How to Utilize FFR and IVUS in Non-LM Bifurcation PCI?

Bon-Kwon Koo, MD, PhD

Seoul National University Hospital, Seoul, Korea



SNUH Seoul National University Hospital





FFR/IVUS-guided PCI for complex lesions can improve outcomes!

Amongst 2, 2011 Jan WHITE HELP

Impact of intravascular ultrasound guidance on long-term clinical outcomes in patients treated with drug-eluting stent for bifurcation lesions: data from a Korean multicenter bifurcation registry.

Kenudik Hannadek Halmid Deald, Yannudik Chandek Hahnudik Generaldik Hendelik Senudik Yanaudik Dealahik Tarkular Beneratik Carkular area Y

Division of Cardiology, Beveralitz: Cardiovascular Hanplat, Yurisel'University Catlege of Medicine, Benal, Roma

Abstract

BACKGROUND: although introvescular ultrasound (MUS) has been widely used for complex lessins during convery intervention, MUS for strating at follocition lesions lies not been sufficiently assessed. The sam of this study was to investigate the arguet of WSS guidance on long-term clinical outcomes during their extension which CES is regularized for this study.

METHODS: the Korean multicenter tratecotor registry inted 1,000 patients with non-left man de novo-tritegrates inscorn who underweet DES empandation between January 2004 and June 2000. Using progremby score matching with chrical and ampographic characteristics, 467 patients with 1/US guidence and AI7 patients with support with who groups. The support of the set of the groups.

REBUT: This basefulle checkel and analysignaphic characteristics were well matched and showed in the significant differences between the 2 props. Twosteril bechangle and lineal locking balloorsing anglopianty were more terguedly performed in the XVIS guided group. Macmail shell diameters at both the main vessel and the side banch were larger in the XVIS-guided group. Persprovabular chainse kill elevation (\sim 1 mmer of rapper normal limit) was bequeitly observed in the anglography-guided group. The incidence of death or nyocardial atlanction was significantly lower in the 7VISguided group compared to the anglography-guided group (1.0% vs. 7.0%, log zerik tent P = 03, hazard ratio 0.44, 95% CI 0.12-0.86, Cox model P = 0.44, 95% CI 0.12-0.8

CONCLUSIONS: Intravencular utrasound guidance during DE5 implementation at bifurcation leaves may be helpful to improve long-term clinical outcomes by reducing the occurrence of death or myocandial inflatchion.

Long-Term Outcomes of Intravascular Ultrasound-Guided Stenting in Coronary Bifurcation Lesions

Sung-Hwan Kim, MD^a, Young-Hak Kim, MD, PhD^a, Soo-Jin Kang, MD, PhD^a, Duk-Woo Park, MD, PhD^a, Seung-Whan Lee, MD, PhD^a, Cheol Whan Lee, MD, PhD^a, Myeong-Ki Hong, MD, PhD^a, Sang-Sig Cheong, MD, PhD^b, Jae-Joong Kim, MD, PhD^a, Seong-Wook Park, MD, PhD^a, and Seung-Jung Park, MD, PhD^{a,*}

Stenting for bifurcation lesions is still challenging, and the effect of intravascular ultrasound (IVUS) guidance on long-term outcomes has not been evaluated. We assessed the long-term outcomes of IVUS-guided stenting in bifurcation lesions. We evaluated 758 patients with de novo nonleft main coronary bifurcation lesions who underwent stent implantation from January 1998 to February 2006. We compared the adverse outcomes (i.e., death, stent thrombosis, and target lesion revascularization) within 4 years, after adjustment using a multivariate Cox proportional hazard model and propensity scoring. IVUS-guided stenting significantly reduced the long-term all-cause mortality (hazard ratio [HR] 0.31, 95% confidence interval [CI] 0.13 to 0.74, p = 0.008) in the total population and in the patients receiving drug-eluting stents (DESs) (HR 0.24, 95% CI 0.06 to 0.86, p = 0.03), but not in the patients receiving bare metal stents (HR 0.41, 95% CI 0.13 to 1.26, p = 0.12). IVUS-guided stenting had no effect on the rate of stent thrombosis (HR 0.48, 95% CI 0.16 to 1.43, p = 0.19) or target lesion revascularization (HR 1.47, 95% CI 0.79 to 2.71, p = 0.21). In patients receiving DESs, however, IVUS guidance reduced the development of very late stent thrombosis (0.4% vs 2.8%, p = 0.03, log-rank test). In conclusion, in patients receiving DESs, IVUS-guided stenting for treatment of bifurcation lesions significantly reduced the 4-year mortality compared to conventional angiographically guided stenting. In addition, IVUS guidance reduced the development of very late stent thrombosis in patients receiving DESs. © 2010 Elsevier Inc. All rights reserved. (Am J Cardiol 2010;106:612-618)



ESTABLISHED IN 1812

JAN UARY 15, 2009

VOL. 300 NO. 3

Fractional Flow Reserve versus Angiography for Guiding Percutaneous Coronary Intervention

Pim A.L. Tonino, M.D., Bernard De Bruyne, M.D., Ph.D., Nico H.J. Pijls, M.D., Ph.D., Uwe Siebert, M.D., M.P.H., Sc.D., Fumiaki Ikeno, M.D., Marcel van 't Veer, M.Sc., Volker Klauss, M.D., Ph.D., Ganesh Manoharan, M.D., Thomas Engstrøm, M.D., Ph.D., Keith G, Oldroyd, M.D., Peter N, Ver Lee, M.D., Philip A. MacCarthy, M.D., Ph.D., and William F. Fearon, M.D., for the FAME Study Investigators®







Bifurcations are complex!

















Practical use of IVUS and FFR in non-LM bifurcation PCI

- Pre-intervention
- After main branch stent implantation
- After side branch balloon angioplasty
- After side branch stenting





Precise anatomical assessment: Use IVUS!





Important anatomical information





- Geometry of bifurcation lesion
- Amount, character and distribution of plaque
- Location, length of carina
- Distance between carina and outer lumen of a side branch

SNUH Seoul National University Hospital

Mechanism of SB stenosis

: You should know this before you do something!







SNUH Seoul National University Hospital Cardiovascular Center

Precise functional assessment: Use FFR!



SNUH Seoul National University Hospital Cardiovascular Center

Diagnostic accuracy of IVUS parameters in pure ostial lesions : You need to understand physiology!





Koh JS, Koo BK, et al., JACC interv 2012

Practical use of IVUS and FFR in non-LM bifurcation PCI

- Pre-intervention
- After main branch stent implantation
- After side branch balloon angioplasty
- After side branch stenting



To decide SB intervention or not, use FFR!



FFR vs. anatomical stenosis in Jailed side branches



SNUH Seoul National University Hospital Cardiovascular Center

11



To know what happened in SB, use IVUS!



Mechanism of SB jailing: Plaque, Carina, Stent.....



Pre-intervention

After stenting



Koo BK,TCT 2008



To decide how to do SB intervention, use IVUS!



Different target, different strategy

- Target: SB plaque
 - Large balloon, high pressure
 - More injury, more dissection
 - \rightarrow Higher chance of SB stenting
 - \rightarrow More late loss
- Target: Shifted carina -
 - Relatively small balloon, low pressure
 - Less injury, less dissection
 - \rightarrow Less chance of SB stenting
 - \rightarrow Less late loss



Integrated use of IVUS and FFR in non-LM bifurcation PCI

- Pre-intervention
- After main branch stent implantation
- After side branch balloon angioplasty
- After side branch stenting



To see your procedure: use IVUS!



SNUH Before Kissing balloon inflation

After Kissing balloon inflation

To determine what to do: use FFR!





After kissing balloon



Koo BK & de Bruyne B, Eurointervention 2010

After MB stenting



SNUH Seoul National University Hospital Cardiovascular Center

Changes of side branch FFR after "gentle" kissing balloon

(Side branch balloon/artery ratio: 0.9 ± 0.1)



After 2 stenting, use IVUS!

Angiographically excellent, but.....

604 Costa et al. Crush Stenting for Bifurcation Lesions

JACC Vol. 46, No. 4, 2005 August 16, 2005:599-605



Figure 4. (A) Intravascular ultrasound image showing complete crush (apposition) of the side branch (SB) stent; arrows indicate the three layers of stent struts: (B, C) Intravascular ultrasound images showing incomplete crush (apposition) of the SB stent struts (arrows).



Courtesy of Dr. Murasato



FFR after SB stenting has different meaning

: When it is bad, it really is bad, but high FFR does not always guarantee the favorable outcomes

DK crush vs. Provisional



In cases of crush **stenting** Pre- and Post- final kissing balloon

and the second	Pre-KBA FFR		Post-KBA FFR
	0.90		0.96
	0.96		1.00
	0.95		0.95
	0.96		0.96
	0.92		1.00
	0.95		0.98
	0.94		0.96
	1.00		1.00
	0.94		0.94
	0.88		0.94
	0.88		0.94
	0.97		1.00
	0.94±0.04		0.97 ± 0.03

Ye F, et al. Chin Medical J 2012

Lee BK, et al. Clinical Cardiol 2010



Use of IVUS and FFR in non-LM bifurcation PCI

- IVUS/FFR-guided intervention strategy for bifurcation lesion is feasible and helpful from the beginning till the end of the procedures.
- However, adequate knowledge on coronary anatomy/physiology and pitfalls of IVUS/FFR is essential to properly use IVUS/FFR in complex bifurcation lesion and in complex bifurcation PCI.

	FFR	IVUS
Pre-intervention		
Main branch ischemia	+++	+
Side branch ischemia	++	+
Planning the procedure	+	+++
After main branch stenting		
Mechanism of side branch jailing	-	+++
Jailed side branch ischemia	+++	+
After side branch intervention		
Residual ischemia	+++	+
Procedural success after 2 stenting	+	+++