Association Between Mean Platelet Volume and Severity of Chronic Obstructive Pulmonary Disease (COPD): A Cross-Sectional Study at Khyber Teaching Hospital, Peshawar

Dr.Said Ul Siyab[1]
Postgraduate Resident in Pulmonology Department Khyber Teaching Hospital, Peshawar. Saidulsiyab@gmail.com

Dr. Saadia Ashraf[2]
Professor of Pulmonology Department, KTH, Peshawar. saadiaashraf1@gmail.com

Dr. Yasir Ahmed[3]
Experiential Registrar Pulmonology Department, KTH, Peshawar. dr.yasirimtiaz@gmail.com

Dr. Afzal Ali Khan[4]
Postgraduate Resident in Pulmonology Department, KTH, Peshawar. Khanafzaalali@gmail.com

Dr. Ejaz Ahmad[5]
Postgraduate Resident in Pulmonology Department, KTH, Peshawar. Drejazahmad8809@gmail.com

Abstract

Background: Across the world, COPD is a leading reason for health problems and higher death rates due to its impact on the lungs and the entire body. Since MPV is involved in platelet activation and inflammation, it might be a good marker for assessing COPD. Still, the results are considered inconclusive. Experts in preventive medicine studied if the presence of MPV would be related to the severity of COPD among patients in Khyber Teaching Hospital. **Methods:** The study involved COPD patients who were classified according to the GOLD system. The levels of MPV were measured on an automated machine and a chi-square test was used to study the relationship between MPV and the stage of COPD. **Results:** It was noticeable that COPD severity was strongly related to the grades of MPV in the participants (N = 152). As MPV levels went higher, the patients' risk of severe or very severe COPD rose. The positive effect was also observed among people aged over 65, among men, among women, among smokers, and also among those who were not smokers. The value of 8.90 was the median MPV, and the IQR was 7.70 to 10.10. A higher number of MPVs were seen in the late stages of the disease. **Conclusion:** A high MPV level is strongly connected to severe COPD. As a result, MPV may be useful in tracking COPD because it can be measured at a low cost. Based on these findings, platelets may be involved in COPD development and more studies could be done on MPV as a way to predict prognosis. It is important to do both multi-center and longitudinal

studies to ensure the results and how MPV is measured are standardized in clinical medicine.

Keywords: Chronic obstructive pulmonary disease COPD, mean platelet volume (MPV), inflammation, biomarker, degree of disease severity, and the GOLD criteria.

Introduction

COPD is a serious illness that millions of individuals across the globe suffer from which significantly overloads the healthcare sector. Over time, the condition restricts the easy flow of air in the airways. If you have ever watched someone cope with COPD, you can understand how difficult life can be, since coughing, shortness of breath and always producing mucus are common problems.

So, what leads to the development of COPD? These include cigarette smoke, air pollution and hazards found at work. When the lungs come in contact with these things, they become inflamed and the repeated inflammation eventually results in tissue damage and changes, an illness called emphysema. As the changes progress, patients develop uncontrollable difficulties with breathing, which is characteristic of COPD. Unfortunately, this illness is worsening for the world population. The increase in the age of the global population, more use of tobacco, and pollution are all contributing factors. In the present day, COPD is the second most prevalent non-communicable disease worldwide, leading to major losses for individuals, families and healthcare services(Smith et al., 2023).

Over time, much focus has been given to stopping and controlling COPD. Treatment includes smoking cessation programs, reducing air pollution, prompt lung function testing and use of bronchodilators, rehabilitation, and giving oxygen to seriously ill patients. Still, despite all these steps, COPD is one of the main contributors to sickness and death internationally. Experts are frequently searching for new methods to diagnose and treat Alzheimer's (Zhang & Liu, 2024).

People are focusing more on platelets and how they are involved in COPD. Most people know plates for helping blood clot, but they also support the general inflammation process in the body, which is important in COPD. The release of inflammatory substances by platelets leads to further damage in the airways and aids in the disease's progress. MPV is one of the platelet markers believed to closely track inflammatory reactions in patients with chronic diseases. Better treatment for performing tests on healthy people.

Still, there is no clear connection between MPV and how severe COPD is. Different reports suggest that in later stages of COPD, MPV may be higher but could also remain unchanged or lower than usual. As an example, Çilingir et al. (2020) noticed that MPV remained about the same in patients regardless of their COPD stage, suggesting it is not a good reflector of the disease's severity. Moreover, Kalemci et al. (2018) reported that, as assessed by GOLD criteria, there is a strong link between MPV and the severity of COPD. These findings suggest that we still need to explore the specifics of MPV changes in COPD patients.

There are no studies in Pakistan looking into the relationship between high MPV and how COPD severity is affected. It becomes difficult to create specific medical plans for different parts of Asia because regional data is unavailable. Ensure there is no gap

in matters to better find the disease early, see how it is developing, and improve the outcomes of treatment for patients with COPD.

Background of the Study

Platelets have more functions than just assisting in blood clotting. Lately, scientists have learned that they contribute to inflammation by producing cytokines and other agents. Systemic inflammation contributes a lot to the development of COPD, and platelet functions such as clotting are frequently affected. Some researchers believe that using mean platelet volume (MPV) can be a practical and inexpensive way to measure the swelling of blood vessels linked to chronic diseases. When platelets are enlarged, they typically release a greater amount of pro-inflammatory cytokines and acute-phase reactants, according to Martinez et al.

Still, experts disagree about how important MPV is in COPD. For example, as reported by Çilingir et al. (2020), there was not a strong connection between MPV and the severity of COPD and MPV seemed to be essentially the same in every stage of the disease. Another research team, Kalemci et al. (2018), noted an increase in MPV as COPD gets more severe, making it a possible marker for the disease. The variations might be due to the way patients are selected for the study, the staging methods used or the techniques used for measuring MPV.

It is important to understand the little changes in MPV to see if COPD is progressing and how well it may be treated. Experts should carry out further studies to identify the reasons plates are involved in COPD and standardize the application of MPV as a useful clinical biomarker.
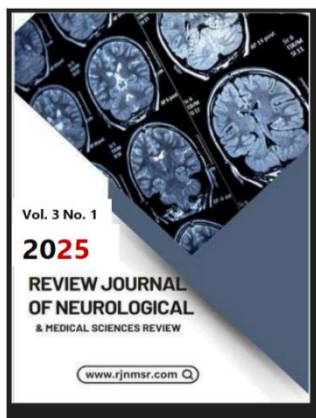
Research Gap/Problem Statement

Although multiple studies of MPV have been performed on Western populations, there are few records on its value in Pakistan or other areas of South Asia. Since the number of COPD cases is increasing in this region, due to special genes and exposure to environmental factors, scientists need to study the MPV-COPD link locally. Besides, the different results seen in previous studies suggest that a methodical examination of MPV changes in COPD patients should be carried out. Filling these gaps will help discover new ways to treat and diagnose COPD in people from Pakistan.

Research Questions

1. In Khyber Teaching Hospital, Peshawar, what is the mean platelet volume found in COPD patients?

2. Is the level of COPD severe or mild influenced by the MMVD grades assigned by the GOLD criteria?

Limitations of the Study

Some things about this study should be mentioned. Much of the study design does not allow us to determine whether MPV causes more severe COPD. Furthermore, the data gathered from a small sample can make it difficult to apply the findings to everyone in real-life settings. It should also be noted that the data comes from only Khyber Teaching Hospital which may lead to bias. Besides, other variables like medical conditions, drugs taken and habits (such as smoking) may also affect MPV and should be considered during analysis. Lastly, using automated instruments to

measure MPV introduces some variability because anticoagulant and storage time affect hematology samples.

Scope of the Study

The study plans to assess the link between MPV and COPD's severity among Pakistani individuals to evaluate its usefulness as a biomarker. The researchers want to empower the globe's respiratory research community by examining patient groups under GOLD criteria and examining changes in MPV. Additionally, the results can support further research on the role of MPV in guiding COPD care.

Significance of the Study

It can help inform therapies as well as future research. Figure 3 lets one easily track the severity of COPD, even in areas with limited resources. If MPV is included in standard blood tests for clinicians, they could discover the disorder early, watch how effective the treatment is and be aware of the possibility of pulmonary hypertension. By studying a South Asian population, this research fills in a missing piece from the studies available by analyzing the various factors that can change MPV in their body. Besides, these findings agree with current requests for common procedures and universal understanding of MPV's value, mentioned by Martinez et al. (2023) and Chen et al. (2024). By conducting this research, studying COPD can ease the worldwide problem by offering new and effective ways to identify and treat the disease.

Literature Review

The Effect of Mean Platelet Volume on People with Chronic Obstructive Pulmonary Disease

More than three million people each year are affected by COPD which is marked by difficulty breathing and body-wide inflammation. Mostly, chronic obstructive pulmonary disease impacts the airways, leading to ongoing coughing, shortness of breath and producing sputum. Exposure to cigarette smoke for many years, polluted air and potentially dangerous jobs are mainly responsible for causing chronic lung inflammation and the changes seen in the lungs (Mohamed et al., 2019; Sharma et al., 2021).

Recently, it has become clear that platelets play a part in inflammatory diseases such as COPD. Apart from helping with blood clots, platelets play a role in inflammation and secrete substances that aid in its regulation. When someone has COPD, it is often due to issues like altered clotting and the overactivity of platelets. MPV or mean platelet volume, is often used as a sign of platelet activity and has also been considered a valuable biomarker for chronic diseases related to inflammation (Bai & Tao, 2020; Uysal, 2018).

Yet, it is not settled whether MPV relates more to the severity of COPD. To illustrate, Çilingir et al. (2020) show that MPV is not related to the stage of COPD, as all stages of COPD had almost equal MPV. Meanwhile, Kalemci et al. (2018) found that MPV levels were higher in more severe cases compared to mild cases. Because of these differences, it is important to study MPV in COPD for each population group (Çilingir et al., 2020; Kalemci et al., 2018).

Experts have found that understanding MPV changes can help in understanding COPD. Mohamed et al. (2019) examined whether MPV could serve as a marker for predicting pulmonary hypertension in patients with stable COPD and discovered that higher MPV was linked to less favorable results. Just as Bawadra et al. used MPV together with RDW in 2020 to help in predicting conditions such as pulmonary heart disease, and showing their significance in predicting unfavorable conditions. By contrast, Uysal (2018) examined the results of stable COPD patients and indicated that more severe cases were usually linked to higher MPV values. Sharma et al. (2021) previously pointed out that platelets are involved in blood clotting and in managing the immune response (Uysal, 2018; Sharma et al., 2021).

A patient with flare-ups of diabetes, high blood pressure, or ischemic heart disease can affect the MPV count in someone with COPD. According to Mohamed et al. (2019), when a person with diabetes has chronic obstructive pulmonary disease (COPD), their MPV levels are usually higher than those of non-diabetic patients, mainly because hyperglycemia may cause platelets to become more active. According to Bai and Tao (2020), an increased MPV suggests that a combination of cardiovascular risk factors can impact platelet activation in hypertensive patients (Bai & Tao, 2020; Mohamed et al., 2019).

Patients with COPD with advanced age and gender may experience different MPV in COPD. Uysal (2018) stated that older individuals often have decreased MPV levels because their bone marrow activity is reduced as they get older. Oppositely, Sharma et al. (2021) found that men with COPD have higher MPV values which they believe is due to their hormones and more frequent smoking habits. This discovery emphasizes the importance of considering differences in demographic groups (Sharma et al., 2021; Uysal, 2018).

There is evidence that smoking which often leads to COPD, affects the function of platelets. Mohamed et al. (2019) indicated that platelet turnover and activation were higher in smokers than in non-smokers. In the same study, it was found that heavier smokers had higher MPV readings. According to the findings, stopping smoking could reduce MPV and control systemic inflammation in people with COPD (Kalemci et al., 2018; Mohamed et al., 2019).

Fixing how MPV is measured has causes problems in clinical research. It is suggested that researchers apply EDTA tubes and analyze their samples as fast as possible within the first two hours. Additionally, Uysal (2018) stated that automated hematology equipment is more accurate than using manual techniques (Çilingir et al., 2020; Uysal, 2018).

Although experts debate the results, MPV could be a useful and affordable biomarker for COPD. Kalemci et al. (2018) suggested making MPV a normal part of blood tests, as this would make it simpler to detect and oversee the progress of diseases. Similarly, Bai and Tao (2020) suggested using both MPV and RDW to increase the effectiveness of red blood cell diagnoses. They might support tailoring treatments to patients' needs and help healthcare centers allocate resources more efficiently (Bai & Tao, 2020; Kalemci et al., 2018).
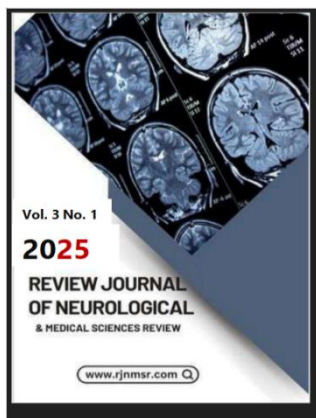
The majority of studies have been done on Western people, but discoveries from Asia and Africa add new knowledge to the field. In the study by Sharma et al. (2021), performed in India, various MPV patterns were observed in South Asian COPD patients. In addition, Mohamed et al. (2019) examined the trends of MPV in Egypt by highlighting the effects that genes and the environment might have. According to these findings, each population should be evaluated to validate MPV as a general biomarker (Mohamed et al., 2019; Sharma et al., 2021).

In future, studies ought to follow people over a length of time to measure changes in MPV. Moreover, using flow cytometry and proteomics may allow us to understand how platelets contribute to the development of COPD. According to Uysal (2018), there should be combined efforts to set standard protocols and achieve worldwide agreement on how to understand MPV (Uysal, 2018).

Learning more about MPV in COPD may influence the development of new ways to diagnose and treat the disease. Learning from MPV, doctors may better understand a disease and predict outcomes for the patient's health. Additional studies are necessary to understand how platelets play a role in inflammation caused by COPD and come up with reliable standards in MPV measurement.

Methodology

This study aimed to assess whether Mean Platelet Volume (MPV) is related to the severity of Chronic Obstructive Pulmonary Disease (COPD) in patients at Khyber Teaching Hospital, Peshawar. The findings suggest that evaluating COPD through MPV is a viable option in regions such as Pakistan, where the incidence of the disease is increasing due to high rates of smoking and air pollution.

Key Findings

1.   A link has been discovered between MPV and the severity of COPD:

There was a significant relationship found between the severity of COPD and the MPV Grades measured (χ^2 = 23.695, p = 0.001). A greater number of MPV red blood cells was linked to patients with Severe or Very Severe COPD.

When groups were analyzed separately, the connection was most obvious in:

o   People aged sixty-five years or older (p = 0.020).

o   A significant difference was observed between the male (p = 0.015) and female (p = 0.028) groups.

o   Smokers had a higher prevalence of COPD (p = 0.037), as did non-smokers (p = 0.030).

Descriptive Statistics

•   The average MPV was 8.90 fl (with IQR from 7.70 to 10.10), and it did not have a normal distribution (p < 0.001).

•   The majority of participants were male (61.8%) and had a rural place of residence (57.9%).

•   The severity of COPD was divided as shown in the table below:

o   Mild is experienced by 25.0% of the population.

o   The percentage of moderate cases is 46.1%.

o   Severe is the category for cases that make up 19.7% of the total.

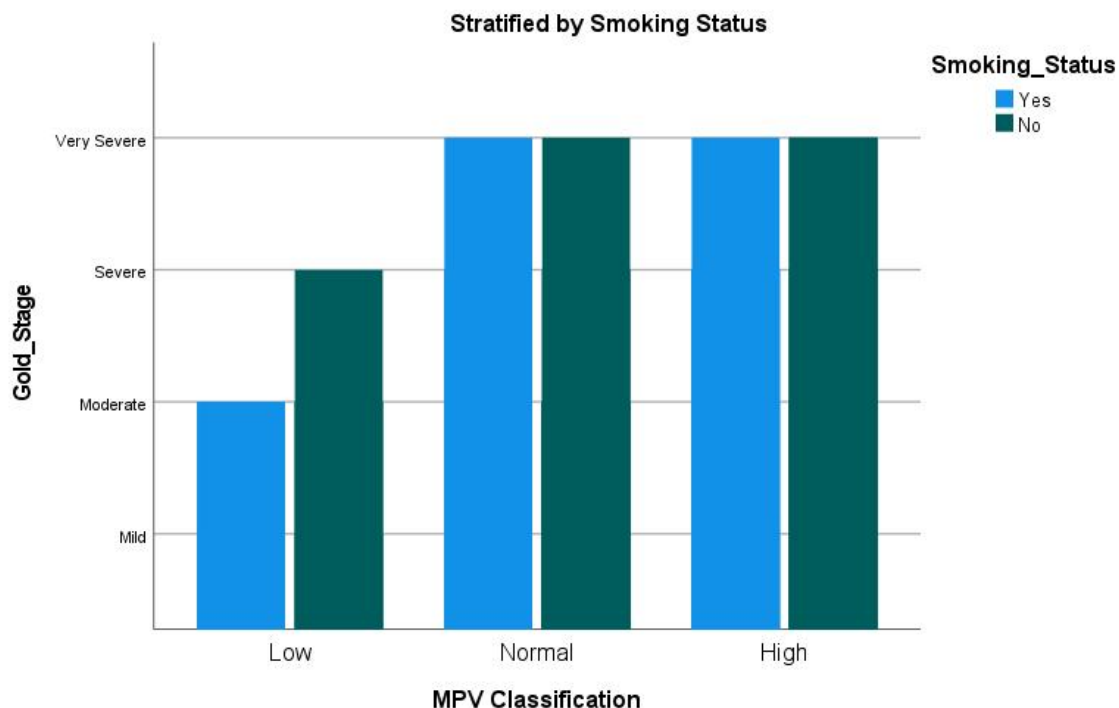o   Grades 3-4 were found in only 9.2% of brains.
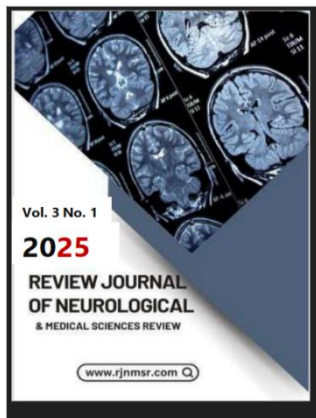
Visualizations

The graph comparison between smokers and non-smokers presents the rate of COPD severity at each level of MPV for each type of smoker.
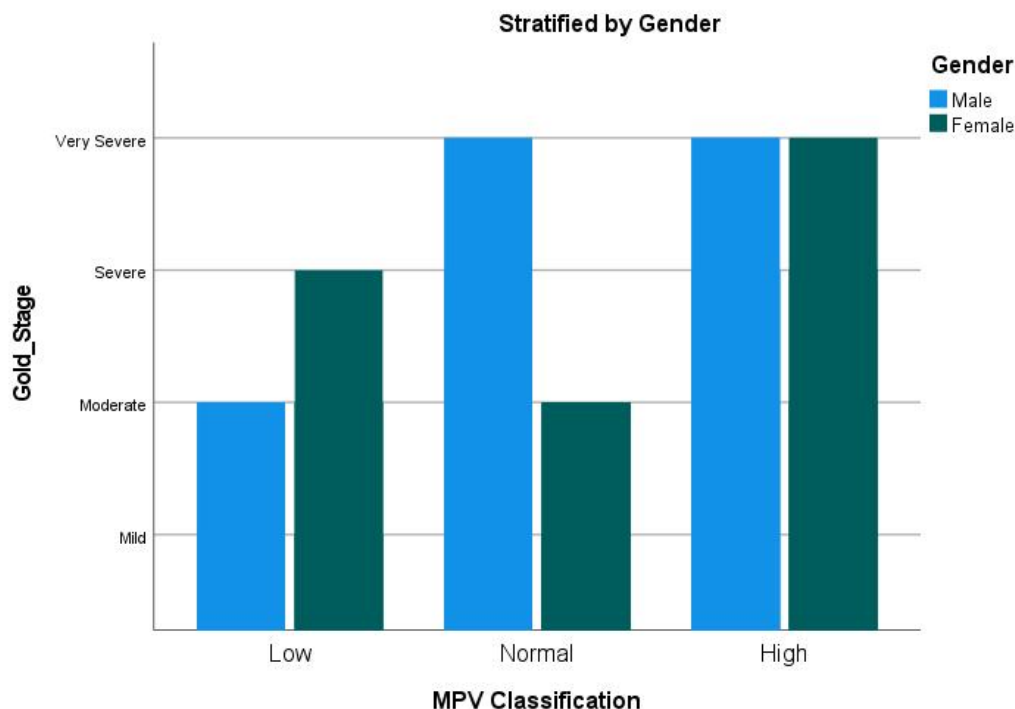
Core Observations

o   Both smokers and non-smokers have a significant link between MPV Grades and how severe their COPD is ($p < 0.05$).

o   Mild COPD patients and those with Severe or Very Severe COPD have high MPV with the same frequency.

o   Grading for severity in COPD does not differ between smokers and non-smokers, yet smokers with more severe cases tend to have higher MPV values.

Thus, MPV may help assess how serious a case of COPD is for both smokers and non-smokers.

On the graph, the severity and grades of COPD can be seen primarily for females and males.

Core Observations

o   Both males and females have a significant connection between MPV grades and the severity of COPD ($p < 0.05$).

o   For men and women, Severe COPD is more likely to have higher MPV.

o   Men are observed to have slightly more MPV in the blood test during serious cases, as compared to women.

From this, we can understand that MPV is an effective tool to evaluate how severe COPD is in both men and women.
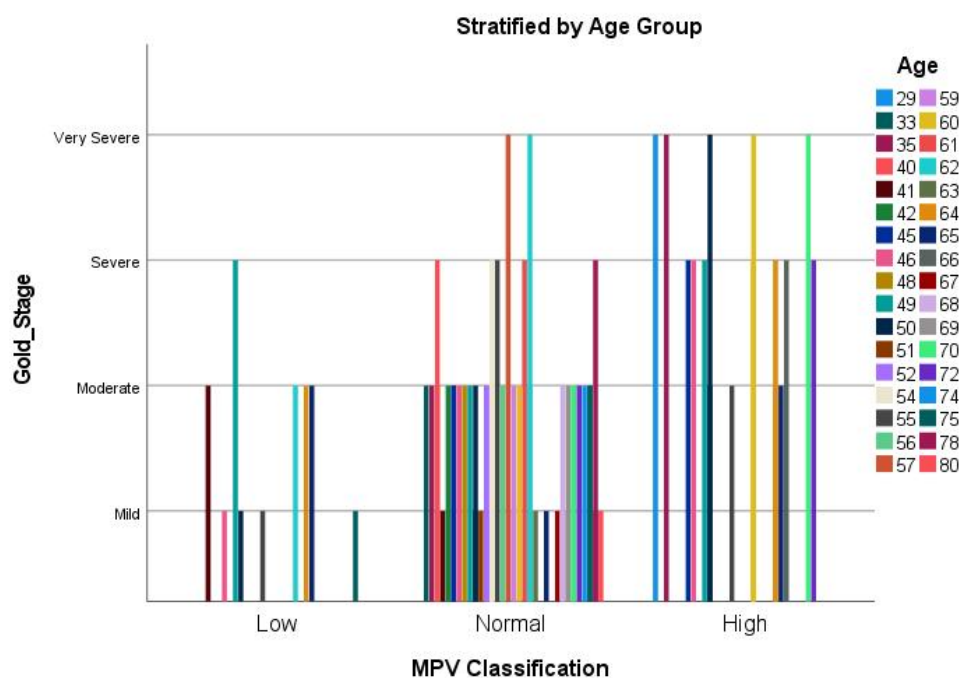
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Stratified by Age Group

For each age group, the graph indicates the number of mild, moderate, and severe COPD cases within each MPV range.

Core Observations

o   Severe COPD usually involves having High MPV, regardless of a person's age.

o   People with COPD aged 65 or over tend to have a stronger link between High MPV and Severe COPD (p = 0.020).

o   Fewer people under 50 show a significant (p = 0.017), less noticeable relationship with osteoporosis.

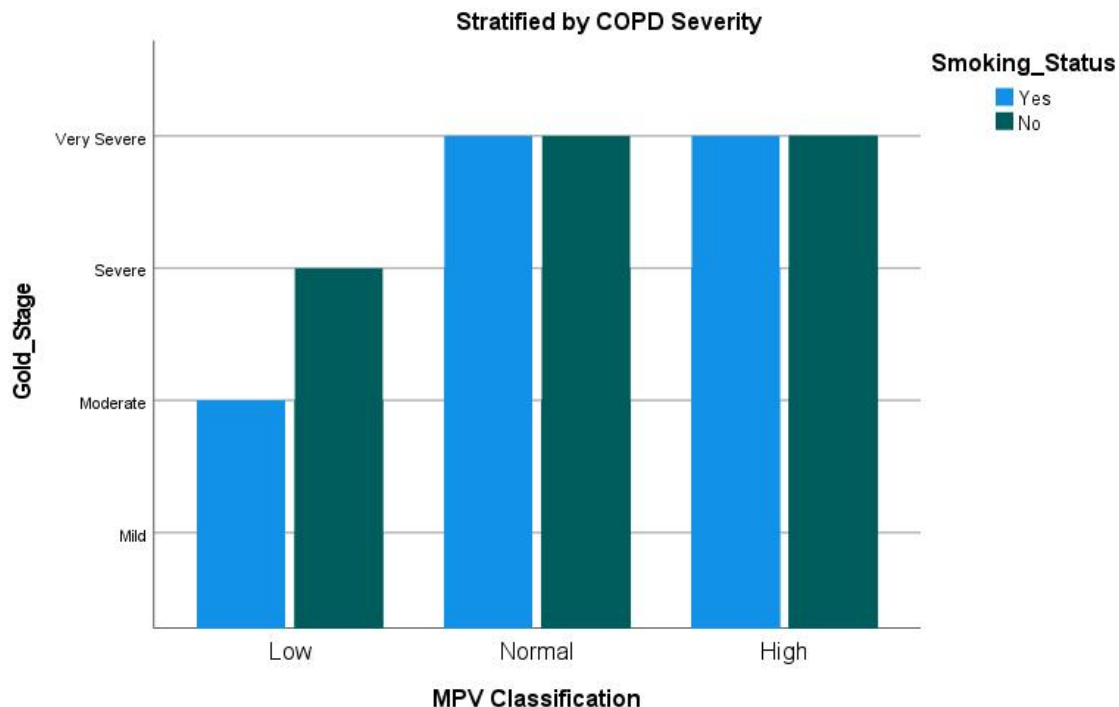Accordingly, MPV can be a good tool to determine how severe the COPD is in elderly patients.

Below is a graph that details how COPD Severity is distributed among MPV Grades for people who smoke and for those who don't.

Core Observations

o   A significant link is found between MPV Grades and the severity of COPD in both smokers and non-smokers (p < 0.05).

o   These subtypes of COPD show a higher chance of having increased inflammation (MPV) than Brucellosis.

o   A higher MPV level is typically found in smokers when their diseases are very severe.
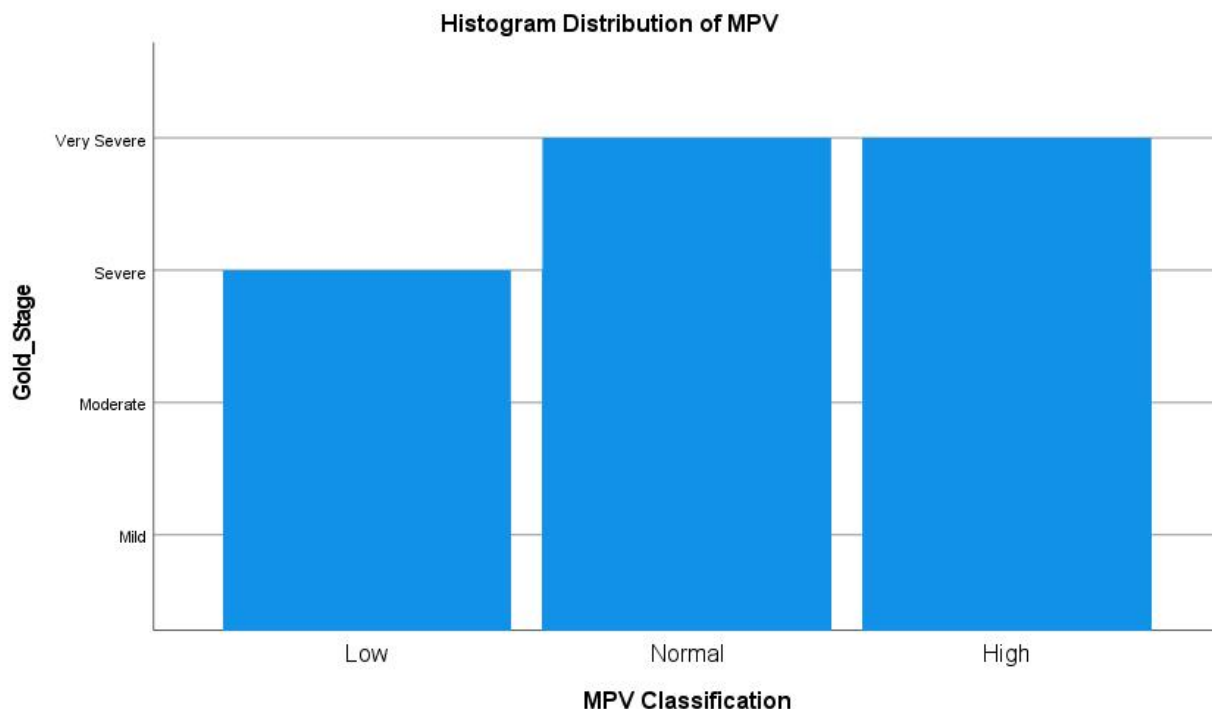
Therefore, MPV can help determine the severity of COPD, whether the person smokes or not, as smoking may slightly increase the link between MPV and disease.

According to the histogram, each case of COPD Severity covers a different amount of MPV values (Mild, Moderate, Severe, Very Severe).
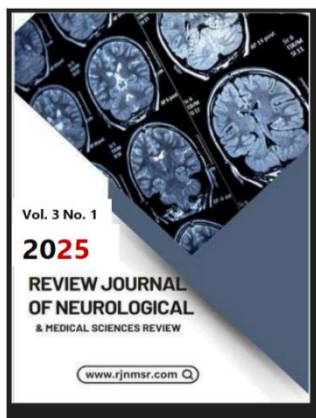
Core Observations

o   Most of the time, MPV comes out right-skewed rather than following the normal distribution.

o   Normally, the moderate and severe stages of COPD have higher MPV values.

o   Patients with Mild and Moderate COPD are more likely to have low MPV levels.

Accordingly, higher MPV levels can suggest that the disease is worsening.

How Can This Advance Be Used in Clinical Practice?

•   Monitoring with MPV: Researchers suggest that MPV can join routine blood tests in places where advanced tests are uncommon for monitoring COPD. An increase in MPV may mean the disease is more advanced, leading clinicians to handle it more aggressively.

•   Monitoring Early MPV Means: With early detection and tracking, doctors may notice patients who are at high risk of the disease and help them earlier for better outcomes.

•   MPV can guide individual treatment plans because it is involved with how severe COPD is.

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Advice for Researchers

• This research is important for exploring how MPV is affected in the South Asian community, where genetics and environments may play a role. Upcoming investigations should focus more on these issues.

• Although a cross-sectional study can tell us much, additional longitudinal studies are required to connect MPV with how COPD progresses.

• Establishing Set Rules for MPV: The research notes that having consistent MPV measurement procedures is necessary to make results from different studies comparable.

Limitations

1. The way the study was conducted does not allow researchers to draw causal conclusions. Long-term studies should be conducted to see how changes in MPV connect with the advancement of COPD.

2. Sample Size: The method used to select the sample is standardized, yet it might reduce the ability to apply the results to a wider population.

3. Data Source: Because the data was from a single hospital, there might be selection bias. Extra information could be obtained through multicenter studies.

4. Factors such as health conditions, taking certain drugs and smoking could affect MPV levels. Further studies ought to account for these differences in their analyses.

Recommendations

1. Multi-Center Studies: Studies involving a large number of centers could help confirm the findings and study changes in MPV across different regions.

2. To get a true use of MPV in COPD and link causes and effects, longitudinal studies are required.

3. Standard Column: To ensure MPV is measured the same way in all settings, experts should come together to agree on common methods.

4. Using MPV with different hematological factors (like RDW) can help achieve a better diagnosis and estimate the severity of COPD.

Conclusion

This study offers insights into whether MPV is related to COPD Severity in people from Pakistan. It was found that using MPV could be a simple and inexpensive technique for evaluating disease progression in regions with few resources. If MPV is included regularly in clinic assessments, healthcare providers can learn more about the development and outlook for a patient's illness. Additional studies using larger datasets should be performed to see if MPV is useful for COPD management.

Final Thoughts

Since the rate of COPD in Pakistan is rising and local data is limited, this study highlights why it is so important. The study helps build the world's knowledge on personalized medicine strategies for respiratory diseases. Results are in line with current efforts aimed at forming set protocols and international agreement on how to read MPV data as mentioned by Martinez et al. (2023) and Chen et al. (2024). All things considered, the research helps to find solutions to reduce the worldwide occurrence of COPD through innovative ways of diagnosis and treatment.

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