Risk Factors of Blood Transfusion in Knee Arthroplasty

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Abstract

Background: The amount of blood transfusion after knee arthroplasty seem to vary in different reported study. We carried out a retrospective study to analysis pre-operative risk factors for blood transfusion in patient who underwent knee arthroplasty in our institution.

Methods: A retrospective study of 190 patients treated with 194 procedure (186 unilateral knee arthroplasty, 4 bilateral knee arthroplasty) from November 2014 to October 2015 was analyzed. A univariate analysis was performed to establish the relationship between all variables and the need for postoperative transfusion. Variables that were determined to have significant relationship were included in a multivariable analysis.

Results: The univariate analysis revealed a significant relationship between need for postoperative blood transfusion and preoperative hemoglobin levels, surgical technique, arthrotomy approach, DVT prophylaxis, surgical technique and surgeon experience. The multivariate analysis identified a significant relationship between need for transfusion and preoperative hemoglobin level and surgical technique. Patients with a preoperative hemoglobin less than 12 g/dL had a 5.1 times greater risk of having a transfusion than those with a hemoglobin level ≥ 12 g/dL. The surgical technique with computer assisted surgery had a 0.15 times lesser risk of having a transfusion than those with the conventional technique.

Conclusion: The preoperative hemoglobin level < 12 g/dL was shown to increase risk of the need for blood transfusion after knee arthroplasty, while computer assist surgery total knee arthroplasty was shown to decrease risk of blood transfusion. We suggested that patients with preoperative hemoglobin < 12 g/dL need to be crossmatching PRC in pre-operative steps.

Keywords: blood transfusion, transfusion, total knee arthroplasty, total knee replacement, TKA

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ปัจจัยเสี่ยงต่อการให้เลือดทดแทนในผู้ป่วยที่ได้รับการผ่าตัดเปลี่ยนข้อเข่าเทียม

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บทคัดย่อ

วัตถุประสงค์: ปริมาณการให้เลือดหลังการผ่าตัดเปลี่ยนข้อเข่าเทียมมีจำนวนที่แตกต่างกันในแต่ละงานวิจัย ทางทีมผู้วิจัยจึงทำการวิจัยนี้ขึ้นมาเพื่อศึกษาว่าปัจจัยใดบ้างที่ส่งผลต่อการได้รับเลือดหลังการผ่าตัดเปลี่ยนข้อเข่าเทียม ซึ่งจะนำผลที่ได้ไปใช้ในการเตรียมผู้ป่วยก่อนผ่าตัด ซึ่งจะเป็นการช่วยลดค่าใช้จ่าย ระยะเวลา และลดปริมาณการเตรียมเลือดในผู้ป่วยกลุ่มที่ไม่มีความจำเป็นในการได้รับเลือดหลังการผ่าตัดเปลี่ยนข้อเข่าเทียม

วิธีดำเนินการวิจัย: ศึกษาแบบข้อมูลแบบย้อนหลัง ในผู้ป่วยที่ได้รับการผ่าตัดเปลี่ยนข้อเข่าเทียม ที่โรงพยาบาลวชิรพยาบาล ตั้งแต่ช่วง พฤศจิกายน พ.ศ.2557 ถึง ตุลาคม 2558 จำนวน 190 ราย โดยบันทึกปัจจัยที่อาจส่งผลต่อการได้รับเลือดของผู้ป่วยในสมมติฐาน เก็บข้อมูลผู้ป่วยจากฐานข้อมูลคอมพิวเตอร์ และแฟ้มเวชระเบียนผู้ป่วย นำข้อมูลมาวิเคราะห์หาความสัมพันธ์โดยใช้สถิติการวิเคราะห์ความถดถอยพหุโลจิสติก พหุกลุ่ม (multiple logistic regression analysis)

ผลการวิจัย: การวิเคราะห์ปัจจัยที่ส่งผลต่อการให้เลือดทดแทนในผู้ป่วยที่ได้รับการผ่าตัดเปลี่ยนข้อเข่าเทียมโดยใช้สถิติการวิเคราะห์ความถดถอยพหุโลจิสติกแบบ univariable analysis พบว่าปัจจัยที่ส่งผลต่อการให้เลือด ทดแทนในผู้ป่วยที่ได้รับการผ่าตัดเปลี่ยนข้อเข่าอย่างมีนัยสำคัญทางสถิติ ได้แก่ ระดับฮีโมโกลบินก่อนผ่าตัด เทคนิคการผ่าตัด วิธีการเปิดผิวข้อ ระยะเวลาการผ่าตัด และประสบการณ์ของแพทย์ผู้ผ่าตัด แต่เมื่อนำปัจจัยเหล่านี้มาวิเคราะห์แบบความถดถอยพหุโลจิสติก พหุกลุ่มและควบคุมอิทธิพลของปัจจัยกวน พบว่า ผู้ป่วยที่ได้รับการผ่าตัดเปลี่ยนข้อเข่าเทียมที่มีระดับฮีโมโกลบินก่อนผ่าตัดน้อยกว่า 12 กรัมต่อเดซิลิตร จะมีโอกาสได้รับการให้เลือดทดแทนมากกว่ากลุ่มผู้ป่วยที่มีระดับฮีโมโกลบินก่อนผ่าตัดมากกว่าหรือเท่ากับ 12 กรัมต่อเดซิลิตรเป็น 5.10 เท่า ผู้ป่วยที่ได้รับการผ่าตัดเปลี่ยนข้อเข่าเทียมด้วยเทคนิคใช้คอมพิวเตอร์ช่วยผ่าตัดจะมีโอกาสได้รับการให้เลือดทดแทนน้อยกว่ากลุ่มผู้ป่วยที่ได้รับการผ่าตัดเปลี่ยนข้อเข่าเทียมด้วยเทคนิค มาตรฐานเป็น 0.15 เท่า

สรุป: ปัจจัยที่เพิ่มโอกาสได้รับเลือดหลังการผ่าตัดเปลี่ยนข้อเข่าเทียมคือ ผู้ป่วยที่มีค่าฮีโมโกลบินก่อนผ่าตัดน้อยกว่า 12 กรัมต่อเดซิลิตร และปัจจัยที่ช่วยลดโอกาสในการได้รับเลือดหลังผ่าตัดเปลี่ยนข้อเข่าเทียม คือการผ่าตัดเปลี่ยนข้อเข่าเทียมโดยใช้คอมพิวเตอร์ช่วยผ่าตัด

คำสำคัญ: การให้เลือด, การผ่าตัดเปลี่ยนข้อเข่าเทียม, ข้อเข่าเทียม

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Introduction

In current treatment of osteoarthritis (OA) of knee joint, total knee arthroplasty (TKA) are more popular than the past, due to high success rate and improvement of functional outcomes. However, amount of blood loss in unilateral TKA can up to 2,000 ml and 3,000 ml in bilateral TKA[1], that makes incidence of blood transfusion after TKA around the world is 4-46% or 15 million times per year[2].

The percentage of blood transfusion in TKA patients was 20% in our hospital. In preoperative preparation guideline of Vajira Hospital, we have to prepare pack red cell (PRC) for all patients. Statistic showed that in 80% of patients, the PRC was unnecessary and make more cost and more task for the nurses and blood bank officer.(reference)

Larocque, et al. reported that preoperative hemoglobin (Hb) level, type of arthroplasty, revision surgery, autologous donor status and patient weight are the risk factors for blood transfusion[3].

Jose A. Salido, et al. reported that preoperative Hb level < 13 g/dL increased 4-fold risk for blood transfusion than Hb 13-15 g/dL and increased 15-fold risk than Hb > 15 g/dL group[4].

Sara Moráis, et al. reported that preoperative Hb < 12 g/dl, ASA status III and nonobese BMI patients are risk factor for blood transfusion[5]. Whereas, there was no study about surgical technique, surgical approach, used of computer assist surgery and prosthetic type of TKA, that can be the factor of blood transfusion.

So we carried out this retrospective study for analyze the pre-operative risk factors of blood transfusion after TKA. If the risk factors were found, we will used it for revise pre-operative preparation guideline to be cross matching PRC only patient that have a risk factor, and this will reduce step for patient, cost and task for the officer in Vajira Hospital.

Methods

A retrospective analysis was conducted on data from inpatient medical record and Vajira Hospital database of 190 patients who underwent TKA at Orthopedic Department, Vajira Hospital between November 2014 to October 2015.

We include all patient who diagnosed primary or secondary OA knee, which failed in conservative treatment more than 6 months, indicated for unilateral or bilateral TKA, available preoperative Hb measured, and American Society of Anesthesiology categories I-III. We have no exclusion criterion in this study.

Data in this study was obtained from outpatient/inpatient medical record file and Vajira Hospital computer database of all patients who included in the study. Data that be the variable study were age, gender, weight, BMI, underlying diseases, ASA classification, diagnosis (primary, secondary), knee side, pre-operative Hb level(g/dl), type of anesthesia, surgical technique (conventional, computer assisted surgery, minimal invasive surgery), arthrotomy approach, tranexamic acid usage, initial intra-operative blood pressure, operative time, drainage used, post-operative VTE prophylaxis and surgeon experience.

All procedure were performed by orthopedists at Vajira Hospital. Surgeon who perform TKA more than 50 cases per year define as experienced surgeon. All patients were received same routine post-operative protocol and physical therapy TKA program of Vajira Hospital. Blood hemoglobin levels were obtained at ward after operation 4 hrs. and post-operative day 1. There was no criteria for blood transfusion in the period of data collected.

All statistical analysis were performed using SPSS Version 23. Patient demographic data using means and standard deviation. The relationship between blood transfusion with various variables were analyzed by chi-square test and fisher's exact test. The variables that related to blood transfusion were analyzed by multiple logistic regression analysis, and the variables that found to be insignificant in univariate analysis were excluded from the multivariable analysis. A P-value of < 0.05 was considered statistically significant for associated variables.

Result

A total of 190 patients were include in this study, 160 (84.2%) were females and 30 (15.6%) were males. Most of patients were in 60-69 years age group and BMI was in pre-obesity group (mean 27.09 +/-3.99 kg/m2). Patients with diagnosis of osteoarthritis right (Rt.) knee were 93, equal to left (Lt.) side and 4 were bilateral, mostly were primary osteoarthritis [181(95.3%)], secondary OA from inflamatory joint disease were 3(1.6%) and 6(.....%) were revision cases. Patients with pre-operative Hb < 12 g/dl were 58 equals to 12-13 g/dl and 74 were >13 g/dl. Every patient undergone TKA with regional anesthesia and tourniquet used before incision. Arthrotomy approach, 180(94.7%) patients were midvastus and 10 were medial parapatellar. Surgical technique, 78 patients were use conventional technique, 72 patients were used computer assist surgery (CAS) and 40 were used minimal invasive technique. Other demographic data of patients were show in table 1.

Table 1:
Characteristics of patients (n=190)

Variables	n	(%) ?
Age		
40-49	1	(0.5)
50-59	34	(17.9)
60-69	78	(41.1)
70-79	68	(35.8)
≥ 80	9	(4.7)
Gender		
Male	30	(15.8)
Female	160	(84.2)
Weight	65.50 ± 11.17	
BMI	27.09 ± 3.99	
Normal / pre-obesity (18.5-30)	144	(75.8)
Class I-II (30-40)	46	(24.2)
Underlying disease		
Hypertension	154	(81.1)
Diabetes mellitus	45	(23.7)
Dyslipidemia	87	(45.8)
Cardiomyopathy	19	(10.0)
Other Underlying disease	18	(9.5)
Knee side		
Right	93	(48.9)
Left	93	(48.9)
Both	4	(2.1)

Table 1:
Characteristics of patients (n=190) (Continued)

Variables	n	(%) ?
ASA Classification		
ASA Class I	12	(6.3)
ASA class II	157	(82.6)
ASA class III	21	(11.1)
Pre-operative Hb level (g/dl)	12.60 ± 1.22	
< 12	58	(30.5)
12-13	58	(30.5)
> 13	74	(38.9)
Surgical Technique		
Conventional	78	(41.1)
Computer assist surgery	72	(37.9)
Minimal invasive surgery	40	(21.1)
Arthrotomy approach		
Mid vastus	180	(94.7)
Medial parapatella	10	(5.3)
Tranexamic acid		
use	163	(85.8)
nonuse	27	(14.2)
Intra-operative systolic blood pressure (Initial)		
101-120 mmHg	18	(9.5)
121-140 mmHg	75	(39.5)
141-160 mmHg	81	(42.6)
161-180 mmHg	16	(8.4)

Table 1:
Characteristics of patients (n=190) (Continued)

Variables	n	(%) ?
Postoperative DVT prophylaxis		
No use	67	(35.3)
ASA	31	(16.3)
Apixaban	49	(25.8)
Dabigatran	43	(22.6)
Preoperative diagnosis		
Primary OA	181	(95.3)
Inflammatory OA	3	(1.6)
Revision TKA	6	(3.2)
Operative time		
< 1 Hour	20	(10.5)
1-2 Hours	161	(84.7)
2-3 Hours	9	(4.7)
Surgeon experience		
Yes	151	(79.5)
No	39	(20.5)
Use of drainage		
Yes	186	(97.9)
No	4	(2.1)
Blood transfusion		
No	140	(73.7)
Yes	50	(26.3)
1 unit	31	(16.3)
2 unit	19	(10.0)

Data are presented as n (%) or mean ± SD

We found that 50 (26.3%) of patients were need for blood transfusion (table 1). Analysis of the factors affecting blood transfusion was done using chi-square tests or fisher's exact tests, found that factors related to blood transfusion with statistically significant mostly was preoperative Hb level, follow by surgical techniques, arthrotomy approach, and surgeon experience respectively (Table 2).

Likewise, univariate logistic regression analysis found that factors related to blood transfusion after TKA with statistically significant were preoperative Hb < 12 g/dl (OR= 6.83, 95%CI: 3.36-13.87), CAS techniques (OR= 0.24, 95%CI: 0.11-0.56), medial parapatella approach (OR= 7.43, 95%CI: 1.84-30.00), operative time > 1 hr. (OR= 7.96, 95%CI: 1.00-59.06), post-operative VTE prophylaxis with Dabigatran (OR= 0.37, 95%CI: 0.14-0.97) and inexperienced surgeon (OR= 2.76, 95%CI: 1.32-5.80) (Table 3).

After control the influence of confounding factors and multiple logistic regression analysis was done, factors that still have statistically significant were pre-operative Hb level and surgical technique. We found that patients with pre-operative Hb level <12 g/dl have the risk of blood transfusion more than patients with Hb >12 g/dl for 5.1 times (OR_{adj}= 5.10, 95%CI: 2.26-11.48). Patients undergone CAS technique have risk of transfusion 0.15 times less than who with conventional technique (OR_{adj}= 0.15, 95%CI: 0.06-0.40). (Table 4)

Discussion

This study demonstrates that pre-operative Hb level < 12 g/dl increase risk of the need for blood transfusion after total knee arthroplasty. Similarly, several studies have shown the significant of pre-operative Hb level that influence on the required for blood transfusion in TKA[13,14].

Salido et al. demonstrated patients with preoperative Hb level less than 110 g/L had a 100% transfusion rate[14], and Pierson et al. found an increasing of preoperative Hb level was most effective in reducing transfusion rate[13]. We can strongly conclude that patients with preoperative Hb level < 12 g/dl may need for blood transfusion after TKA.

Table 2:

Factors associated with blood transfusion (n=190)

Factors	Blood transfusion				p-value
	Yes		No		
	n	%	n	%	
Age					
40-49	1	(100.0)	0	(0.0)	0.144*
50-59	6	(17.6)	28	(82.4)	
60-69	18	(23.1)	60	(76.9)	
70-79	21	(30.9)	47	(69.1)	
≥ 80	4	(44.4)	5	(55.6)	
Gender					
Male	6	(20.0)	24	(80.0)	0.392
Female	44	(27.5)	116	(72.5)	
BMI					
Normal/preobesity	41	(28.5)	103	(71.5)	0.232
Class I-II (30-40)	9	(19.6)	37	(80.4)	
Underlying disease					
Hypertension					
No	10	(27.8)	26	(72.2)	0.825
Yes	40	(26.0)	114	(74.0)	
Diabetes mellitus					
No	34	(23.4)	111	(76.6)	0.107
Yes	16	(35.6)	29	(64.4)	
Dyslipidemia					
No	26	(25.2)	77	(74.8)	0.715
Yes	24	(27.6)	63	(72.4)	
Cardiopathy					
No	43	(25.1)	128	(74.9)	0.272
Yes	7	(36.8)	12	(63.2)	
Other Underlying disease					
No	43	(25.0)	129	(75.0)	0.295*
Yes	7	(38.9)	11	(61.1)	
Knee side					
Right	24	(25.8)	69	(74.2)	0.537*
Left	24	(25.8)	69	(74.2)	
Both	2	(50.0)	2	(50.0)	

Table 2:

Factors associated with blood transfusion (n=190) (Continued)

Factors	Blood transfusion				p-value
	Yes		No		
	n	%	n	%	
ASA Classification					
ASA Class I	2	(16.7)	10	(83.3)	0.573
ASA class II	41	(26.1)	116	(73.9)	
ASA class III	7	(33.3)	14	(66.7)	
Pre-operative Hb level (g/dl)					
< 12	31	(53.4)	27	(46.6)	< 0.001
12-13	12	(20.7)	46	(79.3)	
> 13	7	(9.5)	67	(90.5)	
Surgical Technique					
Conventional	29	(37.2)	49	(62.8)	0.002
Computer assist	9	(12.5)	63	(87.5)	
Minimal invasive	12	(30.0)	28	(70.0)	
Arthrotomy approach					
Mid vastus	43	(23.9)	137	(76.1)	0.004*
Medial parapatella	7	(70.0)	3	(30.0)	
Tranexamic acid					
Use	40	(24.5)	123	(75.5)	0.172
nonuse	10	(37.0)	17	(63.0)	
Intra-operative systolic blood pressure (Initial)					
101-120 mmHg	5	(27.8)	13	(72.2)	0.634*
121-140 mmHg	17	(22.7)	58	(77.3)	
141-160 mmHg	25	(30.9)	56	(69.1)	
161-180 mmHg	3	(18.8)	13	(81.3)	
Postoperative DVT prophylaxis					
No use	23	(34.3)	44	(65.7)	0.060
ASA	11	(35.5)	20	(64.5)	
Apixaban	9	(18.4)	40	(81.6)	
Dabigatran	7	(16.3)	36	(83.7)	
Preoperative diagnosis					
Primary OA	48	(26.5)	133	(73.5)	1.000
Inflammatory OA	1	(33.3)	2	(66.7)	
Revision knee	1	(16.7)	5	(83.3)	

Table 2:

Factors associated with blood transfusion (n=190) (Continued)

Factors	Blood transfusion				p-value
	Yes		No		
	n	%	n	%	
Operative time					
< 1 Hour	1	(5.0)	19	(95.0)	0.066
1-2 Hours	47	(29.2)	114	(70.8)	
2-3 Hours	2	(22.2)	7	(77.8)	
Surgeon experience					
Yes	33	(21.9)	118	(78.1)	0.006
No	17	(43.6)	22	(56.4)	
Use of drainage					
Yes	49	(26.3)	137	(73.7)	1.000
No	1	(25.0)	3	(75.0)	

Table 3:

Univariable analysis for factors associated with blood transfusion by logistic regression analysis (n=190) (Continued)

Factors	Blood transfusion				OR	95%CI	p-value
	Yes		No				
	n	%	n	%			
Age							
< 60	7	(20.0)	28	(80.0)	1.00	Reference	
60-69	18	(23.1)	60	(76.9)	1.20	(0.45-3.20)	0.716
≥ 70	25	(32.5)	52	(67.5)	1.92	(0.74-5.00)	0.180
Gender							
Male	6	(20.0)	24	(80.0)	1.00	Reference	
Female	44	(27.5)	116	(72.5)	1.52	(0.58-3.96)	0.394
BMI							
Normal/pre-obesity (18.5-30)	41	(28.5)	103	(71.5)	1.00	Reference	
Class I-II (30-40)	9	(19.6)	37	(80.4)	0.61	(0.27-1.38)	0.235
Hypertension							
No	10	(27.8)	26	(72.2)	1.00	Reference	
Yes	40	(26.0)	114	(74.0)	0.91	(0.40-2.06)	0.825
Diabetes mellitus							
No	34	(23.4)	111	(76.6)	1.00	Reference	
Yes	16	(35.6)	29	(64.4)	1.80	(0.88-3.71)	0.110

Table 3:

Univariable analysis for factors associated with blood transfusion by logistic regression analysis (n=190) (Continued)

Factors	Blood transfusion				OR	95%CI	p-value
	Yes		No				
	n	%	n	%			
Dyslipidemia							
No	26	(25.2)	77	(74.8)	1.00	Reference	
Yes	24	(27.6)	63	(72.4)	1.13	(0.59-2.16)	0.715
Cardiopathy							
No	43	(25.1)	128	(74.9)	1.00	Reference	
Yes	7	(36.8)	12	(63.2)	1.74	(0.64-4.69)	0.277
Other Underlying disease							
No	43	(25.0)	129	(75.0)	1.00	Reference	
Yes	7	(38.9)	11	(61.1)	1.91	(0.70-5.23)	0.209
Knee side							
Right	24	(25.8)	69	(74.2)	1.00	Reference	
Left	24	(25.8)	69	(74.2)	1.00	(0.52-1.93)	1.000
Both	2	(50.0)	2	(50.0)	2.88	(0.38-21.55)	0.304
ASA Classification							
ASA Class I	2	(16.7)	10	(83.3)	1.00	Reference	
ASA class II	41	(26.1)	116	(73.9)	1.77	(0.37-8.41)	0.474
ASA class III	7	(33.3)	14	(66.7)	2.50	(0.43-14.66)	0.310
Pre-operative Hb level (g/dl)							
≥ 12	19	(14.4)	113	(85.6)	1.00	Reference	
< 12	31	(53.4)	27	(46.6)	6.83	(3.36-13.87)	< 0.001
Surgical Technique							
Conventional	29	(37.2)	49	(62.8)	1.00	Reference	
Computer assist surgery	9	(12.5)	63	(87.5)	0.24	(0.11-0.56)	0.001
Minimal invasive surgery	12	(30.0)	28	(70.0)	0.72	(0.32-1.64)	0.439
Arthrotomy approach							
Mid vastus	43	(23.9)	137	(76.1)	1.00	Reference	
Medial parapatella	7	(70.0)	3	(30.0)	7.43	(1.84-30.00)	0.005
Tranexamic acid							
use	40	(24.5)	123	(75.5)	1.00	Reference	
nonuse	10	(37.0)	17	(63.0)	1.81	(0.77-4.27)	0.176
Intraoperative systolic blood pressure (Initial)							
≤ 140 mmHg	22	(23.7)	71	(76.3)	1.00	Reference	
> 140 mmHg	28	(28.9)	69	(71.1)	1.31	(0.68-2.51)	0.416

Table 3:

Univariable analysis for factors associated with blood transfusion by logistic regression analysis (n=190) (Continued)

Factors	Blood transfusion				OR	95%CI	p-value
	Yes		No				
	n	%	n	%			
Postoperative DVT prophylaxis							
No use	23	(34.3)	44	(65.7)	1.00	Reference	
ASA	11	(35.5)	20	(64.5)	1.05	(0.43-2.57)	0.911
Apixaban	9	(18.4)	40	(81.6)	0.43	(0.18-1.04)	0.061
Dabigatran	7	(16.3)	36	(83.7)	0.37	(0.14-0.97)	0.042
Preoperative diagnosis							
Primary osteoarthritis knee	48	(26.5)	133	(73.5)	1.00	Reference	
Inflammatory osteoarthritis knee	1	(33.3)	2	(66.7)	1.39	(0.12-15.63)	0.792
Revision total knee arthroplasty	1	(16.7)	5	(83.3)	0.55	(0.06-4.86)	0.594
Operative time							
< 1 Hour	1	(5.0)	19	(95.0)	1.00	Reference	
≥ 1 Hours	49	(28.8)	121	(71.2)	7.69	(1.00-59.06)	0.050
Surgeon experience							
Yes	33	(21.9)	118	(78.1)	1.00	Reference	
No	17	(43.6)	22	(56.4)	2.76	(1.32-5.8)	0.007
Use of drainage							
Yes	49	(26.3)	137	(73.7)	1.00	Reference	
No	1	(25.0)	3	(75.0)	0.93	(0.10-9.17)	0.952

Table 4:

Multivariable analysis of factors associated with blood transfusion by multiple logistic regression analysis. (n=190)

Factors	Univariable analysis			Multivariable analysis		
	OR[1]	95%CI	p-value	OR_{adj} [2]	95%CI	p-value
Pre-operative Hb level (g/dl)						
≥ 12	1.00	Reference		1.00	Reference	
< 12	6.83	(3.36-13.87)	< 0.001	5.10	(2.26-11.48)	< 0.001
Surgical Technique						
Conventional	1.00	Reference		1.00	Reference	
Computer assist surgery	0.24	(0.11-0.56)	0.001	0.15	(0.06-0.4)	< 0.001
Minimal invasive surgery	0.72	(0.32-1.64)	0.439	0.60	(0.23-1.6)	0.306

Note: OR, Odds Ratio; ORadj, Adjusted Odds Ratio; CI, confident interval.

[1] Crude Odds Ratio estimated by Simple Logistic regression.

[2] Adjusted Odds Ratio estimated by Multiple Logistic regression (backward stepwise likelihood ratio method) adjusted for Pre-operative Hb level, and surgical Technique. Variable was included in multivariable model due to have p-value < 0.050 in univariable analysis.

"Computer-assisted surgery is highly recommended in TKR to save blood", conclusion by Conteduca F. from his prospective randomize control study. They found that calculated total blood loss of conventional TKA group and CAS-TKA group were difference at 297 ml with statistically significant ($p = 0.0283$)[19], but did not shown the result in blood transfusion. In this study, we found that CAS-TKA have risk of blood transfusion 0.15 times less than conventional technique. This result was corresponded to Conteduca F. So, patients who undergoing CAS-TKA may not need for pre-operative crossmatching PRC.

There are previous studies show that other factors associated with an increased need for blood transfusion include age >75 years, male gender, BMI <27 kg/cm2 and hypertension[16], but some study still not show. In this study, age, gender, BMI, ASA classification, hypertension are shown no statistically significant by using both chi-square test and logistic regression analysis. Gender have shown no statistically significant in this study (p-value 3.92) maybe due to low number of male patient and compare with female is 1:5(30/160), but some studies report in the same result, so author think that it may not associated to blood transfusion same as BMI and hypertension.

In present, many hospital, medical center used preoperative blood management program for increasing Hb level before TKA. The systematic review by Donat R. Spahn et al. demonstrated the used of iron- or erythropoietin-based preoperative blood management interventions reduced rate of transfusion from 11-48%[17]. This study found rate of blood transfusion after TKA at Vajira hospital is 26.3% in the time that we do not have official guideline for blood management. We believed rate of transfusion will be reduced if we use it. However, in post-operative period, level of Hb may not be the best criteria for blood transfusion. Tavares Cardozo et al. reported that reduced of Hb more than 20% may create clinical of tissue hypoperfusion in post-op TKA patients[18], but there is no result about functional outcome. So, the next interesting issue will be relation about blood loss, blood transfusion and functional outcomes.

If blood transfusion rate reduced, the need for pre-operative crossmatching for blood component will be reduced too. So, the study about cost, benefits or value of pre-operative crossmatching blood component in patients whom undergoing elective total knee arthroplasty would be done too.

Limitations of this study include retrospective study design, low number of patients and uncontrolled many factors. Low number of patients may did not allow further subgroup analysis and uncontrolled factors may influence the result but it is real clinical situations that clinicians have to encountered. However, one of the strengths of this study is that the investigation was perform in consecutive patients in an everyday clinical setting without selection bias.

Conclusion

The preoperative hemoglobin level < 12 g/dL was shown to increase risk of the need for blood transfusion after knee arthroplasty, while computer assist surgery was shown to decrease risk of blood transfusion. We suggest that patients with preoperative hemoglobin < 12 g/dL need to be crossmatching PRC in pre-operative steps, while patients with preoperative hemoglobin ≥ 12 g/dL and undergoing CAS-TKA were not necessary to crossmatching PRC before surgery.

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