

# Role of septoplasty in reducing the incidence of comorbidities associated with elevated levels of mean platelet volume

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## Aim

The aim of this study was to analyze the effect of septoplasty on mean platelet volume (MPV) levels in patients with marked nasal septal deviation (MNSD).

## Setting and design

This is a prospective study that was carried out in a Government Medical College and Hospital.

## Materials and methods

A total of 50 patients were selected after proper history and examination.

## Statistical analysis

The data entries were entered into SPSS software and the paired *t*-test was applied.

## Results

Data obtained from preoperative and postoperative blood investigation were analyzed and it was statistically proved that, after septoplasty, the MPV was significantly lowered in patients who had MNSD.

## Conclusion

Septoplasty plays an important role in reducing the MPV value in cases with MNSD, and thus other comorbid conditions can be prevented by performing septoplasty in these patients.

## Keywords:

mean platelet volume, nasal septal deviation, septoplasty

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## Introduction

Nasal septal deviation (NSD) is a common etiology of nasal obstruction [1], although nasal obstruction can be caused by other conditions, such as turbinate hypertrophy, adenoid hypertrophy, and nasal polyposis. Approximately 80% of the general population is estimated to have some type of nasal deformity [2].

Surgical correction of a deviated septum (i.e. nasal septoplasty) is the definitive treatment for septal deviation. Septoplasty is a corrective surgical procedure performed to straighten the nasal septum, the partition between the two nasal cavities. Ideally, the septum should run down the center of the nose. When it deviates into one of the cavities, it narrows that cavity and impedes airflow. The procedure usually involves a judicious excision/realignment of a portion of the bone and/or cartilage in the nasal cavity. Sufficient cartilage is preserved for structural support. After the septum is straightened, it may then be stabilized temporarily with small plastic tubes, splints, gauge packs, or sutures internally, which are removed in a due course of time [3].

Mean platelet volume (MPV) is a machine-calculated measurement of the average size of platelets found in

blood and is typically included in blood tests as a part of the complete blood count.

MPV is higher when there is destruction to Platelet destruction may be seen in immune thrombocytopenic purpura, and in myeloproliferative diseases, Bernard-Soulier syndrome, and various obstructive diseases of the airway [4]. Abnormally low MPV values correlate primarily with thrombocytopenia when it is due to impaired production as in aplastic anemia.

A typical range of platelet volumes is 9.7–12.8 fl, equivalent to spheres 2.65–2.9 μm in diameter. Normal range is given as 7.5–11.5 fl.

Marked nasal septal deviation (MNSD) due to chronic upper airway obstruction (UAO) can lead to alveolar hypoventilation, cor pulmonale, and pulmonary hypertension. UAO leads to chronic hypoxia and hypercarbia because of alveolar hypoventilation [5]. Chronic hypoxia and hypercarbia show tendency for hypercoagulopathy.

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MPV, the most commonly used measure of platelet size, is a potential marker of platelet reactivity. Large platelets that contain more dense granules are enzymatically and metabolically more active and have greater prothrombotic potential. Increased platelet activation plays an important role in the development of atherosclerosis. Studies proved that increased MPV was demonstrated in cardiovascular and cerebrovascular diseases such as hypertension, unstable angina pectoris, myocardial infarction, and stroke [6].

## Materials and methods

The following prospective study was conducted from October 2012 to September 2014. A total of 50 patients were included in the study. The cases were selected from the ENT, OPD, and ENT ward after proper history and examination. Informed consent was obtained from all patients. All procedures performed in the study are in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The blood samples of the selected patients were sent in EDTA vial for preoperative MPV determination before septoplasty and were evaluated for MPV again postoperatively after a period of 4–12 weeks.

### Inclusion criteria

The study included cases of deviated nasal septum refractory to conservative medical treatment with long-term nasal obstruction and headache. The diagnosis of patients with MNSD was based on anterior rhinoscopy and endoscopic nasal examination. All patients underwent septoplasty under local or general anesthesia. Blood samples were collected before septoplasty, and follow-up samples were collected after 4–12 weeks postoperatively. The study population was investigated for evidence of any diseases that would be exclusion criteria for study.

### Exclusion criteria

The study excluded any patient with evidence of coronary artery disease, chronic heart failure, diabetes mellitus, renal or hepatic dysfunction, hematologic disease, cancer, thrombocytopenia, hypothyroidism and hyperthyroidism, autoimmune disease, antithrombotic agent or serotonin reuptake inhibitor drug use, chronic or systemic inflammatory diseases such as bronchial asthma, rheumatoid arthritis, and psoriasis.

All patients were properly assessed with complete detailed history, general examination, respiratory

system examination, and detailed ENT examination. All patients underwent diagnostic endoscopic examination and preoperative complete blood count investigation, which includes MPV. The patients underwent both conventional and endoscopic septoplasty and patients were again evaluated after a period of 4–12 weeks for MPV values.

## Results

Among the 50 patients studied, 34 (68%) cases were male and 16 (32%) were female, showing a male preponderance over female cases. The youngest patient included in the study was 12 years old and eldest patient was 46 years old. Male-to-female ratio was 2.1 : 1. The patients were grouped into four: group A, 10–20 years of age; group B, 21–30 years of age; group C, 31–40 years of age; and group D, older than 40 years of age. The maximum number of patients belonged to group A. The mean age in our study was 24 years. The age at onset in our study was mostly second to fourth decade of life. The most common symptom in our study was nasal obstruction (100%) in all patients, as all patients had MNSD. Complaint of nasal obstruction was followed by nasal discharge (58%), headache (48%), sneezing (32%), nasal bleeding (14%), snoring (14%), and anosmia (6%). Following septoplasty, most marked improvement was in nasal obstruction, as reported by the cases during follow-up.

We compared three variables preoperatively and postoperatively after septoplasty. MPV was recorded before septoplasty (Table 1) and after 4 (Table 2), 8 (Table 3), and 12 weeks (Table 4) weeks of operation. The platelet count and white blood cell (WBC) count were recorded before and 12 weeks after septoplasty operation (Table 5).

MPV was found to be higher in patients with MNSD. Most of the patients had MPV in the range 10–13 fl (76%) preoperatively. Preoperative mean of MPV was found to be 11.0 fl, with an SD of 1.1.

At fourth week after septoplasty, the maximum number of cases (33, 66%) had MPV in the range of 10.1–12.0 fl. The mean MPV was calculated to be 10.7 fl, with 1.05 SD.

At eighth week after septoplasty, the maximum number of cases (35, 70%) had MPV in the range of 9.1–11.0 fl. The mean MPV was calculated to be 10.5 fl, with 1.06 SD.

**Table 1 Preoperative MPV: No. of patients in respective age groups with MPV:-**

Age Group	MPV (<8)	MPV (8.1-9.0)	MPV (9.1-10.0)	MPV (10.1-11.0)	MPV (11.1-12.0)	MPV (>12)
Group A	-	-	7	7	6	7
Group B	-	-	5	4	2	2
Group C	-	-	-	3	2	4
Group D	-	-	-	-	1	-
Total	0	0	12	14	11	13

**Table 2 Post-Operative MPV at 4th week:-**

Age Group	MPV (<8)	MPV (8.1-9.0)	MPV (9.1-10.0)	MPV (10.1-11.0)	MPV (11.1-12.0)	MPV (>12)
Group A	-	-	6	10	8	3
Group B	-	1	4	5	2	1
Group C	-	-	-	4	-	2
Group D	-	-	-	2	2	-
Total	0	1	10	21	12	6

**Table 3 Post-Operative MPV at 8th week:**

Age Group	MPV (<8)	MPV (8.1-9.0)	MPV (9.1-10.0)	MPV (10.1-11.0)	MPV (11.1-12.0)	MPV (>12)
Group A	-	1	8	9	6	3
Group B	-	1	7	4	-	1
Group C	-	-	-	7	1	1
Group D	-	-	-	-	1	-
Total	0	2	15	20	8	5

It was observed that almost all cases had platelet count within the normal range of 150 000–400 000/mm<sup>3</sup> [7]. Preoperatively, the mean platelet count was 261×10<sup>3</sup>, with an SD of 49, and, postoperatively, it was 263×10<sup>3</sup>, with an SD of 65.

WBC count was also observed to lie in the normal range of 4500–11 000/mm<sup>3</sup>. Preoperatively, the mean leukocyte count was found to be 7.7×10<sup>3</sup>, with an SD of

**Table 4 Post-Operative MPV at 12th week:**

Age Group	MPV (<8)	MPV (8.1-9.0)	MPV (9.1-10.0)	MPV (10.1-11.0)	MPV (11.1-12.0)	MPV (>12)
Group A	-	1	8	11	6	1
Group B	-	-	8	4	1	-
Group C	-	-	2	5	1	1
Group D	-	-	-	-	1	-
Total	0	1	18	20	9	2

**Preoperatively:** The highest MPV levels lie in Group A (7 cases) followed by Group C (4 cases) and Group B (2 cases).

The lowest MPV levels also lie in Group A (7 cases) followed by Group B (5 cases).

Maximum number of patients had MPV level between 10.1 to 11.0 fL.

**Postoperatively:** The highest MPV levels lie in Group A in all the tables at 4,8 and 12 wks.

Maximum number of patients had MPV level between 10.1fL to 11.0 fL in all the tables at 4,8 and 12 weeks.

**Table 5 Comparison of MPV, Platelet count and WBC count:**

Blood Parameter:	Preoperative Mean with SD	Postoperative Mean with SD		
		4 <sup>th</sup> week	8 <sup>th</sup> week	12 <sup>th</sup> week
MPV	11.0±1.1	10.7±1.05	10.5±1.06	10.3±0.95
Platelet count	261±49×10 <sup>3</sup>	263±55×10 <sup>3</sup>		
WBC count	7.7±1.7×10 <sup>3</sup>	7.9±1.7×10 <sup>3</sup>		

Mean of platelet count preoperatively: 261±49×10<sup>3</sup>.

Mean of platelet count postoperatively: 263±55×10<sup>3</sup>.

Mean of White Blood Cell (WBC) count preoperatively: 7.7±1.7×10<sup>3</sup>.

Mean of WBC count postoperatively: 7.9±1.7×10<sup>3</sup>.

1.7, and postoperatively at 12th week it was found to be 7.9×10<sup>3</sup>, with an SD of 1.7.

The data entries were entered into SPSS software (SPSS Inc., Chicago, Illinois, USA) and the paired *t*-test was applied.

- (1) The P value between pairs of preoperative MPV and postoperative MPV at 4, 8, and 12 weeks was found to be significant (P<0.001).
- (2) The P value for correlation of preoperative and postoperative platelet count was 0.805, which is insignificant (P>0.001).
- (3) The P value for correlation of preoperative and postoperative WBC count was 0.250, which is insignificant (P>0.001).

The above calculations suggested that there was a significant fall in MPV value after septoplasty operation. However, with same calculations in the

same cases, there was no significant change in platelet and WBC count levels after septoplasty.

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## Discussion

Nasal obstruction is a common presenting symptom in otolaryngology practice. NSD is a very common cause of recurrent and chronic nasal obstruction. The effects of chronic obstructive disorders of the upper airways, such as tonsillar and adenoid hypertrophy and extensive nasal polyposis on the cardiopulmonary system, have been studied [8]. Chronic nasal obstruction leads to increased upper respiratory tract resistance, and upper respiratory tract resistance leads to chronic hypoxia and hypercarbia because of hypoventilation.

Cardiovascular complications of NSD are due to chronic hypoxia and hypercarbia. Hypercapnia and hypoxia caused by obstructive hypoventilation results in respiratory acidosis, which in turn leads to pulmonary arterial vasoconstriction, increased right ventricular work, and cardiac hypertrophy. The cumulative effect of chronic airway obstruction, sustained pulmonary hypertension, right ventricular failure, and cor pulmonale, systemic hypertension, and increased pulmonary arterial pressure are seen in patients with UAO.

MPV is an important biological variable and larger platelets have higher thrombotic potential [9]. In comparison with smaller ones, larger platelets are denser, aggregate more rapidly with collagen, have higher thromboxane A<sub>2</sub> level, and express more glycoprotein Ib and IIb/IIIa receptors [10].

In our study, patients undergoing septoplasty were evaluated preoperatively and postoperatively for MPV, platelet count, and WBC count. The aim of the study was to assess the extent to which septum deviation influences airflow through the nasal cavity, which affects the oxygen content in blood, leading to hypercarbia, which in turn leads to increase in MPV in course of duration of time. The first study on effect of septoplasty on MPV level was by Sagit *et al.* [11], with a total of 60 cases, and their study showed elevated levels of MPV in patients with MNSD, which after septoplasty decreased significantly. They suggested that MPV, a determinant of platelet activation, is elevated in patients with MNSD. Increased platelet activation may be related to increase in cardiovascular risk in patients with MNSD. The increase in MPV levels of the cases

with MNSD could be treated with septoplasty. They also concluded that there was no significant change in values of WBC, platelet count, and platelet distribution width.

Poorey and Thakur [12], in their study in GMCH, Bhopal (2014), emphasized on the concept that MPV is increased in chronic nasal obstruction due to DNS and this increase is in accordance with the severity of DNS. This study suggested that MPV was maximum in impacted type of DNS and in decreasing order in obstructive and simple types. Among the cases as well as controls, MPV was higher in female patients.

In our study, preoperative MPV values were paired with postoperative MPV at 4, 8, and 12 weeks individually and the paired *t*-test was applied; *P* value was found to be 0.000 in all three pairs. Here, *P* value was found to be significant; this means that there is certainly a significant decrease in MPV after septoplasty. This proves our study that septoplasty played an important role in reducing the MPV value in cases with MNSD, and thus other comorbid conditions can be prevented by performing septoplasty in these patients.

This study was conducted with an aim to find the effect of septoplasty on MPV in patients with MNSD and was performed on a total of 50 cases. After recording data obtained from preoperative and postoperative blood investigation and analyzing them statistically, we proved that septoplasty reduces MPV significantly in patients who have MNSD and thus prevents these patients from other comorbid conditions related to increased MPV.

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## Conflicts of interest

There are no conflicts of interest.

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