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# The Relationship Between Erythrocyte Sedimentation Rate, Depression Score, and Palliative Prognostic Index in Palliative Cancer Patients

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## ABSTRACT

**Background:** Patients with advanced-stage cancer face various physical and psychological complications. Depression, which frequently occurs in palliative cancer patients, contributes to poor quality of life and increased mortality. The relationship between Erythrocyte Sedimentation Rate (ESR) as an inflammatory marker and depression scores and the Palliative Prognostic Index (PPI) is not fully understood. This study aims to determine the relationship between ESR, depression scores, and PPI in palliative cancer patients.
**Methods:** This analytical observational study utilized a retrospective approach using medical records of palliative cancer inpatients at Adam Malik Hospital, Medan, from June to August 2024. Eligible subjects underwent blood tests to assess ESR, depression scores using the Beck Depression Inventory II (BD-II), and PPI. The Kruskal-Wallis test was used to compare ESR with depression scores and PPI. A p-value of <0.05 was considered statistically significant.
**Results:** A total of 103 subjects were included, with an average age of 45 years; 74 were women (71.8%) and 29 were men (28.2%). Ages ranged from 18 to 78 years. Statistical analysis revealed significant relationships between ESR and depression scores (p = 0.001) and ESR and PPI (p = 0.007) in palliative cancer patients.
**Conclusion:** ESR can serve as an additional indicator for predicting depression and PPI scores in palliative cancer patients.

***Keywords:*** Cancer patients, palliative care, erythrocyte sedimentation rate, depression, palliative prognostic index

## INTRODUCTION

Cancer is a chronic disease characterized by the irregular growth of cells, which can invade adjacent tissues or distant organs, known as metastasis.[1] In 2020, it was estimated that there were 19.3 million cases (18.1 million excluding non-melanoma skin cancer) and nearly 10 million cancer-related deaths (9.9 million excluding non-melanoma skin cancer). Advanced-stage cancer patients face significant symptom burdens related to cancer itself, treatment (chemotherapy, radiotherapy, and surgery), symptom management, and pre-existing comorbidities. Thus, these patients require specialized care, referred to as palliative care.[2,3,4]

Palliative care aims to improve the quality of life for patients and their families facing challenges related to life-threatening diseases, addressing physical, psychological, social, or spiritual issues. Globally, it is estimated that 56.8 million people, including 25.7 million during their last year of life, require palliative care annually. Currently, only about 14% of those in need receive palliative care.[5]

Studies have shown that patients undergoing chemotherapy who are provided tools to report symptoms to their healthcare teams experience higher quality of life and improved overall survival compared to those receiving standard care. Early detection and prompt management of disease or treatment-related toxicity may explain differences in survival. Similar studies on high-risk lung cancer patients have demonstrated that symptom burden monitoring improves clinical outcomes by identifying supportive care needs early, thereby enhancing quality of life and survival.[6]

The Palliative Prognostic Index (PPI) is a scoring system developed in Japanese inpatient hospital units to predict survival for critically ill cancer patients. It was designed by Morita and colleagues to estimate survival for three to six weeks. Studies have reported that PPI demonstrates good discrimination, calibration, sensitivity, and specificity. PPI is calculated by summing scores from variables including palliative performance score (PPS), oral intake, edema, dyspnea at rest, and delirium.[7-9]

Depression is common in the palliative care population, with prevalence ranging from 24% to 70%. In palliative cancer populations, depression decreases quality of life and increases mortality. Symptoms of depression include anhedonia, feelings of worthlessness, difficulty concentrating, sleep disturbances, and suicidal ideation.[10-13]

The World Health Organization (WHO) estimates a 3.7% prevalence of depression in Indonesia, affecting around 9 million people and contributing to 6.6% of Years Lived with Disability (YLD). Depression has been linked to cancer through shared risk factors and disease mechanisms, as well as behavioral consequences of depression. Chronic inflammation associated with cancer is also thought to contribute to depression. Studies have demonstrated elevated inflammatory markers such as ESR, CRP, and IL-6 in depressed patients.[14,15]

The Erythrocyte Sedimentation Rate (ESR) is a simple hematological test used to indicate and monitor systemic inflammation caused by various conditions such as autoimmune diseases, infections, or tumors. Although ESR is not specific to any particular disease, it is often combined with other tests to confirm systemic inflammatory activity.[16-18]

Systemic inflammation plays a role in cancer development and progression. Studies have shown that elevated ESR is a strong marker for undiagnosed cancer and poorer survival outcomes. In addition, elevated ESR is an independent risk factor for colorectal cancer incidence and overall mortality in the general population.[19,20]

Given these observations, this study aims to evaluate the relationship between ESR, depression scores, and PPI in palliative cancer patients.

## MATERIALS & METHODS

This study employed a retrospective analytical observational design using secondary data from medical records of palliative cancer patients treated at Adam Malik Hospital, Medan, from June to August 2024. The study population included advanced-stage cancer patients receiving palliative care. Inclusion criteria: Patients aged ≥18 years, Cancer patients meeting the Ministry of Health 2015 criteria for palliative care, Solid cancer patients experiencing depression. Exclusion criteria: Patients with evidence of infection (as per medical records), Patients with decreased consciousness, Patients who declined ESR testing or refused to participate. Eligible patients and their families were informed

about the study's objectives, procedures, and benefits. Written informed consent was obtained before data collection, which included blood tests for ESR, depression scores using the Beck Depression Inventory II (BD-II), and PPI.

## STATISTICAL ANALYSIS

Statistical analyses were conducted using SPSS version 24. Spearman's correlation test was used to evaluate relationships between ESR, depression scores, and PPI. A p-value of <0.05 was considered statistically significant.

## RESULT

Based on the medical records of palliative cancer patients hospitalized at Adam Malik Hospital from June to August 2024, 103 subjects met the inclusion and exclusion criteria. The demographic characteristics of the study subjects are summarized in Table 1.

**Table 1. Characteristics of Study Subjects**

| Characteristics | N=103 |
|---|---|
| Age (years) | |
| • Mean±SD | 45,11±15,56 |
| • Median (minimum-maximum) | 44 (18-78) |
| Gender, n (%) | |
| • Male | 29 (28,2%) |
| • Female | 74 (71,8) |
| Cancer | |
| • Breats Cancer | 17 (16,5%) |
| • Gastric Cancer | 1 (0,9%) |
| • Head-Neck Cancer | 22 (21,36%) |
| • Hepatocellular Carcinoma | 4 (3,88%) |
| • Lymphoma | 13 (12,62%) |
| • Ovarian Cancer | 3 (2,91%) |
| • Pancreatic Cancer | 2 (1,9%) |
| • Renal Carcinoma | 1 (0,9%) |
| • *Soft* tissue tumor | 24 (23,30%) |
| • Thyroid Cancer | 16 (15,53%) |
| BDI II Score | |
| • No Depression | 5 (4,9%) |
| • Mild Depression | 7 (6,8%) |
| • Moderate Depression | 27 (26,2%) |
| • Severe Depression | 64 (62,1%) |
| Palliative Peformance Scale | |
| • 10-20 | 17 (16,5%) |
| • 30-50 | 81 (78,6%) |
| • ≥60 | z5 (4,9%) |
| Oral Intake | |
| • A mouthful or less | 44 (42,7%) |
| • More than a mouthful | 45 (43,7%) |
| • Normal | 14 (13,6%) |
| Oedema | |
| • Positive | 76 (73,8%) |
| • Negative | 27 (26,2%) |
| Dyspnea when resting | |
| • Positive | 22 (21,4%) |
| • Negative | 81 (78,6%) |
| Delirium | |
| • Positive | 0 (0%) |
| • Negative | 103 (100%) |
| Survival according to PPI score | |
| • 6 weeks | 5 (4,9%) |
| • <6 weeks | 27 (26,2%) |
| • < 3 weeks | 71 (68,9%) |

The characteristics of laboratory examination parameters are presented in Table 2. Based on the supporting examinations, the mean hemoglobin level was 10.46 ± 1.86 g/dL, the mean leukocyte count was 8,407.52 ± 2,008.93 cells/mm³, the mean platelet count was 301,903 ± 82,350 cells/mm³, the mean erythrocyte sedimentation rate (ESR) was 47.03 ± 35.20, the mean BD-II score was 31.62, and the mean PPI score was 5.60.

**Table 2. Characteristics of Laboratory Examination Parameters**

| Parameter | *Mean* | *Standard Deviation* | Median | Minimum Value | Maximum Value |
|---|---|---|---|---|---|
| Hemoglobin | 10,46 | 1,86 | 10,59 | 7,56 | 13,88 |
| Leucocyte | 8.407,52 | 2.008,93 | 8.435 | 5.043 | 11.997 |
| Platelet | 301.903 | 82.350 | 294.000 | 159.000 | 450.000 |
| ESR | 47,03 | 35,20 | 35 | 4 | 128 |
| BD II Score | 31,62 | 10,21 | 32 | 7 | 56 |
| PPI Score | 5,60 | 2,60 | 5 | 1 | 11 |

Based on BD-II scores, the mean ESR in the mild depression group was 26, in the moderate depression group was 37.07, in the severe depression group was 56.28, and in the non-depression group was 11.8. The mean ESR increased with the severity of depression. Statistical analysis revealed a significant relationship between ESR and depression scores in palliative cancer patients, with a p-value < 0.05 (p = 0.001). Complete data are presented in Table 3.

**Table 3. Analysis of the Relationship Between ESR and Depression Scores in Palliative Cancer Patients**

| Parameter | ESR | p |
|---|---|---|
| No Depression (n=5) | 11,8 ± 5,26 | 0,001 |
| Mild Depression (n=7) | 26 ± 24 | |
| Moderate Depression (n=27) | 37,07 ± 29,75 | |
| Severe Depression (n=64) | 56,28 ± 36,14 | |

Based on PPI scores, the mean ESR for a survival period of >6 weeks was 24, for <6 weeks was 29.70, and for <3 weeks was 55.24. The mean ESR increased as PPI scores and survival predictions worsened. Statistical analysis revealed a significant relationship between ESR and survival in palliative cancer patients, with a p-value < 0.05 (p = 0.007). Complete data are presented in Table 4.

**Table 4. Analysis of the Relationship Between ESR and Palliative Prognostic Index (PPI) in Palliative Cancer Patients**

| Parameter | ESR | p |
|---|---|---|
| >6 weeks (n= 5) | 24,0 ± 2,65 | 0,007 |
| <6 weeks (n= 27) | 29,70 ± 23,71 | |
| <3 weeks (n= 71) | 55,24 ± 37,07 | |

## DISCUSSION

Cancer is the leading cause of death among older adults. As the population ages, the number of elderly patients suffering from cancer increases.[21] In this study, the average age of participants was 45 years, with the youngest being 18 years old and the oldest 78 years old. These findings align with a study by Amare et al. (2023), which showed that the majority of participants were between 20–71 years old, with an average age of 42 years (SD=1.38).[22]

The majority of the participants in our study were women, accounting for 74 individuals (71.8%), while men made up 29 individuals (28.2%). Most participants were diagnosed with soft tissue tumors (23.3%), followed by head and neck cancer (21.4%), breast cancer (16.5%), thyroid cancer (15.3%), and lymphoma (12.6%). These findings are consistent with Amare et al. (2023), which reported that over half (58.5%) of the participants were women, with the top three primary cancers being gynecological cancer

(25.9%), breast cancer (16.9%), and nasopharyngeal cancer (13.3%).[22]

A study by Myint et al. (2021) involving 141 adults over 50 years old with active cancer in Myanmar found that nearly three-quarters (71.6%) of the sample were women, with more than half (53.9%) aged 50–59 years. Emerging evidence highlights gender differences in cancer incidence and mortality. Prostate, lung, and colorectal cancers are more common in men, while breast, lung, and colorectal cancers are more prevalent in women in the United States.[23]

Thyroid cancer incidence is significantly higher in women than men, while men are more prone to head and neck cancers. Cancers of the colorectal, stomach, and liver are more common in men, as are bladder cancer and leukemia. Among colorectal cancer patients, women tend to have malignancies on the right side of the colon, whereas men exhibit more left-sided diseases. Right-sided colon cancer is associated with greater severity than left-sided disease, potentially due to estrogen differences between men and women.[24,25]

Overall, men have higher cancer incidence and mortality rates for most cancer types, including bladder, kidney, colorectal, liver, esophageal, head and neck, brain, skin, and hematologic malignancies.[26]

The average hemoglobin level was 10.46 ± 1.86 g/dL, the mean leukocyte count was 8,407.52 ± 2,008.93 cells/mm³, and the mean platelet count was 301,903 ± 82,350 cells/mm³. The average erythrocyte sedimentation rate (ESR) was 47.03 ± 35.20. A study by Stone et al. (2021) reported mean leukocyte and platelet counts of 11,300 cells/mm³ and 312,900 cells/mm³, respectively.[8]

Based on BD-II scoring, the majority of participants had severe depression (62.1%), followed by moderate depression (26.2%), mild depression (6.8%), and no depression (4.9%). A statistically significant relationship was found between ESR and depression scores among palliative cancer patients ($p < 0.05$, $p = 0.001$).

Elevated ESR is a risk factor for cancer and cardiovascular morbidity and mortality. Increased ESR in older adults is associated with higher mortality risk.[17] Inflammation and vascular dysregulation contribute to depression development and impact erythropoiesis. High MCH and MCHC levels in women, and elevated MCHC levels in men, are associated with geriatric depression scale scores and general depression risk.[27]

The prevalence of depressive and anxiety symptoms among cancer patients is 23.4% and 19.1–19.9%, respectively, with higher rates observed in hospitalized patients (37.1% and 35.6–37.6%, respectively). Depression significantly reduces quality of life and worsens patient outcomes. A meta-analysis revealed that mild or severe depression increases mortality rates by 39%, while even minor depressive symptoms raise the risk of death by 25%.[11]

Based on PPI scoring, the majority of patients had a predicted survival of <3 weeks (68.9%), followed by <6 weeks (26.2%) and >6 weeks (4.9%). The mean ESR for survival predictions of >6 weeks, <6 weeks, and <3 weeks was 24, 29.70, and 55.24, respectively. A statistically significant relationship was observed between ESR and survival predictions in palliative cancer patients ($p < 0.05$, $p = 0.007$).

Studies on PPI development report that scores >6 predict survival of <3 weeks with 83% sensitivity and 85% specificity, while scores >4 predict survival of <6 weeks with 79% sensitivity and 77% specificity.[28,29]

Stone et al. (2021) found that 49.2% of participants had a PPI score >6, 23.4% had scores >4, and 49.2% had scores ≤4. Among patients diagnosed with elevated ESR within 12 months before cancer diagnosis, mortality rates were 50.8% vs. 45.1% at 1 year and 76.2% vs. 70.5% at 5 years, compared to matched cancer controls.[8]

Cumulative studies have shown that high ESR is a significant predictor of survival in solid tumor cancers. Wu et al. (2018) reported that patients with positive ESR had

significantly lower overall survival (OS) (2-year OS: 55.2% vs. 89.0%, $p < 0.001$) and progression-free survival (PFS) (2-year PFS: 37.5% vs. 60.3%, $p < 0.001$) compared to those with negative ESR.[18]

Fernandes et al. (2021) found that among 1,376 critically ill cancer patients, a PPI ≥6 predicted survival of <3 weeks with a positive predictive value (PPV) of 72% and a negative predictive value (NPV) of 68% (sensitivity 67%, specificity 72%). A PPI >4 predicted survival of <6 weeks with a PPV of 88% and an NPV of 36% (sensitivity 74%, specificity 59%). Patients with a PPI <4 had a 39% mortality rate within 3 weeks (relative risk, RR: 0.15, 95% CI: 0.11–0.20, $p < 0.001$) and a 63% mortality rate within 6 weeks (RR: 0.18, 95% CI: 0.13–0.25, $p < 0.001$) compared to those with PPI ≥4.[7]

## CONCLUSION

This study demonstrates a significant relationship between ESR and both depression scores and PPI in palliative cancer patients. Elevated ESR, as a marker of systemic inflammation, is significantly associated with higher levels of depression and poorer prognosis. These findings suggest that ESR can be used as an additional indicator in the psychological evaluation and prognosis of palliative cancer patients, supporting more comprehensive clinical decision-making. Further research is needed to confirm these findings and evaluate their application in clinical practice.

### *Declaration by Authors*

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