Clinical and Experimental Health Sciences

Can Systemic Inflammation Be Predicted in Cervical Discopathy Patients Using Hemogram Data?

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ABSTRACT

Objective: To compare hemogram data of patients with single-level discopathy, multi-level discopathy and no discopathy on cervical MRI.

Methods: The patients' clinical history, MRI images and hemogram data were retrospectively accessed from our hospital data system. The subjects' values of hemogram parameters including neutrophil count, lymphocyte count, white blood cell (WBC) count, platelet (PLT) count, neutrophil /lymphocyte ratio (NLR), PLT/lymphocyte ratio, MPV and RDW were recorded. In addition, cervical MRI images and radiological reports were accessed from the hospital data system.

Results: In the study, data from a total of 416 patients were evaluated in 3 groups. The first was the single-level cervical discopathy (CDH) group (n=79), the second was multilevel CDH (n=186), the third was the control group (n=151). Statistically, there was no difference between MPV, RDW, WBC, neutrophil and PLT counts in the three groups. While there was no difference between patients without discopathy detected on cervical MRI and patients with single-level discopathy, there was a statistical difference in the PLT/lymphocyte ratio and lymphocyte count compared to the multi-level CDH group. While the lymphocyte count was lower in the patient group without discopathy (p=0.012), the Plt/lymphocyte ratio was higher (p=0.02).

Conclusion: This study, which we conducted using the hemogram data of patients with and without cervical discopathy detected on cervical MRI, shows that we cannot predict systemic inflammation using only the hemogram data.

Keywords: Cervical discopathy, hemogram, mean platelet volume, inflammation, neck pain

1. INTRODUCTION

When we look at the etiology of musculoskeletal pain, back pain comes first and neck pain comes second (1). One of the important etiological causes of neck pain is intervertebral disc diseases (2,3). Cervical discopathy is a condition that occurs when a degenerative disc compresses the cervical spinal nerve root, usually seen in people between 30-40 ages (1). There is no strong evidence that the intervertebral discs (with degenerative or other changes) are the cause of discogenic pain (4). On the otherhand, it is known that cervical disc degeneration causes inflammation and likewise inflammation causes degeneration, and inflammation triggers the secretion of inflammatory cytokines from disc cells and the migration of immunocyte cells (5).

Although cervical disc herniation is associated with biomechanical changes in segmental motion, disc mechanism, and foramen morphology, dynamic studies on the motion or anatomical features of the cervical spine that would provide a better understanding of cervical biomechanics in patients with disc herniation are still lacking. The shape, size, and spatial relationship of the intervertebral foramen to the nerve root are important. Symptoms resulting from nerve root irritation are usually related to changes in the size or shape of the foramina through which the nerve passes. Changes in the structure of the spinal foramen are often used to understand the pathoanatomy in terms of corresponding changes in the clinical signs, symptoms, or pathophysiology of certain spinal disorders (6).

Platelets are the smallest blood components but are highly reactive. They are primarily involved in the maintenance of normal hemostasis and especially in fibrosis processes. Abundant evidence of their multifunctional nature has been demonstrated in many studies in recent years. Mean platelet volume (MPV) is an correct measure of the size of a platelet according to the volume distribution calculated by

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hematological analyzers during routine blood morphology testing. The normal value of MPV is 7.5-12.0 fl. The percentage of large platelets should be 0.2-5.0% of all platelets. Studies have found that mean platelet volume (MPV) can provide some information about both the course and prognosis of many diseases such as respiratory diseases, cardiovascular diseases, rheumatoid arthritis, juvenile systemic lupus erythematosus, Crohn's disease, diabetes and neoplastic diseases (7).

Frequently evaluated hemogram parameters are; red blood cell (RBC), red blood cell distribution width (RDW), white blood cell (WBC), lymphocyte, hemoglobin (Hb), neutrophil, mean corpuscular volume (MCV), hematocrit (HCT), HCT: mean platelet volume (HCT), etc.

Many studies have been conducted to show the role of some hematological parameters in some diseases. For example, the potential value of the ratio of platelet count to lymphocyte count or the ratio of neutrophil count to lymphocyte count in the diagnosis of ankylosing spondylitis, rheumatoid arthritis, psoriasis and Behcet's disease has been revealed by studies (8).

In this retrospective study, we looked for an answer to the question of whether there is a difference between the hemogram data of patients with single-level discopathy, multi-level discopathy and non-discopathy in cervical MRI.

2. METHOD

This study was conducted retrospectively using the recorded data of patients who applied to the Physical Therapy and Rehabilitation outpatient clinics of Alaaddin Keykubat University Training and Research Hospital and Sıtkı Koçman University Training and Research Hospital. Ethics committee approval for this study was given by the Alanya Alaaddin Keykubat University Medical Faculty Hospital Clinical Research Ethics Committee. Date and decision number are indicated. (23/10/2024-23-03) Patient data were collected between November 2024 and December 2024. A total of 466 patients from the hospital system were retrospectively screened. Hemogram data were checked and patients with active infection findings, leukopenia and severe anemia were excluded. In addition, patients with chronic heart disease, diabetes mellitus, hypertension and those using a medication that could change platelet counts were identified and their data were not recorded. Hemogram data of 416 patients eligible for the study were divided into 3 groups, taking into account cervical MRI findings (79 patients with single-level discopathy on cervical MRI, 186 patients with multi-level discopathy, 151 patients without a serious discopathy image, i.e. accepted as the control group). Patients with cervical bulging and cervical lordosis flattening were included in the control group. The median ages of the single level CDH, multi-level CDH, and control groups were 43 (20-69), 48 (23–78), and 33 (18–61) years, respectively. There were 26 men and 53 women in the single level CDH group, 63 men and 123 women in the multi-level CDH group, and 24 men and 127 women in the control group. The patients' clinical history, MRI images and hemogram data were retrospectively accessed from our hospital data system. The subjects' values of hemogram parameters including neutrophil count, lymphocyte count, white blood cell (WBC) count, platelet (PLT) count, neutrophil /lymphocyte ratio (NLR), PLT/lymphocyte ratio, MPV and RDW were recorded. In addition, cervical MRI images and radiological reports were accessed from the hospital data system.

2.1. Statistical analysis

No similar study was found in the literature examining the independent variables in our study (single-level disc herniation, multi-level disc herniation, control group). Therefore, we used the G power 3.1 program to calculate the sample size of our study. In the calculation, a medium effect size (f= 0.25), 5% margin of error (alpha = 0.05) and 80% power (1-beta= 0.80) were taken, and the total sample size was calculated as 159. SPSS 25.0 (IBM Corp., Armonk, NY, USA) was used to analyze the data. Categorical variables in the study were compared using the Chi-square test. The Kolmogorov – Smirnov test was used to evaluate the normality of continuous variables. Continuous variables were expressed using mean±SD, median value, and minimum-maximum values. When comparing independent groups, one-way ANOVA was used for data that were normally distributed, and the non-parametric equivalent Kruskal-Wallis test was used for data that were not normally distributed. Statistical significance level was accepted as p<.05.

Table 1. *Demographic data of participants*

	Single level (n=79)		Multi-level (n=186)		Control (n=151)			
	n	Mean±SD	n	Mean±SD	n	Mean±SD	p	Posthoc test
Age (year)		41.±11.2 43 (20-69)[a]		47.6±10.8 48 (23-78)[a]		34±10.7 33 (18-61)[a]	<.001*	Control<single level<multi-level
Sex								
Male	26		63		24		<.001[β]	
Female	53		123		127			

*amedian (minimum-maximum), *Kruskal-Wallis test, β Chi – square test*

Table 2. *Hemogram data*

	Single level (n=79)	Multi-level (n=186)	Control (n=151)		
Dependent variables	Mean±SD	Mean±SD	Mean±SD	p	Posthoc test
White blood cell	7.2 ± 1.5 7.2 (4.5-11.5)*	7.3 ± 1.7 7.1 (4.4-14.6) *	6.9 ± 1.5 6.9 (4.1-12.4) *	.085[a]	
Neutrophil	4.2±1.1 4.2 (2.0-7.0) *	4.1±1.2 4.0 (1.8-9.4) *	4.0±1.1 3.8 (2.0-8.7) *	.480[a]	
Lymphocyte	2.3±0.5 2.2 (1.2-3.9) *	2.4±0.6 2.3 (1.2-5.4) *	2.2±0.6 2.1 (1.1-4.1) *	.012[a]	Multi-level >control (p=.01)
Neutrophil / lymphocyte ratio (NLR)	1.9±0.7 1.8 (0.8-5.0) *	1.8±0.7 1.7 (0.8-5.1) *	2.0±0.8 1.9 (0.7-5.1) *	.167[a]	
Platelet (PLT)	267.1±51.7	262.2±53.8	271.5±59.5	.308[b]	
RLT/ lymphocyte ratio	123.1±37.0 117.0 (60.3-244.1) *	117.3±34.3 112.9 (45.5-245.7) *	132.5±41.5 128.3 (53.5-259.6) *	.002[a]	Control >multi-level (p=.02)
MPV	10.8±0.9 10.7 (8.7-13.1) *	10.6±0.9 10.5 (7.8-13.1) *	10.6±0.9 10.6 (9.1-13.4) *	.365[a]	
RDW	13.0±0.9 12.9 (11.6-17.2) *	13.2±1.1 13.0 (11.5-19.6) *	13.3±1.4 13.1 (11.1-19.8) *	.461[a]	

**median (minimum-maximum), a Kruskal-Wallis test, b One-way ANOVA test*

3. RESULTS

According to the data we obtained from the study; there was a significant difference in age between the 3 groups (p < .001) (average age control group< single level group< multi-level group). When neutrophil (p = .480), WBC (p = .085) and PLT (p = .308) values were examined, no significant difference was found among the patients included in the study. The lymphocyte count was found to be lower in the group without cervical discopathy (p = .012). The mean MPV value was 10.8±0.9 fL in the single-level CDH group, 10.6±0.9 fL in the multi-level CDH group and 10.6±0.9 fL in the control group. However, when all 3 groups were compared statistically, the difference between the MPV values was not significant (p = .365). The mean RDW value was found to be 13±0.9 in the single-level CDH group, 13.2±1.1 in the multi – level CDH group, and 13.3±1.4 in the control group. However, when the above data were compared statistically, no significant difference was found in terms of RDW values (p = .461). In addition, the neutrophil/lymphocyte ratio was similar in both the discopathy (single-multiple levels) and no discopathy groups (p = .167). When the control group was compared with the multilevel CDH group in terms of PLT/ lymphocyte ratio, a significant difference was observed, higher in the control group (p = .02) (Table 2).

Participants' age and gender data are given in Table 1, and hemogram data and the rates obtained from these data are given in Table 2.

4. DISCUSSION

Spondylosis and cervical disc herniation may trigger inflammation and ischemia caused by biochemical and immunological factors involved in the pathophysiology of radiculopathy. A relationship has been shown between high interleukin-6 levels and slower healing rate in patients with lumbar radicular pain (9). The hypothesis of this study was whether it is possible to evaluate systemic inflammation using hemogram data in patients diagnosed with cervical discopathy. However, according to our study, no significant relationship was found between cervical discopathy and hemogram data. It is complicated to classify neck pain in people presenting to health institutions. Degeneration is also common in asymptomatic populations, making it difficult to interpret images. For example, in a systematic review, 29% of asymptomatic 20-year-olds had disc protrusion and 4% had facet degeneration, while these rates were reported as 43% and 83%, respectively, in 80-year-olds (9). Considering this data, we did not include patients without neck pain in our study. Consistent with these data, in our study, the mean age of the patients without discopathy according to cervical MRI findings was lower than the mean age of the patients with discopathy.

In a study investigating the relationships between C reactive protein levels, leukocyte count, erythrocyte sedimentation rate, MPV, RDW, PLR and NLR and their high – frequency hearing thresholds in patients with ankylosing spondylitis; significant increases in NLR, leukocyte count, ESR and CRP were detected in patients with ankylosing spondylitis (10). We also compared NLR and leukocyte count values between each group, but we did not find any significant difference.

A systematic review found a correlation between VAS scores and levels of TNF alpha, TNFR1, IL6, IL8, and interferon-gamma. Marshall et al identified autoantibodies against nucleus pulposus herniated into the epidural space (11). The idea that IL8, IL6, IL15 and type 1 interferon initiate pathological processes in discopathies was also supported in a similar study (12). Considering that the count of neutrophils increases and the count of lymphocytes decreases as a physiological response to stress in the body; NLR can be used to predict the increase in inflammation in the body (13). We compared the groups, thinking that the neutrophil/

lymphocyte ratio might have increased due to increased systemic inflammation in patients with cervical discopathy, but we found NLR to be similar. However, according to the data of our study, the lymphocyte count was found to be lower in patients without discopathy in cervical MRI, while the plt/lymphocyte ratio was found to be higher.

In a retrospective study including 20 patients with sciatic pain, 73 patients with lumbar disc herniation (LDH) and 57 patients as a control group; MPV values were found to be higher in the lumbar discopathy group; RDW values were also found to be higher in this group compared to the sciatic and control groups (14). In our study, when we compared patients with single-level and multi-level cervical discopathy with the control group, we found similar MPV and RDW values.

In a study, the type and extent of disc herniation at presentation in 108 patients who underwent anterior discectomy for cervical radiculopathy was analyzed on MRI using a four-point scale. These were divided into disc protrusion and disc herniation groups. Study outcomes were assessed at baseline and two years after surgery using the visual analog scale for pain, 36-Question Short Form Survey and Neck Disability Index for quality of life. Patient-perceived improvement was also assessed at this time. In patients with cervical radiculopathy, the type and extent of disc herniation measured on MRI before surgery was not associated with symptom severity at presentation or clinical outcome two years after surgery (15). Since the design of our study was retrospective, we could only evaluate cervical MRI findings and hemogram data, but we could not use any scale to evaluate the pain level. Future studies are needed that evaluate prospectively not only the MRI images of the patients but also their hemogram parameters together with their pain levels.

According to a recent study, it was determined that the absolute lymphocyte count before treatment was directly related to the survival rate in patients diagnosed with esophageal cancer treated with chemotherapy, radiotherapy and immunotherapy (16). The data of our study showed that the absolute lymphocyte count was lower and the plt/lymphocyte ratio was higher in the group with normal MRI findings. However, the neutrophil/lymphocyte ratio was similar between the groups.

226 patients diagnosed with insulin-dependent diabetes mellitus and 79 adult patients with latent autoimmune diabetes were retrospectively examined and diabetic nephropathy risk factors were investigated. When the lymphocyte count of patients with insulin-dependent diabetes was examined, it was found that it was higher than the latent autoimmune diabetes group. However, the opposite was seen, the neutrophil/lymphocyte ratio was lower (17). Similar to this study, we found that the lymphocyte count was significantly higher in patients with cervical discopathy than in the group without discopathy; on the other hand, the ratio of the neutrophil count to the lymphocyte count was not different.

If we look at the shortcomings of our study, we can count the following; not using any other inflammation parameter other than hemogram and not evaluating nerve root compression in cervical MRI. In addition, patients' pain and quality of life levels can be evaluated in a prospectively designed study.

5. CONCLUSION

In our study, we wanted to answer the questions of whether we can use the previously defined rates that can be indicators of inflammation using hemogram data in patients with cervical discopathy and if so, is there a relationship with the level of discopathy. According to the data of this study in patients with cervical discopathy; we can say that we cannot predict systemic inflammation using only hemogram data. However, prospectively designed studies with larger sample sizes and using more inflammation parameters are needed.

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Design of the study: DB
Acquisition of data for the study: DB, HA
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