

# ASSOCIATION OF CARBON MONOXIDE RATIO WITH NEUTROPHIL-LYMPHOCYTE RATIOS AND CARDIAC INDICATORS IN CARBON MONOXIDE INTOXICATION; A PILOT STUDY

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## ABSTRACT

**INTRODUCTION:** Carbon monoxide is still a public health problem in developing countries. Brain and heart tissues are mostly affected by intoxications. Carbon monoxide poisoning causes the development of cardiac ischemia and cardiac conduction disorders. Our aim is to study the associations of NRL with cardiac indicators in patients with acute carbon monoxide poisoning.

**MATERIAL AND METHODS:** Patients who admitted to the E.R. between the dates 01.10.2015–01.06.2017 were examined retrospectively. Of 54 patients diagnosed with carbon monoxide intoxication, 41 patients with complete parameters and follow-ups were included in the study. Their demographic information, complete blood count, troponin and CK-MB values and carbon monoxide levels were recorded.

**RESULTS:** Of the patients who included in the study, 18 (43.9%) were female and 23 (43.9%) were male. Their age average was  $43.7 \pm 18.9$ . Troponin, CK-MB, neutrophil-lymphocyte ratio levels of the patients were not correlated with carbon monoxide levels (respectively  $p = 0.238, 0.707, 0.364$ ). Troponin levels of the patients had a positive correlation with neutrophil-lymphocyte ratio ( $r: 0,309, p = 0.049$ ).

**CONCLUSIONS:** Neutrophil-lymphocyte ratio can be used to identify an early diagnosis of cardiac impacts in carbon monoxide poisonings. However, more studies on the subject are needed.

**KEY WORDS:** carbon monoxide, neutrophil lymphocyte ratio, cardiac biomarkers

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## INTRODUCTION

Carbon monoxide poisoning is still a public health problem in developing countries [1]. Carbon monoxide, a colorless and odorless gas produced by incomplete burning of hydrocarbon gasolines, is not irritant [2]. Carbon monoxide has 210 times greater affinity for hemoglobin than oxygen. When carbon monoxide is bound to the hemoglobin, the oxygen disassociation curve shifts to the left. Intoxication

reveals itself as tissue hypoxia and direct damage at the cellular level [1]. As carboxyhemoglobin value increases, symptoms of the intoxication show a large range from non-specific symptoms such as dizziness and nausea to coma and death [3–5].

Intoxication has the most sensitive and most frequent impact on brain and heart tissues [6, 7]. In order to identify the effects of carbon monoxide poisoning in heart, electrocardiogram and cardiac bio

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indicators have been used [6, 8]. Carbon monoxide poisoning may develop both cardiac ischemia and cardiac conduction disorders. The literature has many studies describing those cases [9, 10]. Myocardium damage in carbon monoxide poisoning has been described as the cause of mortality for a long time [11].

Neutrophil-lymphocyte ratio is an easy, quick and accessible non-invasive bio indicator which shows the inflammatory state [12, 13]. This ratio has recently been studied on especially cardiovascular and inflammatory diseases. Neutrophil refers to general inflammation whereas lymphocyte indicates unhealthiness in general physiology [13]. The ratio has also been associated with studies on cardiac ischemia [14–16].

Inflammation has a role in the pathophysiology of acute carbon monoxide poisoning. For that reason, we think that cardiac impact has an association with neutrophil lymphocyte ratio (NLR). In this pilot study, we studied the association of NLR with cardiac indicators in patients with carbon monoxide poisoning.

## MATERIAL AND METHODS

This retrospective study examined the patients who admitted to E.R. in Ataturk Research Training Hospital, a tertiary healthcare service in Ankara, between the dates 01.10.2015–01.06.2017. 54 patients were seen to have been diagnosed with carbon monoxide intoxication. Of those patients, 41 patients with complete parameters and follow-up were included in the study. Their demographic information, complete blood count, troponin and CK-MB values and carbon monoxide levels were recorded. SPSS 15.0 for Windows program was used for the analysis. Spearman correlation test was applied and  $p$ -value  $< 0.05$  was accepted to be significant.

## Findings

Of the patients who included in the study, 18 (43.9%) were female and 23(43.9%) were male. Their age average was  $43.7 \pm 18.9$ . Carbon monoxide level average of the patients was  $20.91 \pm 8.95$ . Troponin and CK-MB levels of the patients were not correlated (respectively  $p = 0.238$ ,  $0.707$ ). Carbon monoxide level and neutrophil-lymphocyte ratio of the patients were not found to be correlated ( $p = 0.364$ ). Troponin values and neutrophil-lymphocyte ratio of the patients had positive correlation ( $r = 0.309$ ,  $p = 0.049$ ). CK-MB level and neutrophil-lymphocyte

ratio of the patients were not found to be correlated ( $p = 0.19$ ). However, a positive correlation was seen between CK-MB levels and WBC ratios of the patients ( $r = 0.333$ ,  $p = 0.033$ ).

## DISCUSSION

The early assessment of cardiac impacts in carbon monoxide intoxications is important. In our study, troponin, which is the most valuable cardiac bio indicator in patients with carbon monoxide intoxication, and neutrophil-lymphocyte ratio show an association.

Former studies showed that NLR indicated an association with central nerves system depression and cardiac complications, which were seen in patients with carbon monoxide intoxications [17–19]. Korkmaz et al. in one of their studies showed that more troponin increase was seen in patients with high NLR [20]. Those results display an association with our results. Gunaydin et al. in their study stated that there was not seen a correlation between NLR, troponin and CK-MB [21].

Karabacak et al. in their study showed that WBC and NLR values were found to be higher in patients with carbon monoxide intoxication [13]. Similarly, NLR and troponin levels were found to have an association in our study. Additionally, WBC ratio was associated with CK-MB value. This situation made us think that as the level of carbon monoxide increased, inflammation increased as well, by which cardiac impacts developed.

Gazi et al. showed that complications were seen to be higher when NLR increased in myocardial infarction patients [22]. Our study also similarly displayed that NLR was higher in patients with high troponin, who namely had the development of complications.

## Restrictions

Among the restrictions of our study, the paucity of the number of the patients included in the study can be counted. The hospital where the study was conducted is situated in a region that economic welfare is higher compared to the other regions in the city. Even though it is a tertiary health care service, fewer cases of carbon monoxide intoxications are admitted to the hospital. Additionally, other restrictions are that complications apart from cardiac ones were not able to be examined and long-lasting follow-up was not able to be done.

## RESULTS

Neutrophil-lymphocyte ratio can be used for early diagnosis of cardiac impacts in carbon monoxide intoxications. However, more research is needed for the subject.

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