Incidence and Risk Factors of Perioperative Stroke in Thoracic Endovascular Aortic Repair (TEVAR) and Endovascular Aneurysm Repair (EVAR) in Songklanagarind Hospital

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Introduction

Perioperative stroke is defined by stroke occurred from start to 30 days after operation. Stroke has emerged as a complication of thoracic endovascular aortic repair (TEVAR) and endovascular aortic repair (EVAR). Identifying risk factors for TEVAR or EVAR related stroke is essential to minimize perioperative stroke.

Objective

To identify the risk factors of perioperative stroke in Thoracic endovascular aortic repair (TEVAR) or Endovascular aortic repair (EVAR) operations.

Materials and methods

This is retrospective 1:4, procedure-matched case control study enrolled all patients underwent TEVAR or EVAR operations from January 2008 to June 2015. Patients' demographic data and clinical characteristics during pre-, intra-, and post-operative periods were analyzed by descriptive statistics to identify factors associated with perioperative stroke. Independent risks for were further determined by multivariate analysis.

Results

There were 774 patients included. Perioperative stroke occurred in 17 cases (2.2%). Nine patients (53%) had strokes within 24 hours post operation. The overall in-hospital mortality rate was 29%. Independent risk factors of perioperative stroke were previous stroke or TIA (OR 9.19; 95%CI 1.56-54.19, $p = 0.014$), abnormal radiological findings of aorta (OR 15.05; 95%CI 2.54-89.22, $p = 0.003$), prolong operation time more than 390 minutes (OR 13.9; 95%CI 2.67-72.28, $p < 0.001$), occurrence of intraoperative hypotension more than 4 times (OR 11.98; 95%CI 2.69-53.31, $p = 0.001$), average duration of hypotension more than 10 minutes (OR 26.09; 95%CI 5.07-134.4, $p < 0.001$), blood loss more than 600 mL (OR 13.9; 95%CI 2.67-72.28, $p = 0.002$), and post-operative hyperglycemia (OR 9.6; 95%CI 1.8-51.19, $p = 0.008$).

Table 1. Risk factors associated with perioperative stroke by univariate analysis.

	Non stroke (n,%)		Stroke (n,%)		P value
	N=68		N=17		
Demographic data					
Sex: male (%)	51	(75)	14	(82)	0.751 ₁
Age: mean (SD)	66.9	(12.1)	71.1	(7.1)	0.182 ₂
BMI: median (Q1,Q3)	22.9	(19.2,26.6)	20.9	(18.1,23.7)	0.039 ₂
Preoperative risk					
Hypertension	53	(78)	13	(76)	1 ₁
Diabetes mellitus	8	(12)	3	(17)	0.686 ₁
Dyslipidemia	35	(52)	10	(59)	0.786 ₁
Renal insufficiency	29	(42)	5	(30)	0.472 ₁
Peripheral arterial disease	2	(11)	1	(10)	1 ₁
Coronary artery disease	6	(9)	3	(18)	0.070 ₁
Cardiac arrhythmia	10	(15)	2	(12)	1 ₁
Previous stroke or TIA	6	(9)	5	(30)	0.039 ₁
Antiplatelet used	31	(45)	12	(70)	0.116 ₁
Discontinue antiplatelet	23	(70)	9	(75)	1 ₁
Antihyperlipidemic drug	39	(57)	10	(59)	1 ₁
Antihypertensive drug	51	(75)	15	(82)	0.338 ₁
Alcohol	10	(15)	4	(33)	0.208 ₁
Smoking	29	(42)	8	(57)	0.485 ₁
Previous cardiac Surgery	9	(13)	2	(12)	1 ₁
Preoperative inotropic drug	5	(7)	1	(6)	1 ₁
Systolic blood pressure: median (Q1, Q3)	130	(120,140)	118	(111,120)	0.023 ₂
Hemoglobin	11.6	(9.7,13.5)	11.6	(9.8,13.4)	0.909 ₂
Platelet [$\times 10^3$] : median (Q1, Q3)	222	(169,276.5)	186	(168,227)	0.149 ₂
PT INR: median (Q1, Q3)	1.1	(1.1,1.1)	1	(1.1,1.2)	0.429 ₂
Abnormal aortic imaging ^c	28	(41)	14	(87)	0.002 ₃
Intraoperative risk factors					
Surgeon					
No.1	17	(25)	7	(41)	0.451 ₁
No.2	16	(24)	5	(29)	
No.3	16	(24)	2	(13)	
No.4	19	(27)	3	(17)	
Operation					
TEVAR	32	(47)	8	(47)	1 ₁
EVAR	36	(53)	9	(53)	
Emergency surgery	19	(29)	4	(24)	
Type of Anesthesia					
Inhalation	57	(84)	15	(88)	0.451 ₁
TCI	10	(14)	1	(6)	
TIVA	1	(2)	1	(6)	
Operative time (min; median (Q1, Q3))	165	(125,229)	420	(150,570)	0.003 ₂
Frequency of hypotension; median (Q1, Q3)	1	(0,3)	5	(2,6)	<0.001 ₂
Duration of hypotension; median (Q1, Q3)	2	(0,5)	20	(5,20)	<0.001 ₂
Blood loss; median (Q1, Q3)	200	(87.5,300)	1000	(250,2500)	<0.001 ₂
Hyperglycemia [Blood sugar > 250 mg%]	1	(2)	2	(12)	0.101 ₃
Cardiac arrhythmia	2	(4)	1	(6)	0.493 ₃
Post-operative risk					
Hypotension	4	(6)	2	(12)	0.407 ₃
Cardiac arrhythmia	0	(0)	5	(30)	
Hyperglycemia ^a	4	(6)	7	(42)	
Respiratory failure	18	(26)	27	(59)	0.024 ₃

1. Fisher's exact test, 2. Unpaired t test, 3. Chi-square test, 4. Ranksum test, ; statistic significant with $p < 0.05$.

^a p value < 0.05, ^b p value < 0.01, ^c p value < 0.001.

^c Calcified wall, porcelain, thrombosis and atherosclerosis of aorta

Fig.1 TEVAR and EVAR in Songklanagarind Hospital

Table 2. Risk factors for perioperative stroke by multiple logistic analysis.

Risk factor	Crude OR (95%CI)	Adj. OR (95%CI)	p value
Previous stroke/TIA	4.7 (1.22, 18.1)	9.19 (1.56, 54.19)	0.014
Abnormal aortic imaging	10 (2.11, 47.5)	15.05 (2.54, 89.22)	0.003
Duration of surgery $\square$ 390 min	11.62 (3.12, 43.33)	13.9 (2.67, 72.28)	< 0.001
Frequency of hypotension $\square$ 4	9.64 (2.81, 33.08)	11.98 (2.69, 53.31)	0.001
Duration of hypotension $\square$ 10 min	35.2 (8.16, 151.9)	26.09 (5.07, 134.14)	< 0.001
Blood loss $\square$ 600 mL	11.62 (3.12, 43.33)	13.9 (2.67, 72.28)	0.002
Post-operative hyperglycemia	9.45 (2.26, 39.5)	9.6 (1.8, 51.19)	0.008

Conclusion

Though stroke complicated with TEVAR and EVAR is uncommon, it is associated with a high mortality. The recognition of the perioperative stroke risks will facilitate early prevention of the risks properly.

References

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