

SUPERFICIALIZATION OF BRACHIAL ARTERY IS ASSOCIATED WITH BETTER SURVIVAL COMPARED TO TUNNELED CENTRAL VENOUS CATHETER PLACEMENT IN HEMODIALYSIS PATIENTS WITH HEART FAILURE

Keywords: Hemodialysis, Vascular access, Heart failure

Kaneyasu Nakagawa¹, Yusuke Kuroki¹, Yushi Uchida¹, Hokuto Arase¹
Yuta Matsukuma², Kensuke Izumaru¹, Koji Mitsuiki¹

¹Division of Nephrology and Dialysis Center, Japanese Red Cross Fukuoka Hospital, Fukuoka, Japan

²Department of Medicine and Clinical Science, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan

Backgrounds

✓ **Superficialization of the brachial artery (SBA)** is an alternative vascular access (VA) applicable to hemodialysis (HD) patients with heart failure (HF)¹.

✓ **Tunneled central vein catheter (tCVC)** placement is recommended in end-stage renal disease patients with HF (Ejection fraction < 30% or New York Heart Association (NYHA) functional class III-IV) at HD inception².

✓ The use of central venous catheters for HD is associated with higher mortality compared to arteriovenous fistula³. The mortality risk of SBA usage for dialysis is uncertain.

Objectives

The aim of our investigation is to compare mortality risk between SBA and tCVC placement in HD patients with HF.

Methods

Design: Retrospective follow-up study

Population: CKD patients with HF who underwent SBA or tCVC placement at our center for the first time between April 2004 and March 2014

The operation indication includes one or more of the followings.

- (1) Ejection fraction < 40%
- (2) History of severe ischemic heart disease
- (3) Severe heart valvular disease
- (4) NYHA functional class III-IV

return vein(+) → SBA return vein(-) → tCVC

Follow up: Up to December 2015

Outcome: All-cause mortality

Statistical analyses: The impact of VA modalities on all-cause mortality was examined using a Cox regression model with propensity score-based adjustments.



Results

Table I Baseline characteristics of subjects according to the VA group

	Total Cohort (n=61)			Propensity score-matched cohort (n=36)		
	SBA (n=37)	tCVC (n=24)	P value	SBA (n=18)	tCVC (n=18)	P value
Age(years)	68.6(11.8)	71.7(10.6)	0.29	69.1(12.7)	70.7(11.6)	0.7
Male	81	54.2	0.02	66.7	72.2	0.72
BMI(kg/m ²)	20.6(3.6)	21.3(5.0)	0.53	19.6(3.8)	21.3(5.2)	0.28
Cigarette smoking	58.3	29.2	0.027	44.4	38.9	0.74
HD vintage(years)	0(0-4)	2.5(0-9.8)	0.10	0(0-7)	5(0-11.2)	0.12
Ejection Fraction (%)	38.7(14.1)	40.9(12.7)	0.56	42.1(13.6)	39.6(13.9)	0.58
NYHA functional class IV	13.5	41.7	0.013	22.2	22.2	1
Hemoglobin (g/dl)	10.2(1.7)	9.8(1.6)	0.36	10.0(1.7)	10.0(1.7)	0.95
Albumin (g/dl)	3.3(0.4)	3.1(0.5)	0.18	3.2(0.5)	3.2(0.4)	0.94
CRP(mg/dl)	0.46(0.1-2.1)	0.90(1.3-2.4)	0.18	2.1(3.3)	1.5(2.1)	0.75
Diabetic nephropathy	32.4	45.8	0.29	33.3	38.9	0.73
Ischemic heart disease (%)	51.4	75	0.065	27.8	72.2	0.007
Cerebrovascular disease (%)	8.1	29.2	0.03	0	33.3	0.007
Peripheral vascular disease (%)	18.9	41.7	0.051	22.2	44.4	0.16

Values are given as the mean (standard deviation), median (interquartile range) or percentage.

The propensity for tCVC placement was determined by logistic regression analysis using the following variables: age, sex, diabetic nephropathy, New York Heart Association(NYHA) functional class IV, albumin, C reactive protein(CRP)

During the follow-up period (median 2.2 years), 18 patients died in both groups.

Table II Univariate and multivariate analysis of risk factors associated with all-cause mortality in the total cohort(n=61)

	Univariate analysis		Multivariate analysis	
	HR (95% CI)	P-value	HR (95% CI)	P-value
Age (1 year increase)	1.03 (0.99 - 1.07)	0.056	1.03 (0.99 - 1.07)	0.076
Male (vs. female)	1.44 (0.69 - 3.40)	0.35	3.46 (1.46 - 9.17)	0.004
BMI (1 kg/m ² increase)	0.98 (0.07 - 5.70)	0.73		
HD vintage (1 year increase)	1.05 (0.99 - 1.10)	0.054		
Ejection fraction ≥40% (vs. <40%)	1.8 (0.93 - 3.52)	0.08		
NYHA functional class IV (vs. I-III)	3.66 (1.67 - 7.59)	0.0018	3.18 (1.31 - 7.70)	0.011
Hemoglobin (1 g/dL increase)	0.79 (0.62 - 0.98)	0.038	0.87 (0.68 - 1.10)	0.26
Albumin (1 g/dL increase)	0.67 (0.31 - 1.46)	0.31		
CRP (1 mg/dL increase)	1.1 (0.98 - 1.21)	0.096		
Diabetic nephropathy (vs. no)	0.76 (0.36 - 1.50)	0.34		
Ischemic heart disease (vs. no)	1.18 (0.63 - 2.40)	0.68		
Cerebrovascular disease (vs. no)	1.22 (0.49 - 2.75)	0.66		
Peripheral vascular disease (vs. no)	1.34 (0.64 - 2.68)	0.42		
tCVC placement (vs. SBA)	3.58 (1.78 - 7.22)	<0.001	3.39 (1.60 - 7.16)	0.002

HR, Hazard ratio; CI, Confidence interval

Fig. 1 Kaplan-Meier analysis of survival comparing SBA group and tCVC group in the total cohort

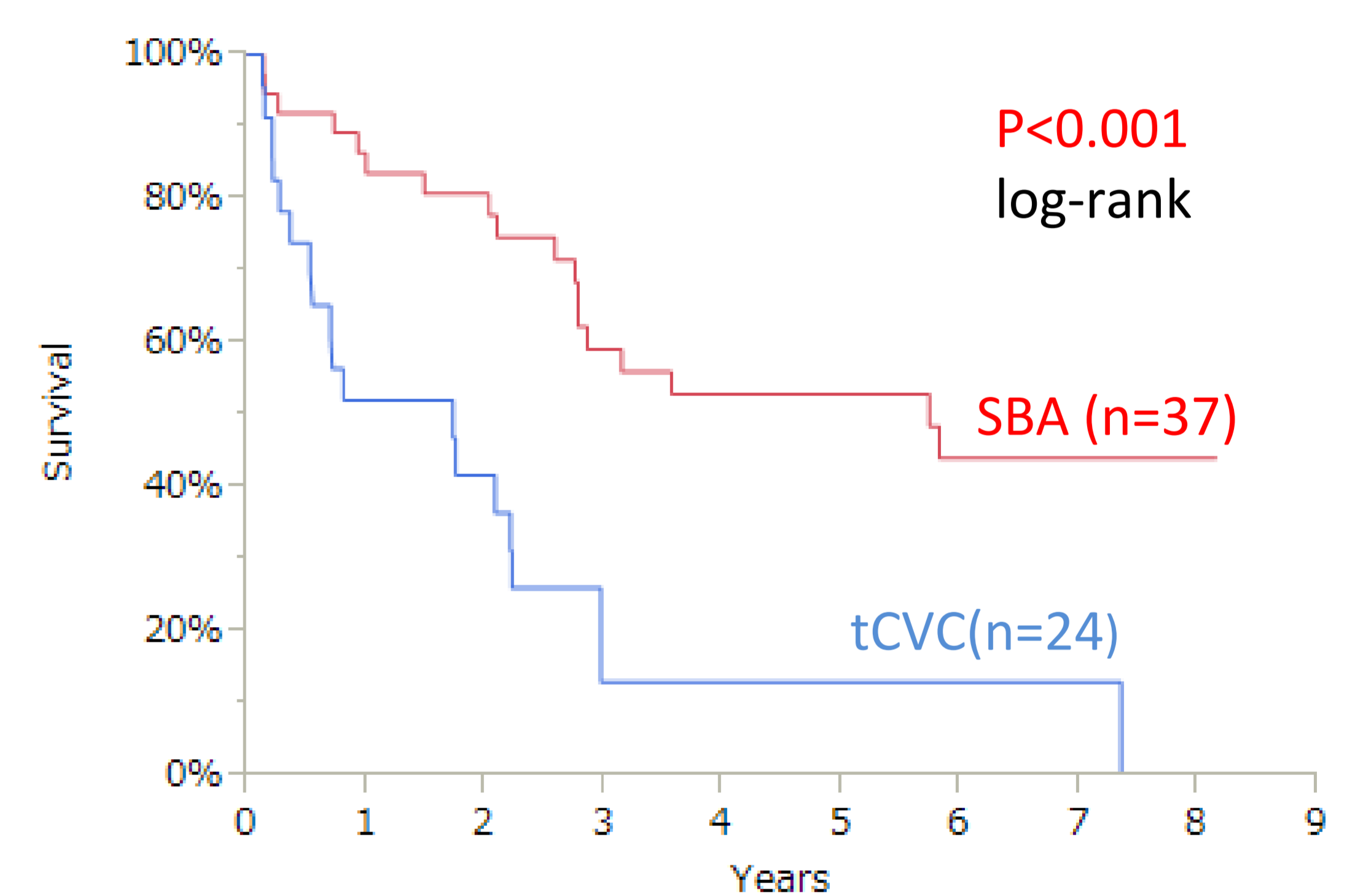


Fig. 2 Kaplan-Meier analysis of survival comparing SBA group and tCVC group in the propensity score-matched cohort

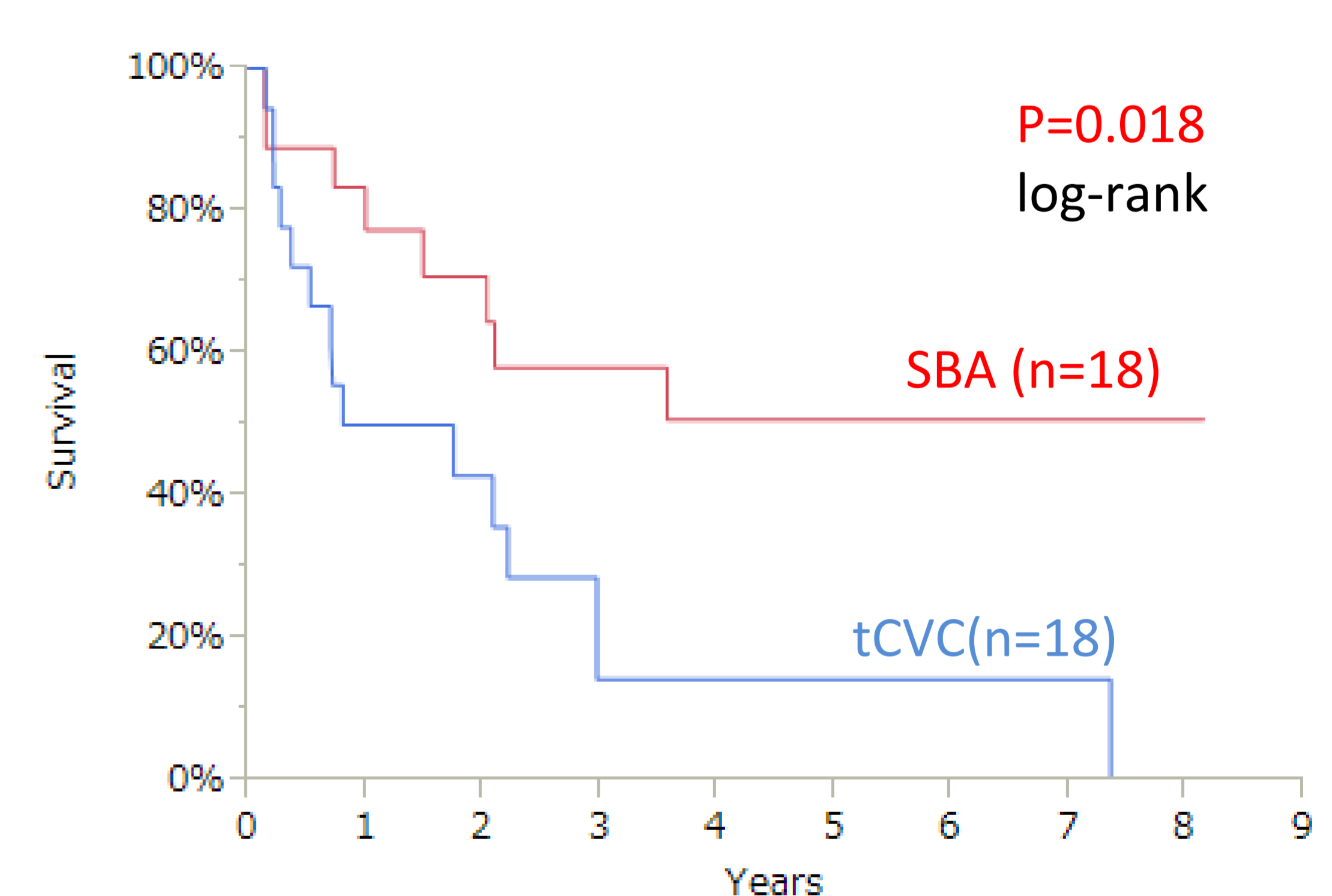


Table III

Hazard ratios for mortality with tCVC placement in HD patients with HF, derived by propensity score methods and conventional Cox regression model

Model	Method	HR (95%CI)	P-value
1	Matched by propensity score	4.0 (1.1 - 14.2)	0.003
2	Stratified by propensity score	2.69 (1.15 - 6.28)	0.022
3	Adjusted for propensity score	2.84 (1.28 - 6.31)	0.010
4	Conventional multivariable Cox regression	3.39 (1.60 - 7.16)	0.002

HR, Hazard ratio; CI, Confidence interval

Conclusions

The results of the current study revealed that the SBA group had a more favorable prognosis than in the tCVC placement group among HD patients with HF. SBA could be an alternative option in HD patients with HF.

References

- 1) Nakamura T: Superficialization of brachial artery as effective alternative vascular access, J Vasc Surg. 2014
- 2) Ramon RT: Permanent arteriovenous fistula or catheter dialysis for heart failure patients, J Vasc Access. 2016
- 3) Brad CA et al: Type of Vascular Access and Survival among Incident Hemodialysis Patients, J Am Soc Nephrol, 2006