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# THE RELATIONSHIP BETWEEN QUANTITATIVE C-REACTIVE PROTEIN (CRP) AND THE NUMBER OF LEUKOCYTES AND BLOOD EDITION RATE (ESR) IN OPTIC NEURITIS PATIENTS

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**ABSTRACT**

Optic neuritis (ON) is a demyelinating inflammatory process that causes sudden visual impairment that can occur in one or both eyes simultaneously or successively. Optic neuritis (ON) can be caused by demyelinating diseases of the central nervous system, immune system diseases, infectious diseases, and can also be caused by inflammatory responses and vaccinations. This study aimed to determine the relationship between quantitative c-reactive protein (CRP) and leukocyte count and blood edition rate (ESR) in patients with optic neuritis. The most common pathophysiology of optic neuritis is inflammatory optic neuropathy associated with multiple sclerosis. In optic neuritis, demyelination occurs due to inflammation of the optic nerve with a lesion pathology similar to plaque in the central nervous system of someone with multiple sclerosis. There will be perivascular swelling, edema of the myelinated nerve sheath, and myelin damage. Inflammation of the retinal vascular endothelium may precede demyelination. Myelin damage is more severe than the damage found in axons. This research was conducted to determine the correlation between quantitative CRP levels and leukocyte counts and erythrocyte sedimentation rate levels in optical neuritis patients. The type of research used is quantitative research with an analytical observational research design, namely a cross-sectional approach. CRP and ESR are two commonly performed laboratory tests that may help physicians in accurately diagnosing and following many complex disease conditions. The relationship between CRP levels and leukocyte counts is to evaluate the effectiveness of treatment response.

Keywords: blood sedimentation rate (ESR); c-reactive protein (CRP); leukocyte count; optic neuritis

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## INTRODUCTION

The optic nerve is formed by one million axons derived from retinal ganglion cells and is an extension of the central nervous system (CNS) as a channel that extends from the eye to the optic chiasm. Optic neuritis (ON) is an inflammation that occurs in the optic nerve, as a result of which demyelinization occurs due to nerve inflammation. It happens all over the world. (Helmut W., Martin S., 2015). Philen's epidemiological study in Cuba found 123 cases of ON in Cuba. Research by Bourne shows that the prevalence rate of ON in schoolchildren in Tanzania is 1%. (Bern C, Philen RM, Freeman D, et al., 2014). The prevalence of ON that occurs is 2–4 per 100,000 individuals. The incidence of ON is higher in Asians and blacks compared to Caucasians (Kondengis HVA, 2020). Optic neuritis (ON) that has occurred in Indonesia is also not very common, so there is no epidemiological data on optic neuritis nationally. A study at RSUP by Prof. Dr. R. D. Kandou Manado conducted throughout 2015–

2017 found 24 optic neuritis patients. The characteristics of patients are dominated by men, with as many as 13 people in the age group of 26–45 years and as many as 11 people.

Extensive laboratory testing is recommended by neurological guidelines in optic neuritis patients, i.e., C-reactive protein (CRP), complete blood count, serum chemistry, blood sugar, rheumatoid factor, antinuclear antibodies, etc. 1. CRP is known as an acute-phase protein that reflects the measurement of the acute-phase response. The acute phase represents local and systemic events in inflammation. Local responses include vasodilation, platelet aggregation, neutrophil chemotaxis, and lysosomal enzyme release. (Wibowo BF, 2018). One of the laboratory tests in optic neuritis patients is the blood sedimentation rate (LED) examination. LED is a non-specific test whose value is related to changes in plasma protein values. In infectious, inflammatory, degenerative, and malignant values, the value will increase, as will the increase in fibrinogen, immunoglobulin, and CRP values. LED values are also influenced by various factors, such as anemia, pregnancy, hemoglobinopathy, hemoconcentration, and the use of anti-inflammatory drugs. A decrease in LED values is a good indicator for assessing control over the development of a disease in particular. (Husain TM, Kim DH, 2014).

Leukocyte count is a well-studied predictor of inflammation with a half-life of 5–6 days. CRP can be a more sensitive marker of the course of infection than leukocytes. The number of leukocytes alone is not enough to determine the presence of infection and has little diagnostic accuracy. Its significance lies primarily in evaluating the patient's response to therapy. Compared to this, CRP is a better measure of infection than leukocytes because levels increase faster. Rosca O, Spice BA, Ancusa, Talpos S, Urechescu H, Ursoniu S, et al. (2023). This study aimed to determine the relationship between quantitative c-reactive protein (CRP) and leukocyte count and blood edition rate (ESR) in patients with optic neuritis.

## METHOD

The method used in collecting this writing information source is literature review by searching various computerized articles sourced from Google Scholar, DOAJ, Science Direct, and Garuda databases. Article searches start in 2014 and last until 2023 for review. The keywords used in the article search are "optic neuritis," "C- reactive protein," "leukocytes "blood sedimentation rate. The inclusion criteria in this article search are: 1)Dependent variables are leukocyte count and blood sedimentation rate (LED); 2)Independent variable (independent) C-reactive protein (CRP); 3)Indonesian and English articles; 4)Accredited journals with at least national journals with an ISSN; 5)Published between 2014 and 2023 in full text PDF format. Exclusion criteria in searching for research articles Risk Factors that Affect Increased Quantitative CRP Levels, Blood Sedimentation Rate, and Leukocyte Counts in Patients with Optic Neuritis: Articles that have been published for more than the last 9 years (before 2014), articles that cannot be accessed easily and completely, and journals that do not have ISSN numbers.

## RESULTS

The results of searching articles from various journals that will be analyzed using a literature review are as many as five articles from various journals. The overview of the results of article analysis in various journals will be displayed in the form of the following table:

Table 1.
Article Search Results

| No | Researchers | Heading | Journal | Research Design |
|---|---|---|---|---|
| 1 | (Jeffrey L Bennet, 2019) | Optic Neuritis | Multi scler Journal | *Literature Review* |
| 2 | (Helmut W, Martin S, 2015) | Diagnosis and Treatment of optic neuritis | German International Medical Journal | *Literature Review* |
| 3 | (Siti Fatima et al, 2021) | Characteristics of Optic Neuritis Patients at Sanglah Central General Hospital (RSUP) for the period 1 January-31 January 2018 | Udayana Medical Journal | The technique in this study is descriptive retrospective with a cross-sectional design |
| 4 | (Ovidiu Rosca et al, 2023) | Role of Protein C Reactive (CRP) and netrophil to lymphocyte ratio in predicting the severity of odontogenic infections in adult patients | Journal mdpi | *Literature Review* |
| 5 | Ziwei lin et al, 2016) | Use of erythrocyte Sedimentation Rate and C-Reactive Protein to predict osteomyelitis recurrence | Journal of Orthopaedic Surgery | This type of research is experimental with a posttest only control group design |

## DISCUSSION

### Laboratory Examination for Optical Neuritis Patients

Extensive laboratory testing is recommended as per neurological guidelines, i.e., CRP, whole blood, serum chemistry, blood sugar, Vitamin B12, rheumatoid factor, antinuclear antibodies, anti-phospholipid antibodies, anti-ds-DNA antibodies, lupus anticoagulants, serum angiotensin-converting enzyme tests, borrelian serology, and urinalysis. Extensive laboratory testing is recommended as per neurological guidelines, i.e., CRP, whole blood, serum chemistry, blood sugar, Vitamin B12, rheumatoid factor, antinuclear antibodies, anti-phospholipid antibodies, anti-ds-DNA antibodies, lupus anticoagulants, serum angiotensin-converting enzyme tests, borrelian serology, and urinalysis.

### Things That May Affect CRP Test Results

CRP is elevated in acute rheumatic fever, rheumatoid arthritis, acute myocardial infarction, postoperative infection, bacterial infection, viral infection, Chron's disease, Reiter's syndrome, vasculitis syndrome, lupus erythematosus, tissue necrosis, or trauma. Drugs that can lower CRP levels, such as colchicines and statins, (Toosy AT, DF, Miller DH, 2014). High-sensitivity C-reactive protein is a small quantity measured by a very sensitive method. CRP was once known only as one component of acute phase protein but is now used as a sensitive marker of systemic inflammation to predict cardiovascular disease. (Lin Z, 2016).

The association between CRP concentration and cardiovascular disease has a strong correlation with risk factors such as genetics, lifestyle, smoking, obesity, BMI, metabolic syndrome, diabetes mellitus, hypertension, age, sex, hypercholestrolemia, and inflammatory markers23. CRP is an acute-phase protein specifically synthesized by the liver under IL-6 control. CRP secreted into atherosclerosis activates local endothelial cells, induces protombotics, and also increases the adhesion of leukocytes in the endothelium. (Bennett JL, de Seze J, Lana-Peixoto M, et al., 2015).

**Relationship of clinical condition with blood sedimentation rate (LED)**

LEDs are elevated in all conditions where there is tissue damage or entry of foreign proteins into the blood, except for mild local infections. LED assignment is useful for checking the progress of the disease. If the patient's condition improves, the LED tends to drop. If the patient's condition gets worse, LEDs tend to rise, but they are not intended for the diagnosis of certain diseases. (Wibowo Fajar B., 2018)

**Relationship of CRP Inspection with LED**

CRP and LED are two commonly performed laboratory tests that might assist doctors in accurately diagnosing and following many complex disease conditions. This examination, when used in conjunction with other clinical and diagnostic data, CRP and LED may be particularly important as components of rapid yet complex decision-making required in individuals with many comorbidities. CRP and LED levels can also give an idea of the underlying disease process. CRP values tend to fall rapidly with treatment; LEDs have been proposed as a better marker for clinical monitoring, following the course of disease over time, and predicting treatment response and duration. (Husain TM, Kim DH, 2014). CRP and LED levels can also be useful in predicting the severity of soft tissue infections and thus prolonging hospitalization or length of stay. Although CRP and LED have been used in combination to diagnose and monitor various conditions for many years, CRP is preferred as a serological marker for acute disease alleviation. (Husain TM, Kim DH, 2014).

**Relationship of CRP Examination with Leukocytes**

Laboratory supporting examinations to establish the optical diagnosis of neuritis, namely hematology and immunoserology, by looking at the results of the examination of leukocyte count and CRP Leukocyte count is a well-studied predictor of inflammation with a half-life of 5–6 days. CRP is a more sensitive marker of the course of infection than leukocytes. CRP is a better measure of infection than leukocyte count because levels increase faster. The relationship between CRP levels and leukocyte count is to evaluate the effectiveness of treatment response due to CRP levels and to evaluate treatment response because this protein is very sensitive to pathological changes in the body. (Yerizel E, Hendra P, Edward Z, Bachtiar H, 2015).

## CONCLUSION

CRP and LED are two commonly performed laboratory tests that might assist doctors in accurately diagnosing and following many complex disease conditions. The relationship between CRP levels and leukocyte count is to evaluate the effectiveness of treatment response due to CRP levels and to evaluate treatment response because this protein is very sensitive to pathological changes in the body. This examination, when used in conjunction with other clinical and diagnostic data.

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