

Original Research Article

Comparative study on the effect of various anterior nasal packing on ear compliance and ear canal volume

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ABSTRACT

Background: Anterior nasal packing (ANP) is a commonly used procedure by otorhinolaryngologist for the control of post-operative bleeding post septoplasty and nasal surgery. However there remains an ambiguity regarding the effect of various nasal packings on the Eustachian tube dysfunctions. The present study intends to compare and evaluate the effects of ribbon gauge nasal packing (RNP), merocel nasal packing (MNP) and merocel with airway packing (MAP) on the eustachian dysfunction such as changes in the compliance and ear canal volume.

Methods: Ninety patients were selected for the study, and randomly divided into 3 groups of 30 patients each where the patients were treated with RNP, MNP and MAP. The pack was kept insitu for 48 hrs and the compliance and ear canal volume was measured at before pack is applied (pre pack), with ANP insitu at 48 hrs (with pack), and after removal of the nasal pack at 5th day (post pack).

Results: The percentage of patients with abnormal compliance level as well as ear canal volume was found to be the highest among the patients in RNP group followed by patients from the MNP group. The least number of patients with abnormal compliance and ear canal volume was observed among the patients in the MAP groups.

Conclusions: MAPs are better than ribbon gauge and MNPs in terms of maintaining the compliance level and ear canal volume.

Keywords: Anterior nasal packing, Compliance, Ear canal volume

INTRODUCTION

Anterior nasal packing (ANP) is a commonly used procedure by the otorhinolaryngologist for the control of post-operative bleeding post septoplasty and nasal surgery.^{1,2} There are different types of intranasal packings that are prescribed for bleeding control, nose bone stabilization, septal mucosal flaps settlement, as well as avoiding adhesions and septal hematoma in patients undergoing septoplasty.³ However, many studies have questioned the effectiveness of ANP and have advocated the use of one packing over the other.⁴ It has also been reported that the nasal packing may lead to various postoperative effects like pain, trauma and discomfort to

the nasal mucosa.⁵ Merocel pack with and without airway and ribbon gauze pack are the most frequently used internal nasal splint packings. It has been reported that nasal pack leads to gross patient discomfort ranging from pain, breathing difficulty and dry mouth to ear problems. Many at times it has been reported that nasal packings post septoplasty may lead to the dysfunction of the eustachian tube accompanied with temporary nasal complaints such as ear fullness and mild pain.⁶ The Eustachian tube is one of the vital parts of the ear which aids in the ventilation of the middle ear. For maintaining the ear pressure the middle ear has an inherent tendency of releasing pressure during which the Eustachian tube helps in compensating the loss of gas by permitting some

gas so that the ear pressure can be maintained.^{7,8} Many types of intranasal packing are reported to completely block the nasal passage completely, leading to increased disturbances for patients which may be due to its association with eustachian dysfunction.⁹

With a view to obtain a picture related to complications associated with various nasal packing the present study has been undertaken to compare the effects of ribbon gauge nasal packing (RNP), merocel nasal packing (MNP) and merocel with airway packing (MAP) on eustachian dysfunction after septoplasty so that the routine nasal packing practice can be modified for better clinical outcome.

METHODS

The study was an observational research work performed on patients in the Department of Otorhinolaryngology, Silchar Medical College and Hospital, Silchar, Assam, India with the need for ANP over a two year time span i.e. November 2016 to December 2018. A total of ninety patients were considered for the study, who were divided randomly into 3 groups of 30 patients each in which the patients were either needed to be applied RNP, MNP and MAP (Figure 1). The patients were examined clinically for any pre-existing ear pathology using otoscopic examination and tuning fork tests before including the patients for the study. Informed consent was taken from all the patients included in the study. Informed consent was obtained from all individual participants included in the study.

Inclusion criteria

The inclusion criteria for the study subjects include patients of age of 18 years or above who were admitted for nasal surgery or epistaxis and requiring ANP.

Exclusion criteria

Patients with posterior nasal packing were excluded from the study. Patients with history of ear discharge, hearing loss, pre-existing ear pathology, life threatening epistaxis and any other serious medical conditions were also excluded from the study.

The selected patients were treated with ANP, using different types of packing materials under study to control epistaxis. The nasal packing was kept insitu for 48 hrs in the patients of all groups. Tympanometry was performed for the patients of all the groups in order to record ear compliance and ear canal volume (ECV) at presentation before the pack is applied (pre pack), with ANP insitu at 48 hrs (with pack), and after the removal of nasal pack on the 5th day (post pack).

Statistical analysis

The differences in the demographic characteristics as well as the clinical conditions of the patients of all the three groups were determined using the Chi-square test. One-way ANOVA test was performed to determine the significant difference of the compliance and ECV between the groups. All the statistical analyses were performed using SPSS Ver.24. The statistical tests were considered significant for p<0.05.

RESULTS

As observed from Table 1 that the mean age±SD for patients with RNP, MNP and MAP group was found to be 33.23±8.34, 34.67±9.86 and 35.07±9.67 respectively. The percentage of male and female patients in the RNP, MNP and MAP group was found to be (male=56.7%, female=43.3%), (male=56.7%, female=43.3%) and (male=60%, female=40%) respectively. Majority of the patients in all the three groups were post surgical cases of nose and paranasal sinuses (PNS) while rest were associated with epistaxis with hypertension or trauma.

Table 1: Distribution of demographic characteristics of the study population.

Demographic characteristics		RNP	MNP	MAP	P value
		N (%)	N (%)	N (%)	
Gender	Male	17 (56.7)	17 (56.7)	18 (60)	0.95
	Female	13 (43.3)	13 (43.3)	12 (40)	
Mean age±SD		33.23±8.34	34.67±9.86	35.07±9.67	
Indication of nasal packaging	H	9 (30)	9 (30)	7 (23.3)	0.9
	M	13 (43.3)	13 (43.3)	12 (40)	
	T	8 (26.7)	8 (26.7)	11 (36.7)	

H: epistaxis with hypertension, M: medical diseases of nose & PNS following surgery, T: traumatic conditions like RTA etc.

It has been observed from Table 2 that the condition of the tympanic membrane among the patients of the RNP group was found to change after the application of nasal packing. About 10% and 6.7% of the patients in the RNP group were reported to have bulged tympanic membrane in the left ear and right ear respectively after the nasal packing. The patients from all MNP and the MAP nasal

packing group were reported to have normal tympanic membrane after the application of nasal packing. The percentage of patients with dull tympanic membrane was found to be the highest in the RNP group (left ear (LE): 33.3%, right ear (RE): 36.7%) which was followed by the patients in the MAP group (LE: 43.3%, RE: 43.3%). The least percentage of patients with dull tympanic membrane

was observed for the patients of the MNP group (LE: 23.3%, RE: 23.3%). The middle ear fluid of the patients for all the three nasal packing groups was found to be nil

in both the left and right ear before nasal packing, with nasal packing and post nasal packing.

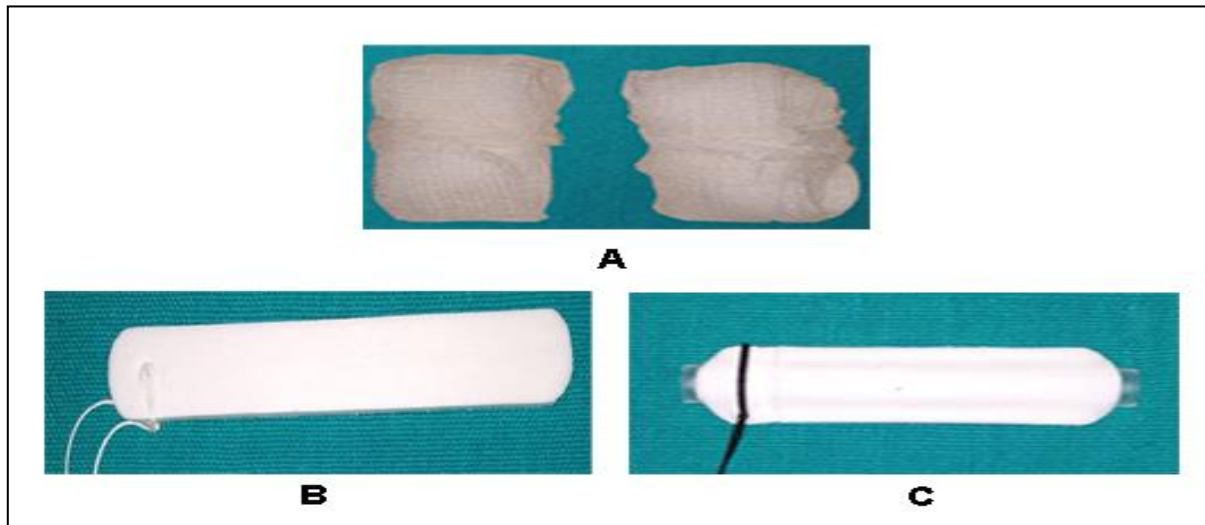


Figure 1: Figure showing the different types of nasal packings (A) RNP, (B) MNP and (C) MAP.

Table 2: Otosopic findings of the study population in the RNP, MNP and MAP group with pre nasal packing, with nasal packing and post nasal packing.

		Condition of TM	Colour of TM	Middle ear fluid
RNP	Pre pack	LE: (I=100%, B=0%) RE: (I=100%, B=0%)	LE: (N=100%, D=0%) RE: (N=100%, D=0%)	LE: (nil) RE: (nil)
	With pack	LE: (I=90%, B=10%) RE: (I=93.3%, B=6.7%)	LE: (N=66.7%, D=33.3%) RE: (N=63.3%, D=36.7%)	LE: (nil) RE: (nil)
	Post pack	LE: (I=100%, B=0%) RE: (I=100%, B=0%)	LE: (N=100%, D=0%) RE: (N=100%, D=0%)	LE: (nil) RE: (nil)
MNP	Pre pack	LE: (I=100%, B=0%) RE: (I=100%, B=0%)	LE: (N=100%, D=0%) RE: (N=100%, D=0%)	LE: (nil) RE: (nil)
	With pack	LE: (I=100%, B=0%) RE: (I=100%, B=0%)	LE: (N=76.7%, D=23.3%) RE: (N=76.7%, D=23.3%)	LE: (nil) RE: (nil)
	Post pack	LE: (I=100%, B=0%) RE: (I=100%, B=0%)	LE: (N=100%, D=0%) RE: (N=100%, D=0%)	LE: (nil) RE: (nil)
MAP	Pre pack	LE: (I=100%, B=0%) RE: (I=100%, B=0%)	LE: (N=100%, D=0%) RE: (N=100%, D=0%)	LE: (nil) RE: (nil)
	With pack	LE: (I=100%, B=0%) RE: (I=100%, B=0%)	LE: (N=56.7%, D=43.3%) RE: (N=56.7%, D=43.3%)	LE: (nil) RE: (nil)
	Post pack	LE: (I=100%, B=0%) RE: (I=100%, B=0%)	LE: (N=100%, D=0%) RE: (N=100%, D=0%)	LE: (nil) RE: (nil)

I: intact; B: bulge; N: normal; D: dull.

In Figure 2 that in order to compare both the ECV and compliance level in both the right and left ear a grouped scatter plot was plotted for the patients with RNP, MNP and MAP nasal packing. It has been observed from the plot that the number of patients in the RNP group with level of compliance above the normal levels in both the left and the right ear has been found to be the highest. This was followed by the number of individuals in the MNP and MAP group for the left and right ear (quadrant α_3 , β_3 and γ_3). A similar observation was also observed for the ECV where it was observed that the highest

number of patients with the level of ECV above the normal level was observed in the RNP group. This was followed by the patients in the MNP group while the least was observed for the patients in the MAP group (quadrant γ_1 , γ_2 and γ_3). The β_2 quadrant identifies the patients with both the compliance and the ECV in the normal level. It has been observed that majority of the patients with normal ECV and compliance was from the MAP group. This was followed by patients from the MNP group while the least was observed among the patients from the RNP group.

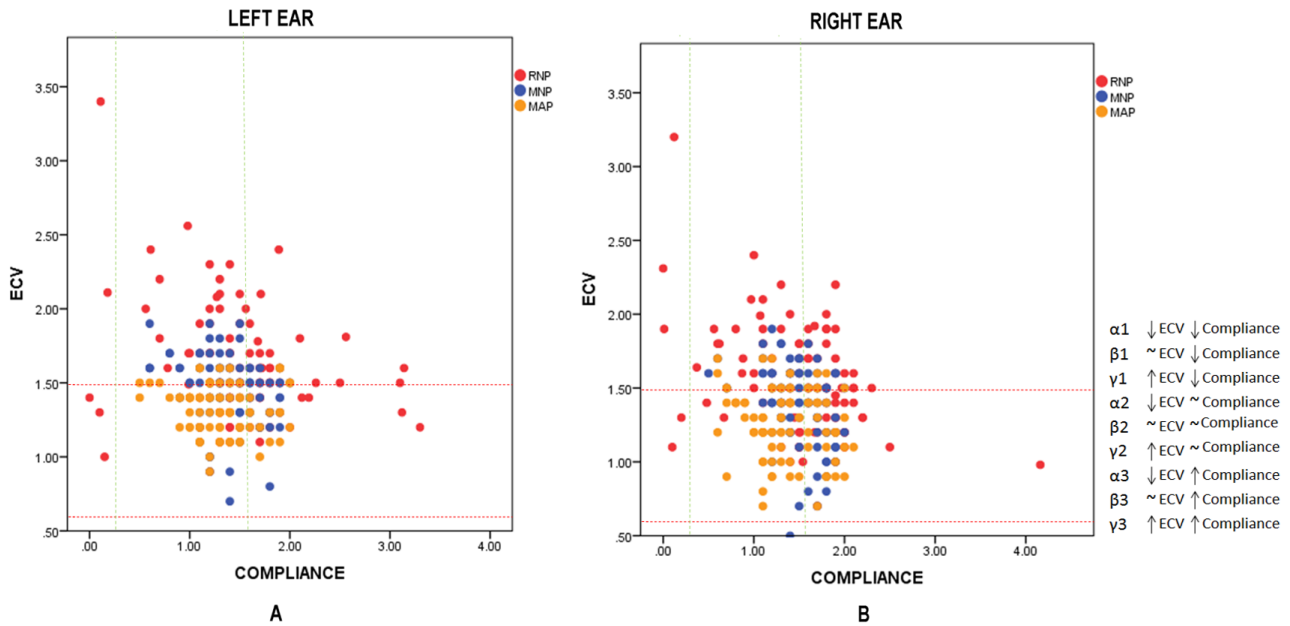


Figure 2: Grouped scatter plot comparing the level of ECV and compliance among the individual patients of the RNP, MNP and MAP group in the (A) LE and (B) RE with nasal packing (with pack).

The dotted lines in red indicates the minimum and maximum range for normal ECV while the dotted lines in green indicates the minimum and maximum range for normal compliance level in a healthy human ear. The plot has been divided into 9 quadrates namely α1, α2, α3, β1, β2, β3, γ1, γ2, γ3. Down arrow denotes below normal level, up arrow denotes above normal level and ~ denotes normal level.

Table 3: Ear compliance in various nasal packing groups among study population.

Nasal packing materials	Compliance (Mean±SD)			P value (One way ANOVA)
	Pre pack (LE+RE)	With pack (LE+RE)	Post pack (LE+RE)	
RNP	1.6±0.6	1.2±0.4	1.6±0.6	<0.0001***
MNP	1.5±0.3	1.2±0.3	1.5±0.3	<0.0001***
MAP	1.5±0.3	1.0±0.3	1.4±0.3	<0.0001***

***p<0.001 (Highly significant), normal compliance: 0.3-1.6 cm³

Table 4: ECV in various nasal packing groups in study population.

Nasal packing materials	Ear canal volume (Mean±SD)			P value (One way ANOVA)
	Pre pack (LE+RE)	With pack (LE+RE)	Post pack (LE+RE)	
RNP	1.26±0.17	1.98 ± 0.34	1.56±0.19	<0.0001***
MNP	1.20±0.24	1.62±0.14	1.42±0.16	<0.0001***
MAP	1.16±0.19	1.45±0.14	1.29±0.17	<0.0001***

***p<0.001(Highly significant); normal ECV: 0.6-1.5 cm³

It was seen from Table 3 that the mean ear compliance level among the patients in all three groups decreased with the insitu application of nasal packing. However, it was observed that the level of the ECV reached the pre pack level after the removal of nasal packing in all the three groups. The intra group differences of the level of ECV among the patients with pre pack, with pack and after pack were observed to be statistically significant (p<0.0001) for all the three groups.

It was evident from Table 4 that the mean level of the ECV among the patients, it was observed that the ECV in all three groups increased with the application of nasal packing. However, it was observed that the level of the ECV did not reach the pre pack level even after the removal of nasal packing in all the three groups. The intra group differences of the level of ECV among the patients with pre pack, with pack and after pack were observed to be statistically significant (p<0.0001) for all the three groups.

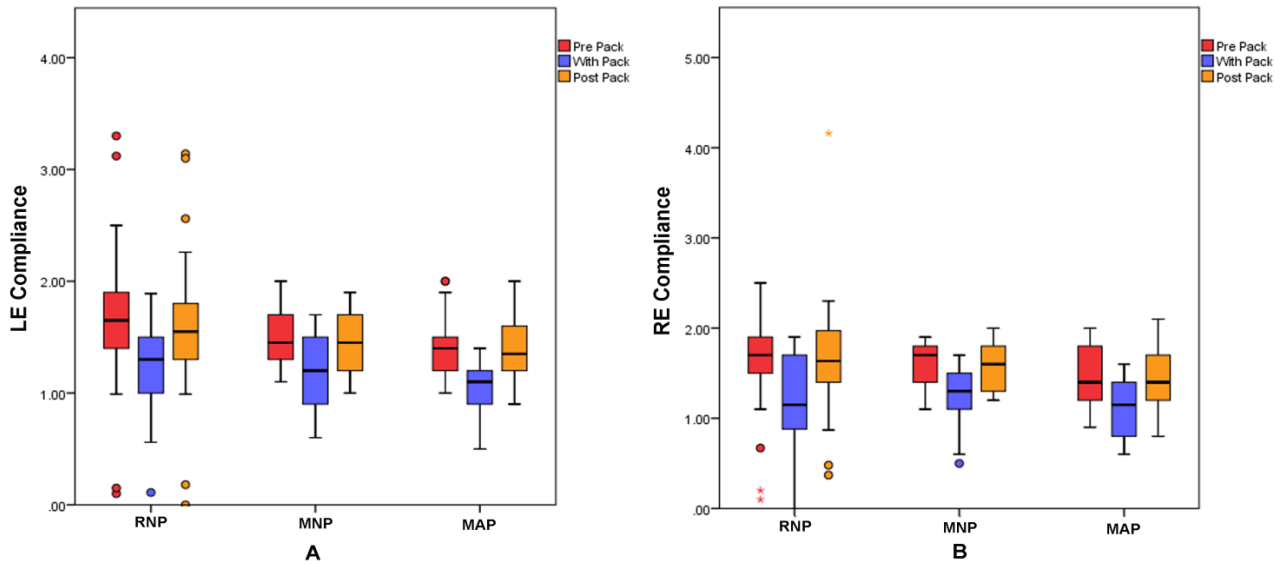


Figure 3: Box plot comparing the level of ear compliance among the patients of the RNP, MNP and MAP group in the (A) LE and (B) RE before applying nasal packing (pre pack), with nasal packing (with pack) and post nasal packing (post pack).

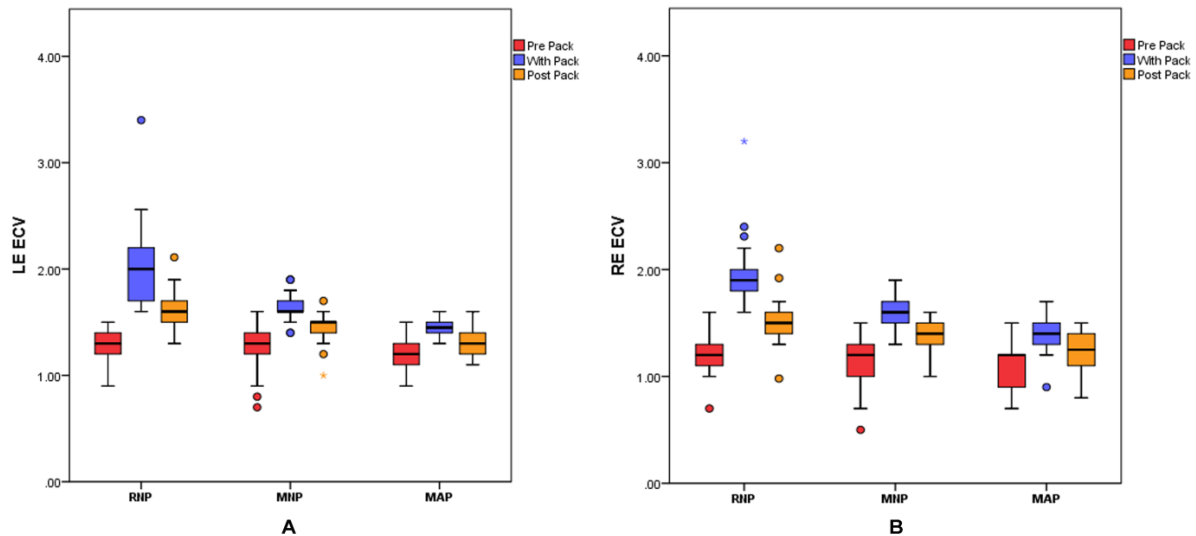


Figure 4: Box plot comparing the level of ECV among the patients of the RNP, MNP and MAP group in the (A) LE and (B) RE before applying nasal packing (pre pack), with nasal packing (with pack) and post nasal packing (post pack).

In Figure 3 that on comparing the level of ear compliance among the patients of RNP, MNP and MAP group it was observed that the difference in the mean level of ear compliance in the pre pack and with pack as well as with pack and post pack in the right ear of the patients with RNP nasal packing was found to be higher in comparison to the level of ear compliance in the right ear of patients with MNP nasal packing. The difference in the pre pack and with pack as well as between with pack and post pack level of ear compliance in the right ear of the patients with MAP nasal packing was found to be least in

comparison to RNP and MNP nasal packing. However, no such noticeable difference in the level of ear compliance was observed in the left ear of the patients for the RNP and MNP groups before, with and post nasal packing. In the MAP group it was observed that the compliance level in the left ear post nasal packing was found to be higher than that observed with nasal packing.

In Figure 4 that on comparing the level of ECV among the patients of RNP, MNP and MAP group it was observed that the difference in the mean level of ECV of

both the left and the right ear in RNP group was found to be higher between pre and with nasal packing as well as with and post nasal packing in comparison to those with MNP and MAP nasal packing. It was observed that the mean difference in the ECV between pre and with nasal packing and with and post nasal packing of both the left and the right ear was found to be the least among the patients in the MAP group.

DISCUSSION

The use of ANP has been found to be widely used by ENT surgeons post septoplasty and nasal surgery. Chronic nasal obstruction due to the application of nasal packings may lead to eustachian tube dysfunction that may affect the compliance as well as the middle ear volume. Nasal packing after septal surgery may frequently lead to short-lasting eustachian tube dysfunction. The application of nasal packing, by itself, may lead to various complications.¹⁰ Therefore in order to validate the previous reports, this study was hypothesised to investigate and compare the effect of different types of nasal packing in the eustachian tube dysfunction. To the best of our knowledge this is the first report comparing the ECV and compliance among the patients applied with ribbon gauge, merocel and merocel with airway nasal packing.

The study was conducted on 180 ears of 90 patients in which the patients were divided into three groups of 30 individuals each based on the type of nasal packing used for the study. The mean age of the patients of the RNP, MNP and the MAP group were observed to be 33.23, 34.67, and 35.07 respectively indicating that the study subjects selected for the study were age adjusted and that the variations observed in the result among the different groups were not influenced by age. It has been observed that majority of the study subjects had medical disease of nose and PNS following surgery for the all the three groups. It was followed by patients with epistaxis with hypertension and traumatic conditions such as RTA etc indicating that the differences observed in the results are not influenced by indications of nasal packing but solely due to the affect of the nasal packings.

It has been observed from the study that the middle ear fluid was found to be normal for all the three nasal groups. The condition of the tympanic membrane (TM) was also found to be normal for the patients of the MNP and MAP group, however a few percentages of patients in RNP group were found to have bulged TM. The colour of the TM was observed to change for the patients of all the three groups with the application of the nasal packings. It was found that the percentage of study subjects with dull TM was found to be higher among the patients in the MAP group in comparison to the RNP and MNP group for both ears.

Form the study of the ear compliance it has been observed that the number of patients with abnormal

compliance level was found to be the highest among the patients in RNP group followed by patients in the MNP group. The least number of individuals with abnormal compliance level was found to be among the patients in the MAP group indicating the MAP is better in maintaining the ear compliance level in comparison to other types of nasal packing under consideration. The RNP was found to be the least effective in maintaining the normal compliance level among the individuals. Upon applying the three nasal packing among the patients it has been observed that the number of patients with abnormal ECV was highest in the RNP group while the least number of patients was found to be from the MAP group indicating that the MAP was more effective in maintaining the ECV while the RNP was found to be the least effective. MAPs are the most recent nasal packing among all the three types while the RNPs were the very basic which might have attributed to the differences in the observations. Moreover, the enhanced properties of the MAPs does not restrict the normal breathing among the patients which might result in better maintaining the compliance as well as the ECV among the patients.¹¹ Merocel[®] has been in the market for more than 30 years and has been the most popular as a non absorbable nasal pack due its various advantages and properties.¹² The MAP is the improved type of the MNP which was reported in previous studies to ease the breathing process through nose among the patients which might reduce the discomfort among the patients.¹³

It was observed that the ear compliance level returned back to the pre-pack level after the removal of the nasal packing in all the three groups. However, the same was not observed for the ECV. Although the ECV decreased after the removal of the nasal packing but it did not revert back to the pre-pack level. Although there are various conflicting outcomes of previous studies on the effect of ANPs post nasal surgeries, our study reports that nasal packing does have a harmful effect on ET function which might affect the ECV as well as the ear compliance level. The effect in the compliance level and ECV was found to be more apparent with patients in the RNP group and least in MAP group.

CONCLUSION

The present study concluded that Merocel with airway nasal packings are better than Ribbon Gauge and MNPs in terms of maintaining the compliance level and ECV thus increasing the comfort level of the patients. It is therefore suggested that MAP should be the preferred nasal packing for routine while RNP should be the last choice for ANP.

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