TREATMENT OF ARTERIOVENOUS FISTULA STENOSIS ACCORDING TO ULTRASOUND MORPHOLOGY

Ru Yu TAN[1], Hiu Yu LEE[1] , Davina LIE[1], Suh Chien PANG[1], Alvin TNG[1], Chee Wooi TAN[1], Kay Yuan CHONG[2], Kiang Hiong TAY[3], Tze Tec CHONG[4], Edward CHOKE[5], Jackie HO[6], Chieh Suai TAN[1]

[1] Department of Renal Medicine, Singapore General Hospital; [2] Division of Medicine, Singapore General Hospital; [3], Department of Vascular and Interventional Radiology; [4] Department of Vascular Surgery, Singapore General Hospital; [5] Department of General Surgery, Sengkang General Hospital; [6] Department of Cardiac, Thoracic and Vascular Surgery, National University Heart Centre

Background

Drug-coated balloons (DCBs) has emerged as a new endovascular treatment for arteriovenous fistula (AVF) stenosis for their ability to combat neointimal hyperplasia (NIH) and improve target lesion primary patency rates (TLPP). However, there have been inconsistencies in benefits of DCB in clinical trials to date. We postulate that stenosis with neointimal hyperplasia seen on ultrasound scan will respond better to anti-proliferative effect of DCB compared to constrictive stenosis treated with DCB versus plain old balloon angioplasty (POBA).

Methods

Fifty-four patients who underwent percutaneous transluminal angioplasty (PTA) were followed-up prospectively with duplex ultrasonography (DUS) of the AVF at 3-, 6-, and 12-months. All stenotic lesions were recorded and the outer (A) and inner (B) diameters of the narrowest segment categorized were measured and intimal hyperplasia rate (%) was determined by [(A – B)/A x 100%). Lesions with intimal hyperplasia rate of ≥ 50% were classified as NIH while those < 50% were classified as constrictive stenosis (CS). The patients were followed-up until a repeat intervention was performed based on clinical indications. TLPP of the lesions treated with DCB vs POBA were analysed.

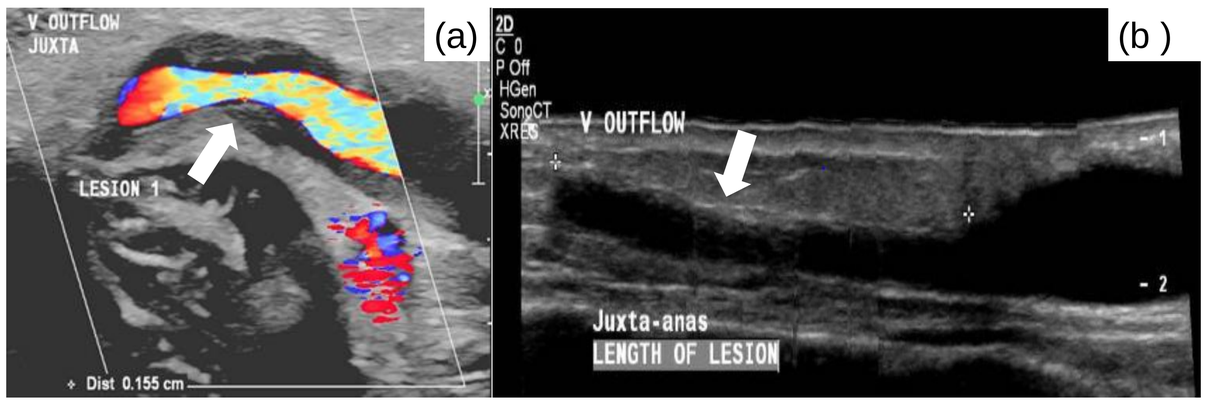

Figure 1. Ultrasound morphology of stenotic lesions: (a) neointimal hyperplasia, (b) constrictive stenosis

Results

Table 1. Baseline demographic of study population

Demographics	Mean (standard deviation) or Median (25th ,75th percentile)
Age, years	64.9 (9.4)
Male, n (%)	37 (68.5)
Race, n (%)	
Chinese	40 (74.1)
Malay	11 (20.4)
Indian	2 (3.7)
Others	1 (1.9)
Cause of ESRD, n (%)	
Diabetes mellitus	36 (66.7)
Chronic glomerulonephritis	11 (20.4)
Hypertension	4 (7.4)
Polycystic kidney disease	1 (1.9)
Others	2 (3.7)
AVF Type, n (%)	
Radiocephalic	34 (64)
Brachiocephalic	14 (25.9)
Brachiobasilic	5 (9.3)
Ulnabasilic	1 (1.9)
AVF vintage, months	30 (19, 70)
Antiplatelets use, n (%)	
Aspirin	30 (55.6)
Clopidogrel	6 (11.1)
Both	4 (7.4)
Anticoagulants use, n (%)	5 (9.3)

Table 2. Characteristics of lesions

Lesion characteristics, n (%)	All	NIH (n = 57)	CS (n = 48)
Inflow artery	1 (1)	1 (1.8)	0
Arteriovenous anastomosis	13 (12.4)	8 (14)	5 (10.4)
Juxta-anastomosis	45 (42.9)	30 (52.6)	15 (31.3)
Cannulation zone	16 (15.2)	4 (7)	12 (25)
Distal outflow	18 (17.1)	9 (15.8)	9 (18.8)
Cephalic arch	8 (7.6)	2 (3.5)	6 (12.5)
Basilic vein swing zone	4 (3.8)	3 (5.3)	1 (2.1)

Table 3. Target lesions primary patency according to ultrasound morphology

	ALL			NIH			CS		
	POBA	DCB	P-value	POBA	DCB	P-value	POBA	DCB	P-value
N	62	43		27	30		35	13	
Overall TLPP, days	203±82	357±236	< 0.01	232 ± 212	361 ± 242	0.04	181± 155	348 ± 232	< 0.01
3-month TLPP, n(%)	51 (82)	40 (93)	0.15	25 (92.6)	27 (90)	0.73	26 (74.3)	13 (100)	0.04
6-months TLPP, n(%)	17 (27)	33 (77)	< 0.01	9 (33.3)	21 (70)	< 0.01	8 (22.9)	12 (92.3)	< 0.01

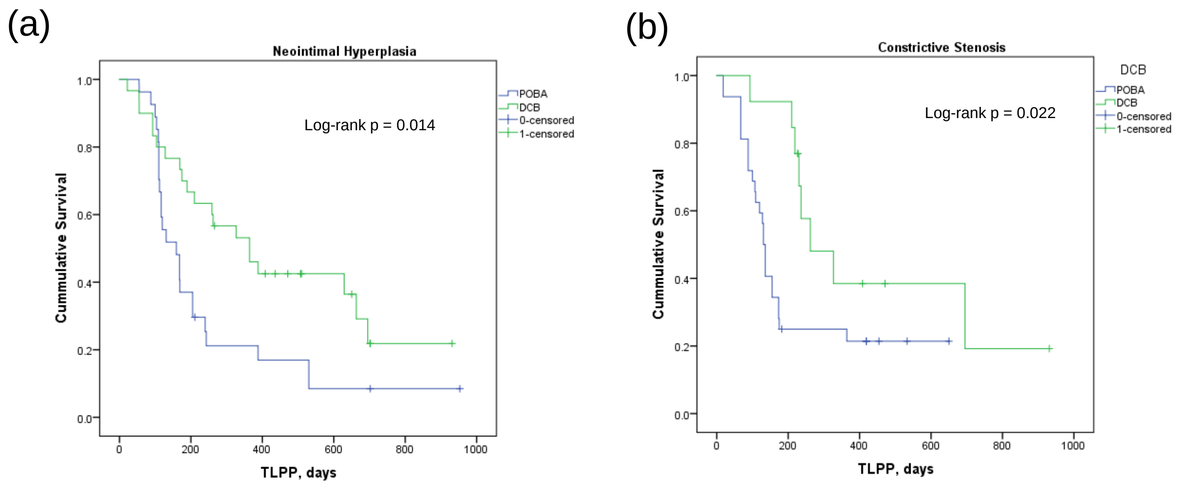

Figure 2. Kaplan-Meier analysis of DCB vs POBA for lesions with: (a) neointimal hyperplasia (b) constrictive stenosis

Conclusions

The study supports the preferential use of DCB over POBA for treating stenosis of NIH and constrictive on ultrasound morphology in dysfunctional AVF for superior target lesion primary patency at 6-month.

References:

1. Yamamoto Y, Nakamura J, Nakayama Y, et al. Relationships between the outcomes of stent placement and the properties of arteriovenous graft outflow vein stenotic lesions. J Vasc Access. 2012;13:426-431.
2. Roy-Chaudhury P, Sukhatme V, Cheung A. Hemodialysis vascular access dysfunction: a cellular and molecular viewpoint. J Am Soc Nephrol. 2006;17:1112-1127
3. Suemitsu K, Shiraki T, Iida O et al. Impact of lesion morphology on durability after angioplasty of failed arteriovenous fistulas in hemodialysis patients. J Endovasc Ther. 2018 Oct;25(5):649-654.

SingHealth DukeNUS ACADEMIC MEDICAL CENTRE

PATIENTS. AT THE HEART OF ALL WE DO.®

Singapore General Hospital · Changi General Hospital · Sengkang General Hospital · KK Women's and Children's Hospital · National Cancer Centre Singapore · National Dental Centre Singapore · National Heart Centre Singapore · National Neuroscience Institute · Singapore National Eye Centre · SingHealth Community Hospitals · Polyclinics SingHealth