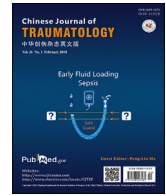




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## Original Article

# Predictors for perioperative blood transfusion in elderly patients with extra capsular hip fractures treated with cephalo-medullary nailing

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## ABSTRACT

**Purpose:** The aim of our study was to determine predictive factors and requirement for perioperative blood transfusion in elderly patients with extra capsular hip fractures treated with cephalo-medullary device.

**Methods:** Seventy-nine patients with extra capsular hip fractures treated with cephalo-medullary nailing were included in the study. Age, sex, ASA grade, timing of surgery, preoperative and postoperative haemoglobin, length of hospital stay, fracture type, number of units transfused and 30-day mortality were recorded.

**Results:** The mean age was 82.3 years. Forty-seven patients underwent a short nail and 32 patients a long nail; 53.4% patients required blood transfusion postoperatively. Transfusion was required in 71.8% of the long nails ( $p < 0.05$ ), 65.8% patients above the age of 80 ( $p < 0.05$ ), 100% of the patients with hemoglobin below 90 g/L and 20 patients with a ASA grade of 3 ( $p < 0.05$ ). 78.5% patients with A2 fracture and 75% of A3 fractures needed blood transfusion ( $p > 0.05$ ). Length of hospital stay in non-transfusion group was 13 days and in transfusion group was 19 days ( $p < 0.05$ ). 55.1% operated within 36 h and 47.6% operated after 36 h of admission needed transfusion ( $p > 0.05$ ). Thirty-day mortality in patients needing blood transfusion was 5% and in non-transfusion group was 3.7% ( $p > 0.05$ ).

**Conclusion:** Patient age, ASA grade, preoperative haemoglobin and length of nail are reliable predictors for perioperative blood transfusion in extra capsular hip fractures in elderly patients treated with cephalo-medullary nailing and reinforce a selective transfusion policy.

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## Introduction

Blood loss in extra-capsular hip fractures in the elderly treated with a cephalo-medullary device can be substantial that can have major implications on patient recovery as delayed mobilization, longer hospital stay, higher re-admission rates and higher mortality,<sup>1–4</sup> hence an early blood transfusion is desirable. Extra-capsular fractures are recognized to be associated with a greater blood loss and higher drop in hemoglobin (Hb) postoperatively than intra-capsular fractures.<sup>5–7</sup> The most common methods of treatment of extra-capsular femoral neck fractures are a dynamic hip compression plate system (DHS) or a cephalo-medullary nail. The choice depends upon fracture personality, surgeon's preference and availability of the hardware. There is no consensus on the

superiority of one over the other,<sup>8</sup> but cephalo-medullary device has gained popularity in recent years in which concerns are blood loss and transfusion requirement in patients treated with an intramedullary device.<sup>9</sup> We undertook this study to determine predictive factors and requirement of perioperative blood transfusion in patients with extra-capsular neck fractures treated with an intramedullary device and whether there should be a selective or liberal transfusion policy.

## Materials and methods

A retrospective study was performed at a district general hospital. Data collected included patient age, sex, type of fracture, time between admission and surgery, ASA grade, preoperative and postoperative Hb, units of blood transfused, length of stay, long or short nail and 30-day mortality. Patients with pathological fractures, multiple injuries, on oral anticoagulation, undergoing revision surgery and below the age of 60 were excluded from the study. From January 2008 to December 2009, 207 patients were admitted

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with extra capsular fractures. Eighty-seven patients were treated with cephalomedullary nails. Six patients were on anticoagulants and two underwent revision surgery hence were excluded. Seventy-nine patients including 16 male and 63 female were enrolled in this study. The mean age was 82.3 years with a range of 62–101 years. Forty-seven patients underwent a short nail and 32 patients a long nail. There were 67 A2 fractures and 12 A3 fractures. Cases were discussed in the trauma meeting and fixation method agreed upon. All patients received enoxaparin subcutaneously and mechanical thromboprophylaxis. Threshold for transfusion was Hb below 80 g/L with the symptoms and signs of anaemia as described by Carson et al.<sup>10</sup> Statistical analysis was done by Chi-squared test of proportions to compare the difference of proportions between the two groups and *t*-test for the difference between the observed means in two independent samples.

**Results**

Forty-two (53.4%) patients required blood transfusion post-operatively. Among them, 19 (40.4%) underwent short nails and 23 (71.8%) long nails (Fig. 1). Transfusion requirement was higher in long nails (95% CI=7.89–52.04) and *p* < 0.05. The mean age of patients receiving blood transfusion was 84.2 years (74–92). Twenty-seven patients (34.1%) needing transfusion were above the age of 80 and fifteen (18.9%) below the age of 80. Twenty seven (65.8%) patients out of forty-one who were above the age of 80 years and fifteen (39.4%) out of thirty eight patients below the age of 80 were transfused (Fig. 2) and *p* < 0.05 (95% CI = 3.24–47.81).

There were 4 patients with Hb of 9.0 g/L or below on admission and all of them required blood transfusion. 39 patients had Hb between 90 g/L and 120 g/L on admission and 24 patients (61%) out of these needed blood transfusion. There were 36 patients with Hb of 120 g/L or more on admission and 14 patients (39%) out of these needed blood transfusions (Fig. 3) and *p* < 0.05 (95% CI = –2.44–43.88). The mean number of units of whole blood transfused was 1.3 units (range 1–4).

Mean ASA grade in transfusion group was 3.2 and in non-transfusion group was 2.9. Six ASA 1, 16 ASA 2 and 20 ASA 3 patients needed transfusion. Transfusion requirement was higher in patients with higher ASA grade (95% CI = 0.23–0.36) and *p* < 0.05. Mean in patient stay was 17.4 days (4–99). The average length of stay for patients needing blood transfusion was 19 days (4–99) and in those who were not transfused was 13 days (4–78). The *p* value was <0.05 (95% CI = 5.62–6.37).

58 patients were operated within 36 h of admission and 32 (55.1%) of these needed transfusion and 21 patients were operated after 36 h of admission and ten (47.6%) needed transfusion (Fig. 4). There was no significant difference between the two

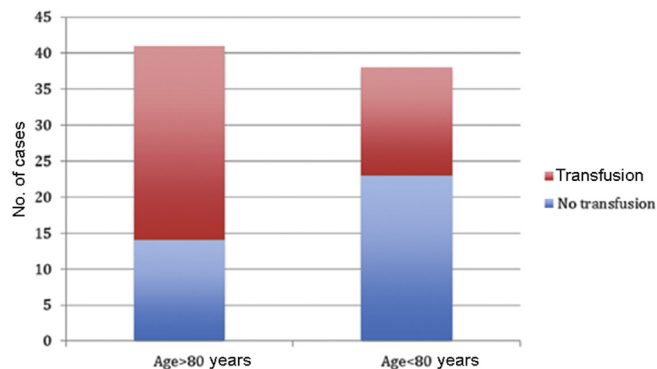


Fig. 2. Age and blood transfusion.

groups in transfusion requirement with a *p* value of >0.05 (95% CI = –16.04–29.41). Thirty-three patients (78.5%) out of 67 with A2 fractures needed transfusion and nine patients (75%) out of 12 with A3 fractures need transfusion. There was no significant difference with a *p* value of >0.05.

Seven patients (8.8%) passed away within 30 days and out of these four patients needed blood transfusion. Thirty-day mortality in patients needing blood transfusion was 5% and in non-transfusion group was 3.7% (95% CI = –11.90–13.09) and *p* > 0.05.

**Discussion**

Many factors are implicated in blood loss in hip fractures but the fracture site and fixation methods are of paramount importance. Most studies concur that extra-capsular fractures are associated with increase blood loss.<sup>5,6</sup> Adunsky et al<sup>7</sup> has shown that blood transfusion requirement is greater in per-trochanteric fractures than subcapital fractures. There are studies that support increase blood loss in patients with extra-capsular fractures treated with intramedullary device<sup>8,9</sup> while a few reports no difference<sup>10–13</sup> and some demonstrate lower blood loss with intramedullary devices.<sup>14</sup> An extensive meta-analysis done by Huang et al<sup>15</sup> has shown that proximal femoral nailing and dynamic hip screw operations had comparable operation time, blood transfusion, hospital stay, wound complications, reoperation and mortality rate. Parker et al<sup>11</sup> believe that increased blood loss found following intramedullary nailing is due to severity of the fractures with a larger amount of bleeding from fractured metaphyseal bone rather than to the fixation device. There is also the issue of “hidden blood loss” described by Smith et al and Foss and Kehlet.<sup>16,17</sup> Sehat et al<sup>18</sup> demonstrated that hidden blood loss is higher in patients with cephalomedullary nail than with a DHS.

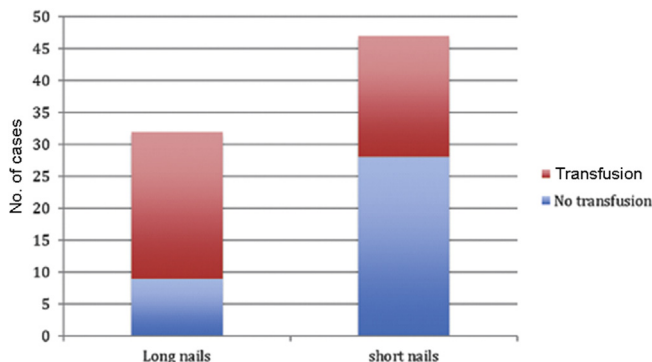


Fig. 1. Blood transfusion in short and long nails.

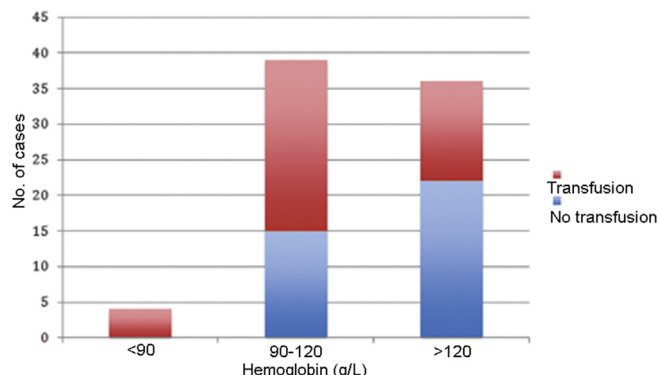


Fig. 3. Preoperative Hb and blood transfusion.

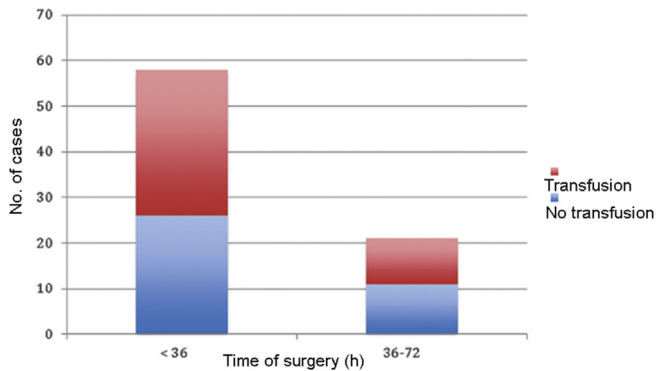


Fig. 4. Blood transfusion and time of surgery.

In cases of a cephalo-medullary device, the length of nail may influence transfusion requirement, as long nails require more reaming compared to short ones. Boone et al<sup>19</sup> has reported that the transfusion requirement was significantly less in patients undergoing short cephalo-medullary nails as compared to long ones. In our study, 71.8% of the long nails and 40.4% of the short nails needed blood transfusion demonstrating higher blood transfusion requirement in patients treated with long nails. We believe that the contributory factor is extra reaming and violation of larger surface area of the medullary canal vasculature with the use of long nails.

Low preoperative Hb is a risk factor for postoperative transfusion.<sup>20–22</sup> The results of our study shows that 100% of the patients with Hb below 9.0 g/L, 61% of those with Hb between 9.0–12.0 g/L and 39% of those with Hb 12.0 g/L or above needed transfusion thus a preoperative Hb below 12.0 g/L is associated with higher levels of transfusion that strongly favors preoperative Hb as one of the reliable indicator for blood transfusion.

There are studies, which show that age can be a risk factor for transfusion.<sup>23,24</sup> The requirement of blood transfusion was significantly higher in patients above the age of 80 in our study as we observed that 65.8% of the patients above the age of 80 and 39.4% of those below age of 80 were transfused.

Dillon<sup>25</sup> and Adunsky<sup>7</sup> demonstrated no correlation between ASA grading and blood transfusion but we found a higher requirement of blood transfusion in patients with ASA grade 3. We observed a slightly increased rate of blood transfusion in patients operated within 36 h of admission as compared to those operated after 36 h of admission but *p* value was not significant. In our study, length of hospital stay in patients needing blood transfusion was significantly higher than patients who did not receive blood transfusion. We believe that this is due to the fact that patients needing blood transfusion were slow to mobilize due to symptoms of low postoperative Hb.

We observed that 75% of A3 and 78.5% of A2 fractures needed blood transfusion but there was no significant difference. Mortality is always a concern in patients of this age group with multiple comorbidities. The 30-day mortality in our study was slightly higher in transfusion group (5% as compared to 3.7%) but was not statistically significant.

Blood transfusion has undeniable risks, especially infection. Carson et al<sup>26</sup> showed a 35%–52% increase in risk of serious postoperative deep wound infection and pneumonia following blood transfusion, resulting in increased mortality and cost to the hospital; their study suggests that this is because of immunomodulation due to allogeneic red cell transfusion. On the other hand, low postoperative Hb in the elderly is associated with medical complications, an increased length of stay, increased readmission rates, and increased mortality.<sup>27–29</sup> Many studies demonstrate a better and more rapid

recovery in patients who have a higher Hb postoperatively.<sup>30,31</sup> It is vital to balance the risks and benefits of blood transfusion and have a practical approach. In our cohort, 53.4% of the patients needed perioperative blood transfusion therefore we recommend selective but an early transfusion policy in symptomatic patients.

In summary, results of our study demonstrate a significantly higher blood transfusion requirement in patients above the age of 80, patients with Hb below 9.0 g/L, ASA 3 and those undergoing long nails (*p* < 0.05). Patients requiring blood transfusion had a significantly longer hospital stay in our study. We recommend that these patients must be carefully monitored with a low threshold for early transfusion that is likely to help in reducing morbidity.

The limitations of our study include retrospective study, different surgeons, small sample size, differences in patient comorbidities and bias in assessing sign and symptoms of anaemia. A prospective, randomized study with a large sample size will be desirable.

We conclude that patient age, ASA grade, preoperative Hb and length of nail are reliable predictors for perioperative blood transfusion in elderly patients with extra capsular hip treated with cephalo-medullary nailing and support a selective transfusion policy.

## Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.cjtee.2017.09.002>.

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