromising the airway.⁴ Unnatural mouth breathing instead of usual nasal breathing, after nasal packing, results in acid alkaline imbalance due to disturbance of pulmonary ventilation.⁵ Rapid shallow mouth breathing following nasal packing may lead onto hypoxia which in turn, further causes shallow breathing, producing a vicious cycle which unless interrupted may inevitably prove fatal.⁶ In mouth breathing, the thoracic movement becomes diminished, which causes changes in pulmonary circulation, decrease in vital capacity and lower blood pO₂.⁵ The nasal packing either causes or worsens sleep-disordered breathing and significantly increases the number, duration and frequency of obstructive events.^{6,7}

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Some patients also experience episodes of severe nocturnal oxygen desaturation after nasal packing.⁸ Clinical studies pertaining to the changes in blood gases following nasal packing may lead on to hypoxia, but the reports are varying regarding levels of partial pressure of CO₂. The decreased saturation of oxygen in blood is explained by one or more of the following pathophysiological processes: alveolar hypoventilation, airway obstruction, decrease of pulmonary gas diffusion and changes in the ratio of ventilation and perfusion.⁹

The hypoxia remains undetected in preliminary examinations of patients. The arterial oxygen saturation monitoring has been established to be a useful method in diagnosing a variety of respiratory disorders and today it is a common and essential monitoring tool used to evaluate patients either undergoing surgery or other procedures.¹⁰ The measurement of arterial blood gases giving information on the arterial oxygen partial pressure (PaO₂), pH and carbon dioxide partial pressure (PaCO₂) remains the gold standard, but the method is invasive, expensive, time consuming and also not immune to complications, such as bleeding, thrombosis and infection. Hence, pulse oximetry has established itself as an acceptable, easy and reproducible way for screening and diagnosing hypoxic patient.¹¹ Pulse oximetry is probably one of the most important advances in respiratory monitoring. A reasonable degree of accuracy coupled with the ease of operation of the pulse oximeters has led to their widespread use for monitoring patients.¹² In view of the few studies and none from India in the literature that the hypoxia is associated with nasal packing, we carried out this study.

MATERIALS AND METHODS

The proposed study was conducted in the Department of Otorhinolaryngology, Pt BD Sharma Postgraduate Institute of Medical Sciences, Rohtak in 30 patients of either sex in age group of 15 to 50 years undergoing septoplasty under local anesthesia.

Inclusion criteria: Patients were symptom free of upper respiratory diseases except deviated nasal septum.

Exclusion criteria: Cases of epistaxis, nasal polypi, cardio-pulmonary disease and those needing blood transfusions were excluded from the study.

Measurement of blood oxygen saturation (SpO₂): The pulse oximetry was carried out three times on each patient to record the blood oxygen saturation (SpO₂) by using digital pulse oximeter JPD-500A. After connecting the optical diodes on patients' finger for 10 seconds, blood saturation (SpO₂) value of each patient was recorded as the percentage of hemoglobin oxygen saturation. Three consecutive readings were taken and average of the three readings was accepted as the SpO₂. The 95% saturation level was set as a limit, and lower values were interpreted as hypoxemic. The first reading of SpO₂ was taken pre-operatively in the ward before surgery. Second reading of SpO₂ was taken 24 hours after nasal packing. The third reading of SpO₂ was taken 3 weeks after surgery.

Statistical analysis: The observed data were recorded in the proforma. The results were statistically analyzed by using Chi-square test and paired t-test was used for comparing the preoperative, 24 hours and 21 days after surgery. A p < 0.05 was taken as statistically significant.

RESULTS

The 33.3% patients were below 20 years of age. Patients between 20 and 30 years of age were 60%. Patients over 30 years of age were 6.7%. Males were 80%. It was observed that the mean preoperative SpO₂ was 98.3 ± 0.794%, at 24 hours postoperative SpO₂ was 97.17 ± 1.744% and 3 weeks after surgery SpO₂ was 98.87 ± 0.629% (Table 1).

On statistical analysis, the differences observed in the means of oxygen saturation at the above three stages was found to be highly significant (p < 0.001) (Tables 2 to 4).

Table 1: Oxygen saturation distribution of patients undergoing septoplasty

SpO ₂	Number of patients	Range of SpO ₂ (%)	Mean SpO ₂ (%)	Standard deviation
Preoperative	30	97–100	98.30	0.794
After 24 hours	30	92–100	97.17	1.744
After 21 days	30	98–100	98.87	0.629

Table 2: Comparison of SpO₂ before and 24 hours after septoplasty

Sl. no.	Number of patients	SpO ₂ %	Mean SpO ₂	Standard deviation	Standard error of mean	p-value
1	30	Preoperative	98.30	0.79	0.15	0.002 HS
2	30	24 hours	97.17	1.74	0.32	

HS: Highly significant

Table 3: Comparison of SpO₂, 24 hours and 21 days after septoplasty

Sl. no.	Number of patients	SpO ₂ %	Mean SpO ₂	Standard deviation	Standard error of mean	p-value
1	30	24 hours	97.17	1.74	0.32	0.001 HS
2	30	21 hours	98.87	0.63	0.11	

HS: Highly significant



Table 4: Comparison of preoperative and 3 weeks postoperative SpO₂ of patients undergoing septoplasty

Sl. no.	Number of patients	SpO ₂ %	Mean SpO ₂	Standard deviation	Standard error of mean	p-value
1	30	Preoperative	98.30	0.79	0.15	0.0001 HS
2	30	21 days	98.87	0.63	0.11	

HS: Highly significant

DISCUSSION

The present study was carried out on 30 patients of either sex in age group of 15 to 50 years, subjected to nasal packing following septoplasty under local anesthesia. Preoperative oxygen saturation in all the patients in the present study was in the range 97 to 100%. All the observations were above 95 percentile, hence no hypoxia was observed.

After 24 hours of nasal packing (second reading), the oxygen saturation was observed in the range of 92 to 100%. The hypoxia (SpO₂ < 95%) was observed in two cases, i.e. 92 and 94% respectively. In three other cases, oxygen saturation was decreased to the borderline, i.e. 95%. Three weeks after surgery, the oxygen saturation in all the patients was in the range 98 to 100%. All the observations were well above the 95 percentile, hence no hypoxia was observed. The hypoxia observed in two cases and decreased SpO₂ to 95% in three cases of nasal packing reverted back to even better than the preoperative stage. Further, it was observed that the means of SpO₂ at preoperative stage was 98.3 + 0.794 %, at 24 hours postoperative SpO₂ was 97.17 + 1.744 % and 3 weeks after surgery SpO₂ was 98.87 + 0.629 %. While, on statistically analyzing, the differences observed in the means of oxygen saturation at the above three stages, found to be highly significant ($p < 0.001$).

Hypoxia was observed by many researchers in the past in upper airway obstruction (oropharynx, nasopharynx and nasal cavity). In experimental studies also, hypoxia was observed by producing nasal obstruction in dogs¹³ and in female albino rabbits.¹⁴ Studies in human beings were carried out by measuring arterial blood gases and the hypoxemia was noted in patients of septoplasty followed by nasal packing.^{15,16} Similar results were also obtained in blood oxygen saturation (SpO₂) using pulse oximetry in patients with adenotonsillectomy and septoplasty followed by nasal packing.¹⁷ However, contrary results are also reported in literature. Experimental complete artificial obstruction of the nose for a period of one hour produced a fall in pO₂ which was not statistically significant. It was explained by the short period of nasal obstruction to induce weakening of the acidobasal balance in a healthy organism.¹⁸ Even increased airway obstruction during sleep showed no significant change in oxyhemoglobin saturation.¹⁹ Nasal obstruction *per se* could cause hypoventilation as reported

by many authors.^{5,6,20} However, there is evidence in favor of other mechanisms involved in the pathogenesis of hypoxia. Nasopulmonary reflex has been incriminated in causing the hypoxemia.²⁰ Similarly, hypoxemia was observed along with increased pulmonary and airway resistance in patients of epistaxis.⁹

Nasal packing in severe epistaxis is associated with morbidity and rarely mortality also. Sudden unexplained deaths, cerebral ischemia or vascular complication following treatment of epistaxis have been thought to be related to hypotension from acute blood loss, however, hypoxemia might be an important contributory factor in these unexplained sudden deaths.⁹ The effect of nasal packing on blood gas analysis was studied on 20 patients and hypoxemia accompanying hypercarbia was found in these patients.²¹ Six of these 20 patients had chronic obstructive pulmonary disease in which the hypoxemia and hypercarbia was more pronounced, thus indicating that hypoxemia accompanying hypercarbia will lead to physiologic responses affecting pulmonary ventilation, a rise in blood pressure and bradycardia. This cardiovascular and pulmonary stress may result in myocardial infarction or cerebrovascular accident. Therefore, the hypoxemia caused due to upper airway obstruction may be severe enough in patients of cardiovascular and/or pulmonary diseases, may lead to serious complications. In the present study, we have excluded cardiopulmonary diseases and no patient in the extremes of ages was included, hence we did not observe any such complications or severe hypoxia after nasal packing.

We did not observe hypoxia before and 3 weeks after surgery, that means at either stage, total nasal obstruction was not present. With nasal packing, we noted hypoxia in two cases and in three cases a decrease in SpO₂ to 95%, which reverted to normal, that implies > 95% SpO₂ was present after corrective surgery. Similar results observed by a number of researchers in the past indicate that there is a definite decrease in all cases in blood oxygen saturation (SpO₂) after nasal packing.^{9,13,15,18,21}

Evaluating arterial blood gases by taking arterial blood samples is invasive, expensive, time consuming and also not immune to its complications, such as bleeding, thrombosis and infection. Hence, application of pulse oximetry devices could be easily acceptable at all ages and easy way for screening and diagnosing hypoxic patients.¹¹

Pulse oximetry is probably one of the most important advances in respiratory monitoring. A reasonable degree of accuracy coupled with the ease of operation of the pulse oximeters has led to its widespread use for monitoring patients.¹² An SpO₂ of > 95%, when breathing room air, is regarded as normal.²²

CONCLUSION

The application of nasal packs can be risky in old age, more so in patients having cardiopulmonary diseases or history of vagal syncope. The use of packs with airflow is recommended in patients prone to hypoxia. Application of pulse oximetry is a simple, non-expensive, easy to use device which should be used in vulnerable cases after nasal surgery.

REFERENCES

1. Weber R, Hochapfel F, Draf W. Packing and stents in endonasal surgery. *Rhinology* 2000;38(2):49-62.
2. Yilidrim A, Yasar M, Bebek AI, Canbay E, Kunt T. Nasal septal suture technique versus nasal packing after septoplasty. *Am J Rhinol* 2015;19(6):599-602.
3. Sedwick JD, Lopez AB, Gajerwski BJ, et al. Caudal septoplasty for treatment of septal deviation: aesthetic and functional correction of the nasal base. *Arch Facial Plast Surg* 2005;7(3):158-162.
4. Fairbanks DN. Complications of nasal packing. *Otolaryngol Head Neck Surg* 1986;94(3):412-415.
5. Ogura JH, Togawa K, Dammkoehler R. Nasal obstruction and the mechanics of breathing: physiologic relationships and the effects of nasal surgery. *Arch Otolaryngol* 1966;83(2):135-150.
6. Drettner B. Pathophysiological relationship between upper and lower airways. *Ann Otol Rhinol Laryngol* 1970;79(3):499-505.
7. Kohli GS, Arora A, Yadav SPS, Singh GP, Goel HC, Jain L. Effect of nasal packing on arterial blood gases and acid base balance. *Pak J Otolaryngol* 1989;5:178-183.
8. Yigit O, Cinar U, Uslu B, Akgül G, Topuz E, Dadaş B. The effect of nasal packing with or without an airway on arterial blood gases during sleep. *Kulak Burun Bogaz Ihtis Derg* 2002;9(5):347-350.
9. Cassisi NJ, Biller HF, Ogura JH. Changes in arterial oxygen tension and pulmonary mechanics with the use of posterior packing in epistaxis: a preliminary report. *Laryngoscope* 1971;81:1261-1266.
10. Gries RE, Brooks LJ. Normal oxyhaemoglobin saturation during sleep: how low does it go? *Chest* 1996;110(10):1489-1492.
11. Vazquez JC, Tsai WH, Flemons WW, Masuda A, Brant R, Hajduk E, Whitelaw WA, Remmers JE. Automated analysis of digital oximetry in the diagnosis of obstructive sleep apnoea. *Thorax* 2000;55(3):302-307.
12. Jubran A. Pulse oximetry. *Crit care* 1999;3(1):11-17.
13. Cavo JW, Kawomoto S, Berlin BP. Arterial blood gas changes following nasal packing in dogs. *Laryngoscope* 1975;85:2055-2068.
14. Ramadan MF. Experimental nasal obstruction and changes in the arterial blood gases. *Clin Otolaryngol* 1983;8:245-250.
15. Haddy MRA, Kodeira KZ, Nasef AH. Effect of nasal packing on arterial blood gases and acid base balance and its clinical importance. *J Laryngol Otol* 1983;97:599-604.
16. Ogretmenoglu O, Yilmaz T, Rahimi KK, Aksoyek S. Effect on arterial blood gases and heart rate of bilateral nasal packing. *Eur Arch Otorhinolaryngol* 2002;259(2):63-66.
17. Yadav SPS, Dodeja OP, Gupta KB, Chanda R. Pulmonary function tests in children with adenotonsillar hypertrophy. *Int J Paediatr Otorhinolaryngol* 2003;67:121-125.
18. Cvetnic V, Cvetnic S, Gbrac I. Temporary artificial obstruction of the nose and changes in gas exchange in the blood. *Laryngoscope* 1981;91:1001-1009.
19. Suratt PM, Turner BL, Wilhoit SC. Effect of intranasal obstruction on breathing during sleep. *Chest* 1986;90(3):324-329.
20. Ogura JH, Unno T, Nelson JR. Baseline values in pulmonary mechanics for physiologic surgery of the nose: preliminary report. *Ann Otol Rhinol Laryngol* 1968;77(3):367-397.
21. Cook TA, Komorn RM. Statistical analysis of the alterations of blood gases produced by nasal packing. *Laryngoscope* 1975;73:1802-1809.
22. Kendrick AH, Wiltshire N, Catterall JR. Effect of signal averaging time on on-line pulse oximetry used for overnight sleep recordings. *Am J Respir Crit Care Med* 1996;153(3):714.

