Blood loss after coil embolization in patients with subarachnoid hemorrhage

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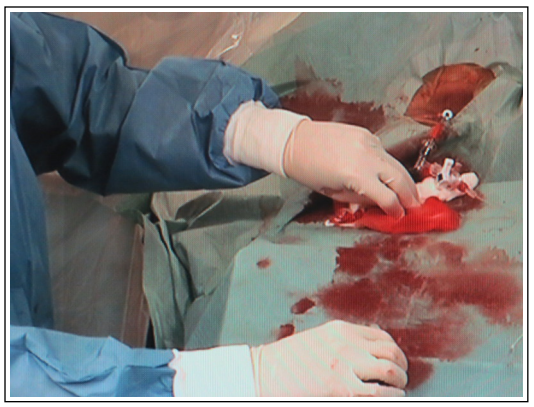

Introduction

Selection of two treatment modality, clipping by direct surgery or coil embolization by endovascular intervention, is a matter of debate to treat ruptured intracranial aneurysms in the recent neurosurgery. Generally, endovascular intervention is thought to be less invasive than direct surgery. Blood loss due to percutaneous cardiac intervention (PCI) was reported previously, but there has been no study that focuses on blood loss after coil embolization in patients with subarachnoid hemorrhage (SAH). The aim of this study was to elucidate blood loss after coil embolization and compare the loss with that of the patients who received direct surgery.

Methods

From 2010 to 2013, 203 patients with acute SAH who admitted to Kurashiki Central Hospital were retrospectively reviewed. Of these, 152 patients received clipping or coil embolization for a ruptured aneurysm (direct surgery 98, endovascular intervention 54). Patients' data including age, sex, WFNS grade, bleeding source, red blood cell count, hematocrit, hemoglobin, blood urea nitrogen (BUN), creatinine on admission and after the operation, red blood cell transfusion, and prognosis were collected from medical records.

Results

Coil embolization was performed significantly more in elderly cases (mean 68.3 vs 61.4, P=0.003) and to the posterior circulation aneurysms, than clipping. There was no significant difference in WFNS grade and Fisher CT group on admission, and postoperative symptomatic vasospasm. Hematocrit and hemoglobin on admission were significantly lower in coil embolization; however the changes between pre- and post-treatment did not show the difference between the two treatment modality (Figure 1). On the other hand, significantly greater difference was observed in BUN decline in direct surgery group compared to endovascular intervention, and serum creatinine was significantly elevated in endovascular group (P=0.003 and P=0.03, respectively, Figure 2). Of 54 patients who received coil embolization, 13 patients (24.1%) received red blood cell transfusion after the procedure. Modified Rankin scale on 3months after the onset was nonsignificant but better in direct surgery group (mean 2.86 vs 2.13, P=0.078).

Figure. Changes in the parameters during intervention for SAH.

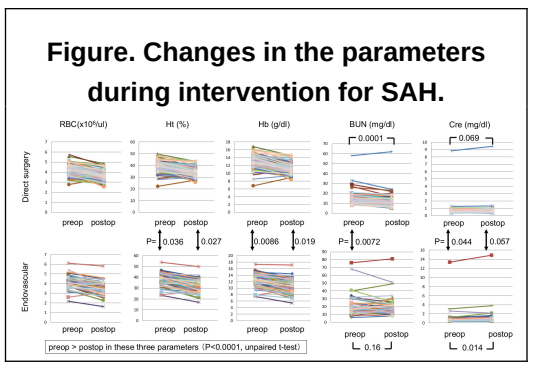

Table. Baseline characteristics and the results of this study.

	Direct Surgery n=98	Endovascular n=54	p
Age	61.3±13.1	68.3±14.7	0.003*
Male	28 (28.6%)	13 (28.9%)	0.6**
Anterior circulation	97	33	
Posterior circulation	1	18	<0.0001**
AVF	0	3	
WFNS grade			
1	29	15	0.38***
2	32	21	
3	8	1	
4	17	7	
5	12	10	
Fisher group			
1	5	0	0.37***
2	11	8	
3	65	37	
4	17	9	
⊿RBC	0.61±0.38	0.59±0.44	0.72*
⊿Ht	5.45±3.51	5.60±3.86	0.81*
⊿Hb	1.96±1.23	1.78±1.39	0.41*
⊿BUN	3.59±3.08	1.26±6.50	0.003*
⊿Cre	-0.03±0.14	-0.10±0.29	0.03*
TIMI hemorrhagic grade			ns
Major	0	1	
Minor	20	9	
Minimal	78	44	
Intraoperative rerupture	5 (5.1%)	2 (4.4%)	ns
Gastrointestinal bleeding	2 (2.0%)	0	ns
Transfusion during the op.	9 (9.1%)	0	0.057**
Transfusion after the op.	8 (8.2%)	13 (24.1%)	0.002**
DIND	18 (18.3%)	6 (13.3%)	0.35
mRS (average)	2.13	2.87	0.078***

⊿x=preoperative x − postoperative x. *unpaired t-test, **Fisher exact test, ***Wilcoxon Rank sum test
AVF: arteriovenous fistula, BUN: blood urea nitrogen, Cre: creatinine, DIND: delayed ischemic neurological deficit, Hb: hemoglobin, Ht: hematocrit, mRS: modified Rankin Scale, op.: operation, TIMI: Thrombolysis In Myocardial Infarction, WFNS: World Federation of Neurological Surgeons.

Discussion

This is the first report that showed the blood loss after the coil embolization for SAH. Red blood cell count, hematocrit and hemoglobin on admission are associated with mortality in SAH. Intraoperative and postoperative transfusions are associated with outcome and vasospasm after SAH, respectively. One report showed that high hemoglobin value predict good outcome. Blood loss or anemia after PCI was shown to increase complication and mortality rate.

In this paper, we showed that substantial blood loss was revealed after the endovascular intervention for SAH. Postoperative blood cell count, hemoglobin and hematocrit were significantly lower in endovascular group than in direct surgery group, possibly because of age. The amount of decrease was not statistically significant in these three parameters between the two groups. However, BUN was significantly decreased in direct surgery group, indicating overhydration during the operation. Indeed transfusion during the operation was performed in direct surgery group, overhydration might offset the hemoglobin increase by the transfusion during the operation. Therefore, the blood loss in endovascular group would be similar to the direct surgery group. TIMI hemorrhagic grade showed no difference between the two groups.

The outcome after SAH in the two groups might be explained by age and aneurysm location.

Past articles showed that 1-2g/dl decrease of hemoglobin and 5-15% of hematocrit was observed 24 hour after PCI. In this study the decrease in hemoglobin and hematocrit level after the intervention was 1.78g/dl and 5.6%, respectively, and was comparable to the past reports regarding PCI.

Conclusions

Significant amounts of blood were lost in the patients who received coil embolization after SAH. Blood count must be checked perioperatively not only during direct surgery but also during endovascular intervention in patients with SAH.

Learning Objectives

By the conclusion of this session, participants should be able to describe the importance of significant blood loss after coil embolization.

References

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