Effect of Deviated Nasal Septum on Mean Platelet Volume: A Prospective Study

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Abstract In E.N.T clinical practice, patients with nasal obstruction due to deviated nasal septum is a common presentation. Nasal airway obstruction is a common cause of upper airway obstruction further leading to obstructive and hypoxic manifestations. Mean platelet volume (MPV) levels increase in hypoxic conditions. MPV is one of the platelet activation index which reflects the platelet production rate. Present prospective study conducted in the department of Otorhinolaryngology and Head and Neck surgery, Gandhi Medical College and Hamidia Hospital, Bhopal, on 63 patients with the clinical evidence of DNS and 63 healthy age matched subjects as control group, aimed to evaluate the relationship between MPV levels and nasal obstruction due to deviated nasal septum (DNS). The diagnosis of patients with DNS was based on anterior rhinoscopy and endoscopic nasal examination. Blood samples were collected before surgical correction. In present study, the authors found that there is preponderance of DNS in the age group of 25–45 years being the most active age group, males having the higher incidence. Majority of cases of DNS being left sided and of obstructed type. MPV were significantly higher in patients with DNS than the control group. Among the cases MPV being higher in females and in the impacted type of DNS. Present study reemphasized the concept that MPV is increased in chronic nasal obstruction due to DNS and this increase is in accordance with the severity of DNS.

Keywords Mean platelet volume (MPV) · Deviated nasal septum (DNS) · Nasal obstruction · Chronic hypoxia

Introduction

Chronic nasal obstruction owing to deviated nasal septum leads to increased upper respiratory tract resistance and this in turn leads to chronic hypoxia because of alveolar hypoventilation [24, 28]. It is well known that constant hypoxia for long time can cause changes in coagulation and in platelet number and function. Mean platelet volume (MPV) that is related to function and activation of platelets is increased and as an indicator of larger, more reactive platelets resulting from an increased platelet turnover, it may therefore represent a risk factor for overall vascular mortality, including myocardial infarction [5, 21, 30].

The exact mechanism of platelet activation in patients with alveolar hypoxia is not clear. The most probable mechanism is the augmented sympathetic activity with increased concentrations of epinephrine and norepinephrine as a result of hypoxemia. As a result, elevated circulating catecholamines may cause concentration dependent platelet activation [4, 6, 7, 24].

Another mechanism is that chronic intermittent hypoxia can cause platelet activation directly. In addition, the inflammation and endothelial dysfunction due to chronic hypoxia in DNS can cause platelet activation [7, 24, 28]. It has been shown that MPV values were elevated in inflammatory diseases [8].

MPV is a parameter used as a platelet activation marker. It is an average measure of the total number of platelets in the blood [9, 12]. MPV that is related to function and activation of platelets has been used as a marker of atherosclerosis [17]. The role of high MPV as a potential risk factor for arterial thrombosis has been a matter of intense debate [8, 19]. There are studies which found that MPV values, considered as a marker of atherosclerosis, were elevated in patients with deviated nasal septum (DNS) [24, 28].

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Whatever the cause, restoration of hypoxia can improve platelet function and cardiovascular morbidity and mortality subsequently in DNS induced hypoxia [24, 28].

The present study is a prospective study comparing the mean platelet volume in patients with DNS having chronic nasal obstruction.

Methods

The study is a prospective observation carried out on 63 patients attending the department of Otorhinolaryngology and Head and Neck surgery, Gandhi Medical College and Hamidia hospital, Bhopal (M.P.), India, from April 2013 to March 2014. All the patients with clinical evidence of nasal obstruction were evaluated with nasal endoscopy.

Inclusion criteria includes all patients presenting with complaints of nasal obstruction which on anterior rhinoscopy and nasal endoscopy were diagnosed to have deviated nasal septum. DNS was classified as Simple = S, Obstructed = O, Impacted = I. Further patients were also categorised on the basis of the type of direction of DNS, left sided = L, right sided = R, S shaped = S, C shaped = C, associated with spur = Sp.

Exclusion criteria includes those with Hypertension, CAD, cancer, infectious or autoimmune disease, diabetes mellitus, disease that potentially affected blood pressure COPD, Hypercholesterolemia, any relevant drug history including nonsteroidal anti-inflammatory drugs, corticosteroids, obesity and bleeding diathesis [24, 28].

EDTA blood samples drawn at admission of the patient were analyzed in an automated hematology analysis system. All patient's sample were processed within 2 h after venipuncture, as recommended in the literature to avoid bias due to excessive platelet swelling [3, 4, 17]. Typically, the mean platelet volume ranges between 7.2 to 11.7 fl. This is roughly equivalent to tiny spheres that range in size from 2.65 to 2.8 micrometer in diameter [12].

Results

Present study includes 63 cases, out of which, 35 cases (55.55 %) were males while 28 cases (44.45 %) were females. Male to female ratio being 1.25:1. Among 63 controls, 32 (50.79 %) were males and 31 (49.21 %) females with Male to Female ratio of 1.03:1. Among the cases, MPV was found higher in females as compared to males (9.43 ± 0.97 fl v/s 8.84 ± 0.95 fl, $p < 0.001$). Among the controls, MPV was found higher in females as compared to males (8.42 ± 0.88 fl v/s 7.63 ± 0.92 fl, $p < 0.001$) (Table 1).

In present study maximum number of cases, 28 cases (44.44 %) was reported in the age group of 26–35 years,

followed by 17 cases (26.98 %) in age group of 15–25 years, 13 cases (20.63 %) in age group of 36–45 years and five cases (07.93 %) in the age group of more than 45 years. The mean age of presentation among cases was 30.4 years. Among controls, majority i.e. 44 (69.84 %) were in the age group of 26–35 years followed by 12 (19.05 %) in the age group of 36–45 years, 5 (07.94 %) in age group of 36–45 years and 2 (3.17 %) above 45 years of age. The association between MPV & increasing age showed a decrease in the levels with increasing age (Table 2).

In this study, 32 cases (50.79 %) were of Obstructed type of DNS, 19 cases (30.15 %) of Impacted type and 12 cases (19.04 %) of Simple type. MPV was maximum in Impacted type of DNS (10.34 ± 1.07) and in decreasing order in Obstructed and Simple types (9.39 ± 0.98 , 8.24 ± 1.05 respectively) (Table 3).

In present study, 32 cases (50.79 %) were of Left sided DNS, 27 cases (42.86 %) of Right sided DNS; S shaped DNS was found in four cases (06.35 %) (Table 4).

MPV was higher in cases with DNS as compared to 63 controls (9.87 ± 0.98 fl v/s 8.24 ± 0.95 fl, $p < 0.001$) (Table 5).

The incidence of the type of DNS in different sex was also studied but the observation was statistically not significant and there was no significant association found between MPV & the direction of DNS.

Discussion

DNS is one of the commonly encountered clinical finding in patients presenting with nasal obstruction [1, 6, 10]. Chronic hypoxia as a result of nasal obstruction leads to changes in platelet function [7, 26, 30]. It has been shown that MPV is the most accurate measure of the size of platelets and thus their function [18, 19, 26].

In the literature, there are several articles regarding association of MPV to atherosclerosis and incidence of coronary artery disease [5, 17, 21, 31]. Several recent studies have pointed out the relationship between increased mean platelet volume and a variety of diseases including cardiovascular and thrombotic risk [19, 21, 31]. There are also studies correlating MPV and chronic respiratory insufficiency in cases with Obstructive Sleep Apnoea [7, 30]. MPV is an easy and quick platelet activity indicator, a reliable marker of inflammation and thrombotic risk [8, 19].

However, best to our knowledge, limited numbers of studies exist in literature suggesting a relationship between MPV and DNS [24, 28].

In present study, MPV was found increased in patients with DNS similar to studies by Sagit et al. and Ulu S et al.

Table 1 Sex distribution

Sex	No. of cases	Percentage of cases (%)	MPV in cases (fl)	No. of controls	Percentage of controls (%)	MPV in controls (fl)
Male	35	55.55	8.64 ± 0.95	32	50.79	7.8 ± 0.88
Female	28	44.45	9.43 ± 0.97	31	49.21	8.2 ± 0.91
Total	63	100		63	100	

Table 2 Age distribution

Age groups (in years)	No. of cases	Percentage (%)	MPV (fl)	No. of controls	Percentage (%)	MPV (fl)
15–25	17	26.98	8.89 ± 1.04	05	07.94	7.68 ± 0.86
26–35	28	44.44	9.07 ± 0.96	44	69.84	7.89 ± 0.92
36–45	13	20.63	9.05 ± 0.88	12	19.05	8.24 ± 0.94
>45	05	07.93	8.86 ± 0.98	02	03.17	7.63 ± 0.98
Total	63	100		63	100	

Table 3 Classification

Type of DNS	No. of cases	Percentage (%)	MPV (fl)
Simple	12	19.04	8.57 ± 1.05
Obstructed	32	50.79	9.39 ± 0.98
Impacted	19	30.15	10.34 ± 1.07
Total	63	100	

Table 4 Direction of DNS

Direction	No. of Cases	Percentage (%)
Left	32	50.79
Right	27	42.86
S shaped	04	06.35
Total	63	100

Table 5 MPV comparison in cases and control

Variable	Cases (n = 63)	Control (n = 63)
MPV (fl)	9.87 ± 0.98*	8.42 ± 0.95

* $p < 0.001$ compared to the control group

MPV Mean Platelet Volume

[24, 28] owing to chronic nasal obstruction induced hypoxia and this increase was found in relation with the severity of obstruction similar to previous study [28].

Majority of cases (50.79 %) were of moderate severity as in Obstructed type of DNS followed by severe obstruction as in Impacted type of DNS (30.15 %) and then mild i.e. simple type (19.04 %) of deviation (23 %).

Similar findings were recorded in previous study [15] wherein moderate deviation in 53 % followed by severe (25 %) and mild (22 %) were reported.

The age predilection in the present study showed that majority of patients (44.44 %) fell in the age group of 26–35 years followed by 26.98 % in the 15–25 years with the mean age of 30.4 years. In various other studies, mean age of 31.5 years [14], 33.5 years [11] has been reported. These findings by different investigators are in keeping with our findings.

In this study male to female ratio of 1.25:1 has been observed. Ratio of 1.8:1 [15] and 2.2:1 [13] have been reported in previous studies. Preponderance in males can be reasoned out by the fact that most common etiology of deviated nasal septum is nasal trauma which occur more frequently in males [1, 10, 22].

In the present study, MPV levels were found higher in females similar to study of Masanori S. et al. and Min et al. [20, 22]. The work of Kadikoylu et al. [16] also observed that MPV increases in women with iron deficiency anaemia. The reduction of body iron in menstruating women plays a role in their lower haemoglobin levels, but is probably related also to their higher platelet count in that moderate iron deficiency is known to stimulate platelets production. A hormonal hypothesis is also proposed yet to be proven in humans [20, 23, 25].

In the present study MPV was found to decrease with increasing age but after a certain age limit and to further establish this older population need to be studied. The observation about platelet count decline in older age has been already reported in other studies. Concerning the mechanisms that are responsible for the age-related changes, this decrease may reflect a reduction in hematopoietic stem cell reserve during aging or a survival advantage in subjects with lower platelet counts. However, these are

only hypotheses and further investigation is required to identify the mechanisms underlying age-related changes [29].

A higher prevalence of left sided defects was found similar to previous studies [1, 14, 15, 22, 27].

Conclusion

The present study demonstrated that patients with chronic nasal obstruction owing to DNS had increased MPV values, compared to controls. Future prospective studies with standardized measurements may clarify the physiological mechanisms which regulate MPV within the megakaryocytes and the clinical role of MPV in thromboembolic and cardiovascular complications of DNS.

Conflict of interest The authors declare that they have no conflict of interest.

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