

Identify the trends of post-operative haemoglobin level change and risk factors for blood transfusions in surgically managed neck of femur fractures

W.Y.M. Abeysekera, D.H.B. Ubayawansa, K.D.G.K. Siriwardane, M. de Almeida, M.B.N. Dassanayake
Colombo South Teaching Hospital, Kalubowila, Sri Lanka.

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Abstract

Introduction

Neck of femur fracture (NOFF) is a major public health issue and there is a hidden blood loss during the surgery for the NOFF.

Objectives

To identify the trend of post-op anaemia and risk factors for blood transfusions in surgically managed Neck of femur fractures (NOFF).

Materials and methods

A prospective cohort analysis of 69 surgically managed NOFF patients was done for a period of 4 months. Age, sex, comorbidities, delay of admission, delay of surgery, type of fracture, level of the surgeon and diet of the patient were considered as risk factors for blood transfusions (BT). Pre-op and post-op day 1 and 3 Haemoglobin (Hb) and Haematocrit (Hct) values were assessed.

Results

Out of 69 patients who underwent surgery for NOFF, 28.9 % (n=20) received blood transfusions at some point of their management. Among non-transfused patients a significant decrease in Hb in post-op day 1 (mean drop = 1.06 [95% CI = (0.807, 1.317) (P < 0.05) and further significant drop from post-op day 1 to 3 (mean drop = 0.77 [95% CI = (0.556, 0.984) (P < 0.05) was noted. In Hct a similar pattern noted recording a 2.93 [95% CI = (2.131, 3.722) (P < 0.05)] mean drop in post-op day 1 and a mean drop of 2.20 [95% CI = (1.411, 2.992) (P < 0.05) from post-op day 1 to 3. Except for the fracture type (p = 0.02) none of the other factors as, age of the patient (p = 0.93), delay of admission (p = 0.09), delay of surgery (p = 0.16), blood group

(p = 0.34), level of the surgeon who performed the surgery (p = 0.51), dietary pattern (p = 0.27) the comorbidities (p = 0.5, 1.0, 1.0) had any significant impact for transfusion.

Conclusion

Hb level continues to drop even on post-operative day 3. Post-op Hb drop is partly due to haemodilution and extra capsular fractures has a higher risk of blood transfusion than intracapsular NOFF.

Introduction

Neck of femur fracture (NOFF) is a major public health issue due to an ever increasing ageing population. Its incidence has increased significantly over the past few decades [1].

Actual blood loss related to NOFF surgery is six times more than that observed during the surgical procedure [2]. Reasons for such a hidden blood loss may be the trauma itself leading to a pre-operative blood loss, which may not be reflected in the pre-operative Haemoglobin (Hb) and Haematocrit (Hct) level. Continuous haemorrhage after surgery due to inadequate haemostasis and prolonged bleeding due to medication with anticoagulant effect or other sources of bleeding such as gastro-intestinal tract may add to the overall blood loss [2]. As a result blood transfusions are relatively common among neck of femur fracture patients to prevent post-operative anaemia which will lead to poor tissue healing and impair early mobilization of the patient. According to a study conducted in United States, out of 90000 blood transfusions, 5.2% were for NOFF patients [3].

Objective of our study was to observe the post-operative change in Hb level up to post-operative day 3 and to determining the possible risk factors for peri-operative blood transfusions in NOFF patients.

Materials and methods

A prospective analysis of patients who underwent surgery for NOFF was done for a period of 4 months from 01st of May 2015 till 31st of August 2015. Patients managed conservatively, old fractures (more than 2 weeks), fractures with any type of intervention e.g. native treatments and

Correspondence: W.Y.M. Abeysekera
E-mail: yohan.abeysekera@yahoo.com
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suspected pathological fracture were excluded from the study. Patients on Aspirin or Clopidogrel were off of drugs for 5 days and if the clotting profile was normal underwent surgery.

According to our unit policy we performed surgery for NOFF as soon as the patient is ready for surgery, preferably within first 5 days from admission.

Intra-capsular fractures were treated with bipolar or unipolar hemiarthroplasty or cannulated screw fixation based on the age and fracture pattern and none of the patients underwent total hip arthroplasty. Extra-capsular fractures were managed with Dynamic Hip Screw (DHS) or Dynamic Condylar Screw (DCS) based on the fracture personality since we had no facilities to perform proximal femoral nailing or locking plate for extra-capsular fractures. None of the patients had drains after surgery. Pre-operative and post-operative day 1 and 3 Haemoglobin (Hb) and Haematocrit (Hct) values of all patients and post transfusional Hb & Hct values of patients were documented.

Age, sex, delay of admission (> 48 hours from injury), delay of surgery (> 5 days from admission), type of fracture (extra or intra capsular), diet of the patient, level of the surgeon (Senior house Officer, Senior Registrar, Consultant) and comorbidities were considered as risk factors for blood transfusions. The level of significance was set at $p < 0.05$. Data analyses were performed using Paired T-test and chi square test with SPSS version 10.1 software.

Results

Sixty nine consecutive patients underwent surgery for fracture NOFF with in the given period out of which 28.9% (n= 20) received blood transfusions at some point of their management. When consider non-transfused patients a significant decrease in Hb at post - op day 1 (mean drop = 1.06 [95% CI = (0.807, 1.317)] ($p < 0.05$) and further significant drop from post-op day 1 to 3 (mean drop = 0.77 [95% CI = (0.556, 0.984)] ($p < 0.05$).

Hct also followed a similar pattern recording a significant drop at post-op day one [mean drop = 2.93 [95% CI = (2.131, 3.722)] ($p < 0.05$) and further significant drop from post-op day 1 to 3 [mean drop = 2.20 [95% CI = (1.411, 2.992)] ($p < 0.05$). (Table 01)

Mean age of both patients with and without transfusions were 69 (SD = 8.6) and 69 (SD = 29.5) respectively. Except for the fracture type ($p = 0.03$) none of the other factors including, age of the patient ($p = 0.93$), delay of admission ($p = 0.09$), delay of surgery ($p = 0.16$), blood group ($p = 0.34$), level of the surgeon who performed the surgery ($p = 0.52$), dietary pattern ($p = 0.27$) nor the comorbidities like diabetes ($p = 0.56$), hypertension ($p = 1$), ischemic heart disease ($p = 1$) or other diseases (malignancy, bronchial asthma,

chronic kidney disease) ($p = 0.83$) of the patient had been a significant risk factor for transfusion. It was the extra capsular fractures (26%, n = 18) in contrast to intra-capsular fractures (2.9%, n = 2) which had a higher risk of blood transfusions. (p -value 0.03) (Table 02).

Discussion

Hb value to decide on blood transfusion for in NOFF is controversial. A retrospective study of 8,787 hip fracture patients, aged ≥ 60 years, found that perioperative transfusion had no effect on mortality in patients with haemoglobin levels ≥ 8 g/dl [4, 5].

But some other studies have suggested that patients with known cardiac disease may benefit from transfusion at higher haemoglobin levels [6,7,8]. According to our unit policy all NOFF patients with a Hb less than 9g/dl at any point of their management received blood transfusions until the Hb is over 9g/dl.

Nearly every one out of four NOFF patients required blood transfusions at some point of their surgical management [2]. When observing the natural Hb and Hct change during the surgical management of patients who did not receive transfusions, clearly both Hb and Hct had statistically significant drops at post-operative day 1 in comparison to pre-operative values indicating that the Hb drop in post-operative day 1 is partly due to haemodilution in intra operative period on top of the blood loss during surgery.

Similar significant drop was evident in both Hb and Hct at post-operative day 3 in comparison to post-operative day 1 values. Probable reason for this further drop is due to continuous bleeding in to the operative region until complete haemostasis is achieved with physiological haemodilution takes place in plasma volume expansion. In 1973 in an animal study Carey et al demonstrated in Twenty - four hours after haemorrhage, the most significant change was a reduction in hematocrit and whole blood viscosity [9].

It is the usual procedure to perform Hb levels on post-operative day 1 and there after patient will be discharged on post-operative day 3 after surgical wound inspection as early supported discharge is recommended by many evidence based guidelines [5, 10]. According to our finding it is important to do Hb levels on post op day 3 prior to discharge since the Hb level will drop even after post - op day 1. In a similar study Foss et al emphasized the value of frequent measurements of the levels of haemoglobin in order to avoid prolonged post-operative anaemia [2].

Similar to our findings Sagar et al also agreed that risk of blood transfusion had no association with age, delay to operation or duration of surgery [11] but in another study of 249 cases, patients aged 80 years and above as a group

		Patients without Blood Transfusion		Patients with Blood Transfusion		p-value
Mean Age		69.15 (SD = 29.5)		69.55 (SD = 8.6)		0.93 (> 0.05)
		number	Percentage (%)	number	Percentage (%)	
		49	71.01	20	28.99	
Sex	Males	13	18.84	4	5.80	0.79
	Females	36	52.17	16	23.19	
Fracture Type	Extracapsular	29	42.03	18	26.09	0.03
	Intra capsular	20	28.99	2	2.90	
Delay of admission	<48 Hours	47	68.12	16	23.19	0.09
	>48 Hours	2	2.90	4	5.80	
Delay of Surgery	<5 days	37	53.62	11	15.94	0.16
	>5days	12	17.39	9	13.04	
Blood group	A	13	18.84	4	5.80	0.34
	AB	3	4.35	3	4.35	
	B	13	18.84	8	11.59	
	O	20	28.99	5	7.25	
Surgeon	SHO	34	49.28	11	15.94	0.52
	SR	12	17.39	7	10.14	
	Consultant	3	4.35	2	2.90	
Diet	Vegan	1	1.45	2	2.90	0.27
	Semi Vege	3	4.35	2	2.90	
	Non vege	45	65.22	16	23.19	
Comorbidities	DM(-)	37	53.62	13	18.84	0.56
	DM(+)	12	17.39	7	10.14	
	HTN(-)	25	36.23	10	14.49	1.00
	HTN(+)	24	34.78	10	14.49	
	IHD(-)	43	62.32	17	24.64	1.00
	IHD(+)	6	8.70	3	4.35	
	Other(-)	34	49.28	12	17.39	0.83
	Other(+)	15	21.74	8	11.59	

Table 1 Risk factors for blood transfusions in surgical management of NOFF (SHO - Senior house officer, SR - Senior registrar, DM - Diabetes mellitus, HTN - Hypertension, IHD - Ischemic heart disease)

Mean drop of Hb and Hct		Paired t-test p value
Pre op Hb - Post op Day 1 Hb	1.062 (SE = 0.125, 95% CI = (0.807, 1.317))	< 0.05
Post op Day 1Hb- Post op Day 3 Hb	0.771 (SE = 0.105, 95% CI = (0.556, 0.984))	< 0.05
Pre op Hct - Post op Day 1 Hct	2.927 (SE = 0.391, 95% CI = (2.131, 3.722))	< 0.05
Post op Day 1Hct- Post op Day 3 Hct	2.202 (SE = 0.388, 95% CI = (1.411, 2.992))	< 0.05

Table 2. Significance of post-operative change in Hb and Hct levels. (Comparison of pre op with post op day 1 value, Post op day 1 with Post Op day 3 value)

were transfused significantly more blood than those aged less than 80 years [1].

NOFF are generally divided into two main groups. Those above the insertion of the capsule of the hip joint are termed intracapsular NOFF. Those below the insertion are extracapsular NOFF. Out of these two main types of neck of femur fractures, the extracapsular fractures were more prone for peri-operative blood transfusions than intracapsular fractures and many other studies have demonstrated the similar finding [1, 2, 11].

As the name denotes intracapsular fractures occur within the capsule where the capsule will prevent excessive bleeding from the fracture by forming an intracapsular haematoma, thus the personality of fracture itself will cause less peri fracture bleeding than extracapsular fractures. Similarly surgery for intracapsular fracture was either cannulated screw fixation with minimal soft tissue dissection or a hemiarthroplasty where the femoral head is replaced with an artificial metal head with lateral approach to the hip. In the latter the implant itself will act as a barrier for the medullary canal bleeding.

In contrast, extra-capsular fractures will have considerable risk of peri fracture bleeding as there is no barrier to restrict the expansion of hematoma as in intracapsular fractures. Also certain fracture subtypes e.g. Fractures with subtrochanteric extension or reverse oblique fractures are known to cause significant haemorrhage at the fracture site. Irrespective of the type (DHS / DCS) of implant surgery for extracapsular fractures will need significant soft tissue dissection and bone drilling for plate fixation. As the thigh is a region with relatively large compartments, post-surgical bleeding will be significant and concealed inside the tissue planes.

Conclusion

Post - operative Hb level should be reassessed on day 3 prior to discharge since the level continues to drop even on day 3. Post - op low Hb level is partly due to haemodilution by intraoperative intravenous fluids and subsequent intravascular volume expansion as evident by significant drop in Hct. Extra capsular fractures has a higher risk of blood transfusion than intracapsular FNOF.

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