MEDICO RESEARCH CHRONICLES
ISSN NO. 2394-3971
DOI No. 10.26838/MEDRECH.2019.6.6.536
Contents available at: www.medrech.com

MEAN PLATELET VOLUME AS A MEASURE OF ALVEOLAR HYPOVENTILATION CONSEQUENT TO CHRONIC NASAL OBSTRUCTION

Dr. Mahiben J.
Consultant ENT Surgeon, Mathilakam, Ponvila, Ayira PO, Parassala, Thiruvananthapuram

ARTICLE INFO

Article History
Received: October 2019
Accepted: November 2019
Keywords: Mean platelet volume (MPV), Deviated Nasal Septum (DNS), Nasal obstruction, Peak expiratory flow rate (PEFR), Chronic hypoxia.

Corresponding author*
Dr. Mahiben J.

ABSTRACT

ORIGINAL RESEARCH ARTICLE

Nasal obstruction is a common presenting symptom in everyday rhinological practice. The chronic nasal obstruction causes upper respiratory tract resistance further leading to chronic hypoxia because of alveolar hypoventilation[1, 2]. MPV is associated with the function and activation of platelets and used as a marker of hypoxemia[3]. This prospective study conducted in the Department of Otorhinolaryngology and Head and neck surgery Vinayaka Missions Kirupananda Variyar Medical College, Salem on 30 patients with chronic nasal obstruction with 30 healthy control group. This study is to determine whether MPV values are elevated in patients with chronic nasal obstruction compared to healthy controls. The study also compares the Peak expiratory flow rate (PEFR) of nasal airflow between cases and controls. The diagnosis was based on anterior rhinoscopy and diagnostic nasal examination. In the present study deviated nasal septum was commonest followed by nasal polyps.MPV values are increased in all age groups compared to controls. The study also shows PEFR is decreased in cases compared to controls.

INTRODUCTION

Mean platelet volume is one of the platelet activation indexes which reflects platelet production rate. It shows the average measurement of total platelet in blood[4, 5]. The role of high MPV as a potential factor for arterial thrombosis has been a matter of intense debate[6, 7]. Restoration of hypoxia can improve the platelet function and cardiovascular mobility and mortality subsequent to chronic nasal obstruction induced hypoxia, whatever the case maybe[1, 2].

One of the most common etiology of nasal obstruction is nasal septal deformity[8]. Inflammation and endothelial dysfunction as a result of chronic hypoxia in DNS can also cause platelet activation[9, 5]. A subjective feeling of obstruction to nasal airflow is a common symptom associated with septal deviation[10]. Objective methods of measuring nasal function have been developed and established[11].

Objective measurement of severity of septal deviation would help the surgeon to

select appropriate patients for surgical treatment and could also be used to assess the effectiveness of surgery[12]. Rhinomanometry and acoustic rhinometry are currently the best methods for objective assessment of nasal obstruction[13]. Many studies have investigated the usefulness of portable spirometers to assess the severity of septal deviation[10].

Recent reports have demonstrated the possibility of quantifying nasal airflow in terms of nasal partitioning ratio, determined by rhinomanometry and spirometry using a portable spirometer. Peak expiratory flow rate of nasal airflow can be done as an objective measurement of evaluation of patients' nasal breathing and acceptable correlation with the clinical findings.

The present study is a prospective study to determine whether MPV values are elevated in patients with chronic nasal obstruction compared with healthy controls. The study also compares the PEFR of the nasal airway between cases and controls

METHODS

The study is a prospective comparative study carried on 60 patients (30 cases and 30 controls in the Department of Otorhinolaryngology, Vinayaka Missions Medical College Salem, Tamilnadu from December 2014 to October 2016. Inclusive criteria were patients presenting with complaints of nasal obstruction more than 3 months according to the Nasal Obstruction Symptom Evaluation (NOSE) scale were confirmed with anterior rhinoscopy and nasal Endoscopy. All other cases of defective gas exchange such as Hypertension, CAD, cancer, infectious diseases, autoimmune diseases, Diabetes Mellitus, COPD, Hypercholestremia , any relevant drug history including NSAID's, Corticosteroids, obesity, bleeding diathesis and smoking habit were exclusion criteria.

The main aim is to see the septal deviation, nasal polyp and other benign tumors in the nasal cavity (determined endoscopically after decongestion). Deviated nasal septum was classified as Simple, Obstructed and Impacted. Further patients are also categorized on type of DNS i.e. Left-sided,Right-sided, S shaped and DNS with a spur.

MPV normal value is between 7.2-11.7fl.MPV was measured in the blood samples and collected in dipotassium EDTA tubes.MPV was analyzed within 2 hours after venepuncture to avoid bias due to excessive platelet swelling.

To confirm reduced gas exchange in chronic nasal obstruction lung function is measured with Wright's Peak flow meter. Each nasal airway is vasoconstriction with lidocaine-adrenaline 1/100000 soaked cotton. Subject is asked to inhale the vital capacity after full expiration through each nostril whilst the other nostril was occluded with surgical tape. The PEFR is calculated by the expiration of vital capacity through the Peak flow meter after inhaling their inspiratory vital capacity first through the asymptomatic and then through the symptomatic nostril. Subjects are asked to perform the procedure up to three times, and the mean of vital capacity for each side.

RESULTS:

Out of 30 cases, 14 cases (46.68%) were reported in age groups 26-30 years followed by 8 cases (26.66%) in the age group of 20-25 years, 6 cases (20%) in the age group of 31-35 years and 2 cases in the age group of 36-40 years. Among controls majority 15 (50%) were the age group of 26-30 years followed by 7(23.33%) in the age group of 20-25 years,5(16.66%) in the age group of 31-35 years and 3(10%) in the age group 36-40 years.The study shows that the majority of cases and controls are from 26-30 years and least from 36-40 years. The MPV values in cases of all age groups are increased compared to controls (Table 1). The PEFR of nasal airflow is decreased in cases when compared to controls (Table 2)

Out of 30 cases 18 cases (60%) were males and 12 cases (40%) were females. The male to female ratio is being 1.5:1. Among the controls 16(53.5%) were males and 14(46.66%) were females. Male to female ratio

being 1.14:1. Males were comparatively more than females in both cases and controls. Among the cases, MPV was found higher in females compared to males. (10.63±0.56 fl v/s 8.89±0.78fl). Among the controls, MPV were found higher in females compared to males (8.49±0.419 v/7.16±0.25).MPV values are found higher in females compared to males (Table 3). The PEFR of nasal airflow values of males is increased when compared with females i.e., in cases (391.11±46.95 v/s 262±45.9) and in controls (499.38±31.08 v/s 414±35.8). The PEFR of nasal airflow values are decreased in cases compared to controls for both males and females i.e., in males (391.11±46.95 v/s 499.38±31) and in females (262±45.9 v/s 414±35.8) (Table 4).

In the present study among 30 cases 26 cases (86.65%) were of septal deviation, 4 cases (13.33%) were of Nasal Polyposis and nil for other benign tumors. Previous studies show that nasal septal deviation is a very common cause for recurrent and chronic nasal obstruction.

In the study population, types of nasal obstruction were Obstructed type of DNS 14 cases(46.7%),Impacted type of DNS 8 cases(26.7%),Simple type of DNS 4 cases(13.3%) and Nasal Polyposis 4 cases(13.3%).The majority of the cases were Obstructed type of DNS followed by Impacted, Simple type and Nasal Polyposis. The MPV values were maximum in impacted type of DNS (10.79±0.70) and in decreasing order in Nasal Polyposis (9.40±0.77) followed by the Obstructed type of DNS (9.36±0.76) and Simple type of DNS (8.17±0.94) (Table5). It proves that MPV values are increased when the degree of obstruction is more.

In this study, PEFR of nasal airflow values was maximum in Simple type of DNS (452.5±57.37) and in decreasing order in Nasal Polyposis (382.5±9.57) followed by the Obstructed type of DNS (345.0±50.34) and impacted type of DNS (252.50±49.9). It proves that the PEFR of nasal airflow values is decreased when the degree of obstruction is more. (Table 6).In the present study the direction of nasal obstruction were 12 cases (40%) Left-sided DNS, Right-sided DNS 10 cases(33.3%),Nasal Polyposis 4 cases(13.3%),S-shaped 2 cases(6.7%) and DNS with spur 2 cases(6.7%).(Table 7)

MPV of cases (9.58±1.11) is higher compared to controls (7.78±0.75). PEFR of nasal airflow values is lower in cases (339.67±78.71) compared to controls (459.67±54.23).

Table 1. Mean Platelet Volume of Study Population according to Age

Age groups (in yrs)	No. of cases	Percentage of cases (%)	No. of controls	Percentage of controls (%)		MPV in cases(fl)		MPV in controls (fl)	
20-25 yrs	8	26.66%	7	23.33%	Fisher's exact test p value=0.942	9.33±1.33	ANOVA p value=0.088	7.32±0.55	ANOVA p value=0.058
26-30 yrs	14	46.66%	15	50%		9.99±1.00		7.88±0.59	
31-35 yrs	6	20%	5	16.66%		8.75±0.703		8.39±0.9	
36-40 yrs	2	6.66%	3	10%		10.24±0.063		7.33±1.07	

Table 2. PEFR of Nasal Airflow Value of study population according to age

Age groups (in yrs)	PEFR in cases (l/min)	ANOVAs p value=0.271	PEFR in controls (l/min)	Anova p value=0.050
20-25 yrs	321.25±86.2		470±50	
26-30 yrs	326.4±82.3		430±80	
31-35 yrs	396.6±41.79		485±45	
36-40 yrs	335±77.78		440±90	

Table 3. MPV Value of study population according to Gender Distribution

Sex	No. of cases	% of cases (%)	No. of Controls	Percentage of Controls (%)	Chi square test p value= 0.602	MPV in Cases (fl)	Independent t-test p value=0.0001*	MPV in Controls (fl)	Independent t- test p value= 0.0001 *
Male	18	60%	16	53.3%		8.89±0.787		7.16±0.25	
Female	12	40%	14	46.66%		10.63±0.56		8.49±0.419	
Total	30	100	30	100					

Table 4. PEFR of Nasal Airflow Value of study population according to Gender Distribution

Sex	PEFR in cases(l/min)	Independent t test p value=0.0001*	PEFR in controls(l/min)	Independent t test p value=0.0001*
Male	391.11±46.95		499.38±31.08	
Female	262±45.9		414±35.8	
Total				

Table 5. Types of Nasal Obstruction with MPV

Type of Nasal obstruction	No. of cases	Percentage (%)	MPV(fl)	Anova p value=0.0001*
Obstructed DNS	14	46.7	9.36±0.76	
Simple DNS	4	13.3	8.17±0.94	
Impacted DNS	8	26.7	10.79±0.70	
Nasal Polyp	4	13.3	9.40±0.77	

Table 6. Types of Nasal Obstruction with PEFR

Type of Nasal obstruction	No. of cases	Percentage (%)	PEFR (l/min)	Anova p value=0.0001*
Obstructed	14	46.7	345.0±50.34	
Simple	4	13.3	452.5±57.37	
Impacted	8	26.7	252.50±49.9	
Nasal Polyp	4	13.3	382.5±9.57	

Table 7. The direction of Nasal Obstruction in the Study population

Direction of obstruction	No. of cases	Percentage (%)
Right DNS	10	33.3
Left DNS	12	40.0
S-shaped	2	6.7
DNS with spur	2	6.7
Nasal Polyp	4	13.3

DISCUSSION:

Nasal obstruction is a common presenting symptom in otorhinolaryngology practice.DNS is one of the commonly encountered clinical findings inpatient with nasal obstruction[14] although nasal obstruction can be caused by other conditions such as nasal polyps, turbinate hypertrophy, adenoid hypertrophy, and nasal tumors. Chronic nasal obstruction leads to increased upper respiratory tract resistance and also leading to chronic hypoxia and hypercarbia because of alveolar hypoventilation[15, 16].

Chronic hypoxia as a result of nasal obstruction leads to a change in platelet function[17, 18, and 19]. It has been shown that MPV is the most accurate measure of the size of platelet and thus their function[20, 21, 22]. In the literature, there are several articles regarding the association of MPV to atherosclerosis and incidence of coronary artery disease[23, 24, 25, 26]

Many methods have been developed for measuring nasal function[8]. The present study also investigates an additional method of a quantitative assessment of chronic nasal obstruction. PEFR of nasal airflow (Rhinospirometry) is a rapid, effective, comfortable and relatively simple screening diagnostic method of measurement of airflow and evaluation of patients ability to breathe, which correlates significantly with clinical findings[27]

The age predilection in the present study showed that the majority of patients (46.66%) fill in the age group of 26-30 years followed by 26.66% in the age group of 20-25 years. In various other studies, the mean age of 31.5 years[28], 33.5 years[29] has been reported. The MPV values were higher in all age groups compared to controls. It proves that alveolar hypoventilation was found to be increased in patients with chronic nasal obstruction in all age groups compared to controls. The PEFR of nasal airflow was found to be decreased in cases of all age groups compared to controls. It proves that reduced gas exchange is higher in patients with chronic nasal obstruction in all age groups compared to controls.

In this study Male to Female ratio of 1.5:1 has been observed. Ratio of 1.8:1[30] and 2.2:1[31] has been reported in previous studies. Inthis study PEFR of nasal airflow values were lower in females compared to males. The chest movements of females are physiologically weaker than that of males which result in lower PEFR among females[32]

In the present study majority of cases (86.65%) were of septal deviation, 13.33% were of nasal polyposis and nil for other benign tumors. Previous studies show that Nasal septal deformity is one of the most common disorders causing subjective nasal obstruction[33]. Majority of the cases(46.7%)were of moderate severity as in the obstructed type of DNS followed by severe obstruction as in the Impacted type of DNS(26.7%), Mild i.e., Simple type(13.3%) and Nasal polypi(13.3%).MPV was higher in Impacted type of DNS(10.79±0.70) and in decreasing order in Nasal Polyposis(9.40±0.77) followed by the Obstructed type of DNS(9.46±0.76) and Simple type of DNS(8.17±0.94). It proves that alveolar hypoventilation is decreased according to the severity of nasal obstruction.

PEFR of nasal airflow was maximum in Simple type of DNS (452.5±57.37) and in

decreasing order in NasalPoyposis (382.5±9.57) followed by the obstructed type of DNS (345.0±50.34) and impacted type of DNS (252.50±49.9). It confirms reduced gas exchange and depends on the severity of nasal obstruction. The study shows a high presentation of left side DNS. Previous studies also showed the same results.

The study shows MPV values are higher in cases compared to controls. Fidan et al[34] specified that septoplasty at proper time might prevent cardiopulmonary disorder in patients with marked nasal septal deviation. This study also shows PEFR of nasal airflow values is lower in cases compared to controls. Rhinospirometry may have diagnostic value in evaluating nasal obstruction[35].

CONCLUSION:

The present study demonstrates that patients with chronic nasal obstruction have increased MPV values and decreased PEFR of nasal airflow values compared to to controls.MPV is a parameter that should be a part of routine blood test and rhinospirometry constitutes an objective, simple and practical method to assess the amount of asymmetry of nasal airflow, which can serve as an indicator facilitating patient selection, evaluation, and prognosis, regarding nasal septal deviation surgery.

CONFLICT OF INTEREST:

The author declares that there is no conflict of interest.

REFERENCES:

1. Nagata Y et al (2003) Proplatelet formation of megakaryocytes is triggered by autocrine estradiol. Genes Dev 17:2864–2869
2 Toryila J.E. et al Study of nasal septal deviation in Curitiba, Science World Journal Vol 4 (No 1) 2009
3. Kamath P et al (2001) Platelet activation: assessment and quantification
4. Giles C (2008) Platelet count and mean platelet volume. Br J Haematol 48(1):31–37
5. Health research and foundation.org-MPV Blood Test Results Explained, Dec 20, 20135791
6. Gasparyan AY et al (2011) Mean platelet volume: a link between thrombosis and inflammation. Curr Pharm Des 17:47–58
7. Leader A et al (2012) Are platelet volume indices of clinical use? A multidisciplinary review. Ann Med. 44(8):805–816
8. Bath PM et al (1993) The routine measurement of platelet size using sodium citrate alone as the anticoagulant. Thromb Haemost 70:687–690
9. Francoise L et al (2012) Leukotriene B4 activation and atherosclerosis in obstructive sleep apnoea. J Lipid Res 53(9): 1944–1951
10. Bain BJ (1985) Platelet Count and Platelet Size in Males and Females. Scand J Haematol 35(1):77–79
11. Belic´ B, Andric´ V. Importance of active anterior rhinomanometry. Srp Arh Celok Lek 2002; 130 (suppl 1):33–6
12. Hanif J, Jawad SS, Eccles R. A study to assess the usefulness of a portable spirometer to quantify the severity of nasal septal deviation. Rhinology 2003;41:11–15
13. Schumacher MJ. Nasal congestion and airway obstruction: the validity of available objective and subjective measures. Curr Allergy Asthma Rep 2002;2:245–51
14. Adriana et al (2005) Prevalence of nasal septal deviation in Curitiba, Brazil, Intnatl Arch Otolaryngol Vol.9, Num. 4–Oct/Dec
15. Rappai M, Collop N, Kemp S, et al. The nose and sleep-disordered breathing: what we know and what we do not know. Chest 2003; 124:2309 Y2323
16. Olson EJ, Park JG, Morgenthaler TI. Obstructive sleep apnea-hypopnea syndrome. Prim Care 2005; 32:329Y359
17. Francoise L et al (2012) Leukotriene B4 activation and atherosclerosis in obstructive sleep apnoea. J Lipid Res 53(9): 1944–1951

18. Stevens RF, Alexander MK (1977) A sex difference in the platelet count. Br J Haematol 37:295–300
19. Ulivi et al Age- And sex-related variations in platelet count in Italy: a proposal of reference ranges based on 40987 subjects' data. PLoS ONE
20. Lance MD et al (2012) Mean platelet volume as a diagnostic marker for cardiovascular disease: Drawbacks of preanalytical conditions and measuring techniques. Clin and Appl Thromb Hemost 18(6):561–568
21. Leader A et al (2012) Are platelet volume indices of clinical use? A multidisciplinary review. Ann Med. 44(8):805–816
22. Boos CJ et al (2008) The effects of coronary artery disease severity on time-dependent changes in platelet activation indices in stored whole blood. J Thromb Thrombolysis. 25: 135–140
23. Kamath P et al (2001) Platelet activation: assessment and quantification. Eur Heart J 22:1561–71
24. Masanori S et al (2014) Gender differences in the relationship between serum uric acid and mean platelet volume in a Japanese general population 25(3):202–206.
25. Varol E et al (2010) Mean platelet volume is increased in patients with severe obstructive sleep apnea. Scand J Clin Lab Invest. 70(7):497–502
26. Francoise L et al (2012) Leukotriene B4 activation and atherosclerosis in obstructive sleep apnoea. J Lipid Res 53(9): 1944–1951
27. Belic´ B, Andric´ V. Importance of active anterior rhinomanometry. Srp Arh Celok Lek 2002;130(suppl 1):33–6
28. Jang JY et al (2008) Classification of the deviated nose and its treatment. Arch Otolaryngol Head Neck Surg 134(3):311–315.
29. Guyuron B, Uzzo C, Scull H (1999) A practical classification of septonasal deviation and an effective guide to septal surgery. Plast Roconstr Surg 104:2202–2209
30. Jin HR, Lee JY, Jung WJ. (2007) New description method and classification system for septal deviation. J Rhinol 14(1):27–31
31. Janardhan Rao J, Vinaykumar EC, Ram Babu K, et al. (2005) Classification of nasal septal deviation—relation to sinonasal pathologies. Indian J Otolaryngol Head Neck surgery 57(3): 199–201
32. Sikandar Hussain, "PEFR in cement pipe factory workers in relation to smoking".Indian J Physiol Pharmacol 2000; 44(3):371-372
33. Min YG, Jung HW, Kim CS. Prevalence study of nasal septal deformities in Korea: results of a nation-wide survey. Rhinology 1995; 33:61–5
34. Fidan V, Aksakal E (2011) Impact of septoplasty on pulmonary artery pressure in patients with a markedly deviated septum. J Craniofac Surg 22:1591–1593.
35. Suzina AH, Hamzah M, Samsudin AR. Objective assessment of nasal resistance in patients with the nasal disease. J Laryngol Otol 2003; 117:609–13.