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Impact of nasal packing on arterial blood gases and acid base balance

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Abstract
Nasal packing is a routine procedure for treatment of epistaxis and after surgery in the nasal cavity and is associated with several local and systemic effects in the nose. Effect of nasal packing was studied on arterial blood partial pressure of oxygen (pO_2), carbon dioxide (pCo_2, bicarbonate (HCo_3), acidity (pH) and haemoglobin (Hb) levels. One hundred ten patients had anterior nasal packing as part of management of epistaxis or following nasal surgery. It included 10 patients with chronic obstructive pulmonary disease (COPD). Hypoxemia was observed in all patients. Patients with COPD showed hypoxaemia along with hypercarbia and change in acid base balance. Study emphasis the need of close monitoring in patients with compromised lung functions subjected to nasal packing. Nasal packing with ventilation tube is recommended.

Keywords: Nasal packing, Blood gases, Acid base balance, Ventilation tube.

Introduction
Nasal packing is a routine procedure for treatment of epistaxis and after surgery in the nasal cavity and is associated with several local effects in the nose [1]. Though Adams [2]. Clearly defined an 'asthmogenic area' in the nose, the stimulation of which led to bronchial spasm and described nasopulmonary reflex. It was Ogura *et al.* [3]. Who after detailed experimental studies observed that pulmonary resistance increased with the degree of nasal obstruction and the change was attributable to naso-pulmonary reflex or due to changes in surfactant. Cassisi *et al.* [4] observed the decrease in arterial oxygen tension in patients with nasal packing for epistaxis, while Slocum *et al.* [5] noticed decrease in pO2 was also associated with post surgical nasal packing. Other workers [6, 7] have also observed that hypoxaemia was associated with significant hypercarbia, more so in patients with obstructive pulmonary disease (COPD), through Jacobs *et al.* [8] were unable to find any change in pCO2 levels associated with hypoxemia. In a recent study Banglawala *et al.* [9] found that bilateral anterior nasal packing does not cause adverse cardiopulmonary changes after Septoplasty.
Present study is undertaken with the view to evaluate the effect of nasal packing (in epistaxis and after surgery) on anterior pO_2, pCo_2, HCo3, pH and Hemoglobin. An attempt has also been made to see the effect of ventilation tube, with anterior nasal packing.

Material and Methods
The study was carried out with 110 patients of both sexes in the age group of 20 to 60 years. All the patients were screened for any condition affecting blood gases and acid base balance except for a group of patients (A_2) with established chronic obstructive pulmonary disease (COPD). All the patients were subjected to bilateral anterior nasal packing. The surgical procedures were undertaken under local anesthesia. No sedation was used in any of the patients. The patients were divided in to four groups.

Group A: This group comprised of patients presenting with epistaxis and were managed with bilateral anterior nasal packing as a part of treatment. Patients were further sub divided in to two groups.

Group A_1: comprised of 41 patients of epistaxis, without any pulmonary disease.

Group A_2: comprised of 10 patients of epistaxis with COPD and were on regular treatment for chronic obstructive pulmonary disease.

Group B: Comprised of 30 patients of Deviated Nasal Septum (DNS) subjected to sub mucus resection (SMR) or Septoplasty with conventional post operative nasal packing.

Group C: Comprised of 19 patients of DNS undergoing SMR or Septoplasty in which post operative nasal packing was done with ventilating tubes; size 14-16 FG (Fig. 1). Care was taken to ensure the patency of ventilation tubes and patients breathed through the tubes. Periodic examination and toilet of tubes were done. The lengths of tubes were tailored depending on individual requirements.

Group D: Comprised of 10 patients of Ethmoidal polypi, subjected to polypectomy with post operative bilateral anterior nasal packing.

Blood was taken from Radial artery in each case, 24 hours before and after nasal packing. Blood samples were fed in to automated blood gas analyzer at body temperature and levels of pC_2, pCo_2, HCo_3, pH and Hb were recorded.

Fig 1: Anterior Nasal packing with Ventilation tubes.

Results

The results obtained in this study of arterial blood gases and acid base balances in different groups of patients have been outlined below;

Group A_1This group had 41 patients in whom anterior nasal packing has done after epistaxis. The Mean values of Hb (gm%), pH, pCO_2, pO_2 and HCo_3 were before nasal packing 11.98,7.37, 37.8, 97.16, 22.45 and after bilateral nasal packing were 11.84, 7.36, 39.3, 78.82 and 22.22 respectively.

Group A_{II}. This group had 10 patients with epistaxis who had been diagnosed earlier with suffering from COPD and were under treatment. The Mean value of Hb (gm%), pH, pCO_2, pO_2 and HCo_3 were before packing 9.54%,7.366, 51.2, 75.0, 21.3 and after nasal packing were 9.58, 7.345, 59.5, 62.1, 23.3 respectively.

Group B. This group had 30 patients diagnosed with deviated nasal septum and were operated for Septoplasty or sub-mucus resection (SMR) of septum. Mean values of Hb (gm%), pH, pCO_2, pO_2 and HCo_3 before nasal packing i.e pre operatively were 12.25, 7.378, 37.21, 95.43, 21.7 and post operatively after nasal packing were 12.39, 7.376, 38.32, 85.77, 21.8 respectively.

Group C. This group had 19 patients of DNS who were subjected to Septoplasty or SMR in whom anterior nasal packing was done with ventilation tubes. The Mean values of Hb (gm%), pH, pCO_2 and HCo_3 before nasal packing were 13.3, 7.358, 38.47, 91.5, 21.2 and after nasal packing were 13.01, 3.376, 37.06, 88.6, 21.3 respectively.

Group D. This group had 10 patients with bilateral ethmoidal polypi who were subjected to bilateral ethmoidal polypectomy. The Mean values of Hb (gm%), pH, pCO_2 and HCo_3 before surgery were 12.49, 7.390, 35.89, 97.72, 21.68 and after nasal packing post operatively were 12.85, 7.370, 38.01, 86.59, 21.80 respectively.

From the above data following observations were made.

1. The significant hypoxemia was observed after nasal packing ($p< 0.001$). The mean value of decrease in pO_2 levels after nasal packing with ventilating tubes (group C) was insignificant.
2. No significant change in pCo_2 levels were observed except in patient with COPD (group A_2), in which pco_2 levels were raised significantly after nasal packing ($p<0.05$).
3. No significant change in pH was observed. However HCo_3 levels were increased significantly with COPD (group A_2, $p<0.05$).
4. No significant change was observed in Hb levels after nasal packing.

Discussion

Hypoxaemia, following nasal packing has been reported by a number of investigators [4, 6-10]. Naso-pulmonary reflex has been hypothesized to explain the phenomenon of hypoxaemia, leading to decrease pulmonary compliance and increased airway resistance [3, 11-12]. It could be explained in terms of activation of trigeminal afferents in the nasal mucosa. If the trigeminal receptors can be activated by odours, fluids and probing, they could also be responsive to the pressure of the nasal pack. The explanation seems to be logical and does explain the hypoxemia induced after nasal packing in our series of patients too, but this can not be the sole contributing factor. We have observed significant less hypoxaemia in patients having nasal packing with ventilation tubes, where the naso-pulmonary reflex stimulus, the pressure of pack, remained unchanged. Another possibility could be that nasal obstruction per se and mouth breathing leading to hypoventilation, might be having significant role in development of hypoxaemia [3, 11, 14]. Grossly enlarged tonsils and adenoids significantly narrow the upper airway leading to increase airway resistance, decreased ventilator capacity and alveolar hypoventilation. In susceptible individuals, this may lead to pulmonary hypertension and ventricular hypertrophy [13]. However, since most of the cases of cor-pulmonale have been reported in patients with enlarged tonsils and adenoids, where, not only the nasal airways is obstructed but the oral airway is also reduced, therefore it is difficult to say, how much role is played by nasal obstruction. Aspiration of blood and palatal edema due to nasal packing has also been described as etiological factor in causing hypoxaemia in cases of epistaxis [8].

Hypoxaemia along with hypercarbia following nasal packing have been reported by a number of workers [7, 8, 15] while others failed to demonstrate it [4, 5, 10]. In the present study also no significant changes in p Co_2 levels were observed. This may partly be due to the fact that the patients selected in the present study were free from systemic disorders affecting acid base balance. This could also be due to the fact that the Co_2 have a high diffusion coefficient as compared to oxygen, the exchange of Co_2 is not usually affected, although the diffusion of O_2 may be impaired. But hypoxemia with hypercarbia has been observed in patients with chronic obstructive pulmonary

disease (COPD) [4, 6]. In patients with compromised pulmonary functions role of oxygen supplementation becomes controversial, as hypoxemia may be severe enough to warrant oxygen supplementation, while the other who support the naso-pulmonary reflex causing hypoventilation have advised against it, as the hypoxaemia may reduce the respiratory drive in such cases leading to severe complication [9, 16].

We did not observe any significant changes in blood levels of pCo_2, HCo_3 and pH in patients without pulmonary diseases. Abdel Hady *et al.* [7] also did not observe any change in pH because the increase in pCo_2 was associated with increase in HCo_3 levels. They attributed the rise in HCo_3 levels as a secondary change to increase in pCO_2. However it may be pointed out that compensatory rise in HCo_3 induced by hypercarbia takes place by increase in HCo_3 resorption and regeneration in renal tubules. This is a slow process and is therefore, unlikely to increase the HCo_3 levels secondarily. Besides the secondary rise in HCo_3 level results in only partial restoration of pH. Further in ordinary course, metabolic acidosis is not likely to develop in patients with nasal packing. This may be due to the fact that the hypoxaemia is not severe enough to cause any tissue hypoxia which can cause lactic acidosis. However in the patients with impaired pulmonary functions, nasal packing may precipitate the life threatening lactic acidosis, so while managing these patients with epistaxis, either nasal packing with ventilation tubes should be put in, with controlled oxygen supplementation as titrated by repeated blood gas estimations or alternatively surgical procedures of artery ligation may be considered [2, 17].

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