# The Effect of Total Lymphocyte Count on Postoperative Complications in Elderly Patients with Hip Fractures

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***Objective:*** *To evaluate the effect of total lymphocyte count on postoperative complications in elderly patients with hip fractures.*

***Methods:*** *In-patient medical records of elderly patients with hip fracture surgery including patient demographic, site of fracture, comorbidities, postoperative complications, operative technique, length of stay, hematocrit, total lymphocyte count and albumin were reviewed then evaluated the effect of total lymphocyte count on postoperative complications*

***Results:*** *16 males and 52 females with mean age 73.81±8.17 years were included in this study. 37 patients had postoperative complications. There were 4 postoperative deaths. Patients with low total lymphocyte count had a higher prevalence of postoperative complications as compared with patients with normal total lymphocyte count but the difference was not statistically significant.*

***Conclusions:*** *From this study, total lymphocyte count had no statistically significant affect on postoperative complications in elderly patients with hip fractures. However, patients with low total lymphocyte count had a higher prevalence of postoperative complications than patients with normal total lymphocyte count.*

***Keywords:*** *total lymphocyte count, comorbidities, postoperative complications, elderly, hip fractures*

Hip fractures in the elderly are common and serious injuries. Due to increased life expectancy, the incidence of hip fracture in the geriatric population has also risen every year. Hip fractures continue to be a major cause of morbidity and mortality in the elderly[1,2]. Pre-existing malnutrition is more common in the elderly and has affected the clinical outcome in surgical patients. Many studies have reported that malnutrition is associated with significant morbidity and mortality in hip fractures in the elderly[3-5]. Nutrition can be assessed with many indicators such as skin antigen testing, nitrogen balance, prealbumin levels, transferrin levels, total lymphocyte count, and albumin[6-8]. There are some controversies about the effect of total lymphocyte count on morbidity and mortality. Koval *et al.*[4] reported that a total lymphocyte count less than 1500 cells/ml was predictive for one-year mortality after hip fracture and that neither parameter was predictive of patients developing postoperative complication. Contrary to this, Foster *et al.*[8] reported that total lymphocyte count was not predictive of mortality after hip fracture, and Grossbard *et al.*[9] reported that lymphocytopenia has been shown to be a significant risk factor for the development of postoperative complications.

The aim of the present study is to evaluate the effect of total lymphocyte count on postoperative complications in elderly patients with hip fractures because total lymphocyte count is the routine preoperative laboratory test.

## Material and method

Medical records for neck or intertrochanteric hip fractures ICD-10 [International Classification of Diseases, Tenth Revision] codes 7200 and 7210 from 2008 to 2009 were searched. Patients aged 60 years of age or older who underwent operative fixation or prosthetic replacement in Samutsakhon Hospital were identified. Inclusion criteria were age more than 60 years old, non pathological fracture, low energy trauma, having undergone operative fixation or prosthetic replacement, and a complete in-patient medical record. Exclusion criteria were missing data or missing medical records.

A retrospective medical records review was performed to obtain data regarding age, sex, diagnosis, comorbidities, postoperative complications, method of treatment, length of hospital stay, hematocrit, total lymphocyte count, and albumin.

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The level of hematocrit, total lymphocyte count, and albumin were measured on the day of admission. The total lymphocyte count was measured by CELL-DYN Ruby (Product of Abbott Diagnostics U.S.A. in 2006) which uses Multi Angle Polarized Scatter Separation technology to perform cell analysis. The measurement was done at the laboratory unit of Samutsakhon Hospital.

The general status of the patient's health was defined by the number of pre-existing major medical conditions which included diabetes mellitus, congestive heart failure, ischemic heart disease, previous cerebrovascular accident, renal disease, neurological disorders, hypertension, and chronic obstructive pulmonary disease. These conditions were chosen because the literature identifies them as factors related to morbidity after hip fractures[2,10].

The postoperative complications included incident pressure sore, electrolyte imbalance, delirium, urinary tract infection, renal failure, pneumonia, gastrointestinal bleeding, bowel ileus, sepsis, acute myocardial infarction, pulmonary embolism, deep vein thrombosis, and surgical wound infection. Patients were deemed to have had postoperative complications if any of these complications were noted in their medical records.

## Statistical Analysis

Association among categorical variables was assessed with the Pearson chi-square or the Fisher exact test, as appropriate. The association between total lymphocyte count and postoperative complication was further evaluated with odds ratio and 95% confidence interval (CI).

The analysis assumed a background complication rate of 25% in patients with a hip fracture, with a difference in the rates of any given independent variable of 35%. The analysis was conducted with a one-tailed alpha of 0.05 and a beta of 0.20. The sample size was calculated from this formula ($N = [2(Z\alpha+Z\beta)^2 P(1-P)] / (P1-P2)^2$). With this formula, the total sample size needed to be 48 patients. This study consisted of 68 patients.

## Results

There were 68 patients. The mean age of the patients was $78.81 \pm 8.18$ years. Fifty-two patients (76.5%) were female and 16 patients (23.5%) were male. There were 38 patients (54.4%) aged 60-75 years and 30 patients (45.6%) aged more than 70 years. There were 45 femoral neck fractures (66.2%) and 23 intertrochanteric fractures of the femur (33.8%).

**Table 1.** Characteristics of the patients according to total lymphocyte count

| Patient characteristics (n, %) | n (%) | | |
|---|---|---|---|
| | <1500 cells/ml | ≥ 1500 cells/ml | p value |
| Gender | | | |
| Male | 112(75) | 4(25) | 0.324 |
| Female | 32(61.54) | 20(38.46) | |
| Age | | | |
| 60-75 | 22(57.89) | 16(42.11) | 0.186 |
| 75 and over | 22(73.33) | 8(26.67) | |
| No. of Comorbidities | | | |
| < 2 | 31(67.39) | 15(32.61) | 0.503 |
| ≥ 2 | 13(59.04) | 9(40.91) | |
| Site of fracture | | | |
| Neck | 27(60) | 18(40) | 0.256 |
| Intertrochanteric | 17(73.91) | 6(26.09) | |
| Hematocrit | | | |
| ≤ 30 | 10(66.67) | 5(33.33) | 0.857 |
| > 30 | 34.(64.15) | 19(35.85) | |
| Method of treatment | | | |
| Operative fixation | 17(73.91) | 6(26.09) | 0.256 |
| Prosthetic replacement | 27(60) | 18(40) | |
| Length of hospital stay | | | |
| <20 | 30(65.22) | 16(34.78) | 0.985 |
| 21-40 | 12(63.16) | 7(36.84) | |
| > 40 | 2(66.67) | 1(33.34) | |
| Discharge status | | | |
| Alive | 41(64.06) | 23(35.94) | 0.657 |
| Dead | 3(75%) | 1(25%) | |

The number of comorbidities was < 2 in 46 patients (67.6%) and ≥ 2 in 22 patients (32.4%). Fifteen patients (22.1%) had hematocrit ≤ 30% and 53 patients (77.9%) had hematocrit > 30%. Treatment consisted of fracture fixation in 23 patients (33.8%) and prosthetic replacement in 45 patients (66.2%). Forty-six patients (67.6%) had length of hospital stay < 20 days, 19 had length of hospital stay 21-40 days, and 3 patients (4.4%) had length of hospital stay > 40 days.

Forty-four patients (64.7%) had total lymphocyte count less than 1500 cells/ml and 24 patients (35.3%) had total lymphocyte count ≥ 1500 cells/ml. There were no significant differences between the two groups (Table 1). Thirty-seven patients (54.4%) had postoperative complications and 31 patients (45.6%) had no postoperative complication. Patients who had complications had a lower mean total lymphocyte count (1350.56 ± 616.28 cells/ml) than the patients who had no complication (1510.56 ± 976.12cells/ml). Postoperative complications are shown in Table 2. Age, sex, and total lymphocyte count had no statistically significant effect on postoperative complication but comorbidities affected postoperative complications (Table 3).

Four patients died in the postoperative period. Three patients who died during the postoperative period had total lymphocyte count on the day of admission < 1500 cells/ml (2 patients died from sepsis, 1 patient died from acute myocardial infarction), and 1 patient who had total lymphocyte count on the day of admission ≥ 1500 cell/ml died from pulmonary embolism. There was no correlation between total lymphocyte count and in-hospital death (OR 1.68; 95% CI, 0.17 to 17.13).

**Table 2.** Postoperative complications in elderly patients with hip fracture

| Complications** | Number |
|---|---|
| Pressure sore stage 1,2 | 24 |
| Electrolyte imbalance | 8 |
| Delirium | 5 |
| Urinary tract infection | 3 |
| Renal failure | 1 |
| Pneumonia | 3 |
| GI bleeding | 3 |
| Ileus | 1 |
| Sepsis | 2 |
| Acute myocardial infarction | 1 |
| Pulmonary embolism | 1 |
| Surgical wound infection | 1 |

** Complications were found in 37 patients. 8 patients had more than one complication.

**Table 3.** Odds ratio (with 95 CI) for suspected risk factor of postoperative complication

| Risk factor | OR | 95% CI | p value |
|---|---|---|---|
| **Gender** | | | |
| Female / Male | 0.309 | 0.088-1.083 | 0.059 |
| **Age** | | | |
| Over 75 / 60-75 | 0.727 | 0.525-3.601 | 0.516 |
| **No. of Comorbidities** | | | |
| ≥ 2 / < 2 | 3.174 | 0.105-0.949 | 0.036 |
| **Total lymphocyte count** | | | |
| < 1500 cells/ml / ≥ 1500 cells/ml | 1.707 | 0.626-4.654 | 0.294 |

## Discussion

Since this study was retrospective, it had some limitations. Finding cases depended on the adequacy of medical records. Failure to identify relevant cases could be caused by miscoding, incomplete data, and lost records. Therefore the cases themselves may not be a representative sample of a larger population. Evaluating guidelines of treatment, comorbidities, and postoperative complications retrospectively also posed problems because they depended on assessments by different physicians.

In spite of these limitations, the retrospective study may identify some cues which can later be used in prospective studies with larger populations. In this study, 64.7% of patients had low total lymphocyte count and 72.4% of patients had hypoalbuminemia. These results showed that some elderly patients with hip fracture had malnutrition. Similarly, Koval et al.[4] reviewed 490 patients with hip fracture and found that 18% of patients had hypoalbuminemia and 57% had low total lymphocyte count. Patterson et al.[7] reported 60% of hip fracture patients were in a protein-depleted condition during the first week of hospitalization. Due to increased rates of malnutrition in elderly patients with hip fracture, physicians should evaluate the nutrition status of all elderly patients with hip fracture and correct any malnutrition before surgery is performed. In this study, albumin levels were investigated in only 42.64% of patients. This shows that some physicians were not concerned with nutrition status.

A decreased number of lymphocytes has been shown to be a significant risk factor for the development of postoperative sepsis and

mortality[4,9,11,12], but contradictory findings have also been reported[13].

In the current study, total lymphocyte count < 1500 cells/ml had no effect on postoperative complication or in-hospital mortality but patients with low total lymphocyte count tended to have a higher prevalence of postoperative complications than patients with normal total lymphocyte count (59.1% vs. 45.8%).

Bistrian *et al.*[14] reported that decreased levels of albumin had associations with an increase hospital stay; impaired wound healing; increased rates of wound infection, pneumonia, and sepsis; increased incidence of post operative complication; delayed physical rehabilitation; and decreased likelihood of survival. Koval *et al.*[4] reported similar results.

Patterson *et al.*[7] evaluated protein depletion and metabolic stress in hip fracture patients and found protein depletion in 58% of patients. Patients with protein depletion had a higher prevalence of complication and increased hospital stays. On the other hand, Mizrahi *et al.*[15] showed that albumin level had no effect on functional outcome and length of hospital stay.

In this study, only 29 patients were investigated for albumin level, which is inadequate to study. We also found that comorbidities affected postoperative complication, similar to Derek *et al.*[16]

## Conclusions

Total lymphocyte count did not affect postoperative complications but comorbidities significantly affected postoperative complications.

Patients with low total lymphocyte count had a higher prevalence of postoperative complications than patients with normal total lymphocyte count. Total lymphocyte count is an inexpensive and easy parameter to measure, so further study about total lymphocyte count should be done in the larger population.

## Acknowledgements

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*ผลของจำนวนเม็ดเลือดขาวลิมโฟซัยต์ต่อภาวะแทรกซ้อนภายหลังการผ่าตัดในผู้ป่วยสูงอายุที่กระดูกสะโพกหัก*

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**วัตถุประสงค์** เพื่อศึกษาผลของจำนวนเม็ดเลือดขาวลิมโฟซัยต์ต่อภาวะแทรกซ้อนภายหลังการผ่าตัดในผู้ป่วยสูงอายุที่กระดูกสะโพกหัก

**วัสดุและวิธีการ** รวบรวมข้อมูลผู้ป่วยสูงอายุที่กระดูกสะโพกหักแบบไม่มีพยาธิสภาพและได้รับการผ่าตัดประกอบด้วย อายุ, เพศ, ตำแหน่งที่กระดูกหัก, โรคร่วม, ภาวะแทรกซ้อนภายหลังการผ่าตัด, ชนิดการผ่าตัด, ระยะวันนอนโรงพยาบาล, ความเข้มข้นของเลือด, จำนวนเม็ดเลือดขาวลิมโฟซัยต์และระดับอัลบูมิน นำข้อมูลมาประเมินความสัมพันธ์ของจำนวนเม็ดเลือดขาวลิมโฟซัยต์กับภาวะแทรกซ้อนภายหลังการผ่าตัด

**ผลการศึกษา** ผู้ป่วยจำนวน 68 ราย เพศชาย 16 ราย เพศหญิง 52 ราย อายุเฉลี่ย 73.81±8.17 ปี เกิด ภาวะแทรกซ้อนภายหลังการผ่าตัด 37 ราย มีการติดเชื้อ 8 ราย ผู้ป่วยเสียชีวิต 4 ราย ผู้ป่วยที่มีจำนวนเม็ดเลือดขาวลิมโฟซัยต์น้อยกว่า 1500 เซลล์ต่อมิลลิลิตร มีภาวะแทรกซ้อนภายหลังการผ่าตัดมากกว่าผู้ป่วยที่มีจำนวนเม็ดเลือดขาวลิมโฟซัยต์มากกว่าหรือเท่ากับ 1500 เซลล์ต่อมิลลิลิตรโดย มีภาวะแทรกซ้อนร้อยละ 59.1 และ 45.8 ตามลำดับ แต่ไม่มีนัยสำคัญทางสถิติ

**สรุป** จากการศึกษานี้ จำนวนเม็ดเลือดขาวลิมโฟซัยต์ ไม่มีผลต่อภาวะแทรกซ้อนภายหลังการผ่าตัดอย่างมีนัยสำคัญทางสถิติ แต่ผู้ป่วยที่มีจำนวนเม็ดเลือดขาวต่ำมีโอกาสเกิด ภาวะแทรกซ้อนมากกว่าผู้ป่วยที่มีจำนวนเม็ดเลือดขาวลิมโฟซัยต์ปกติ