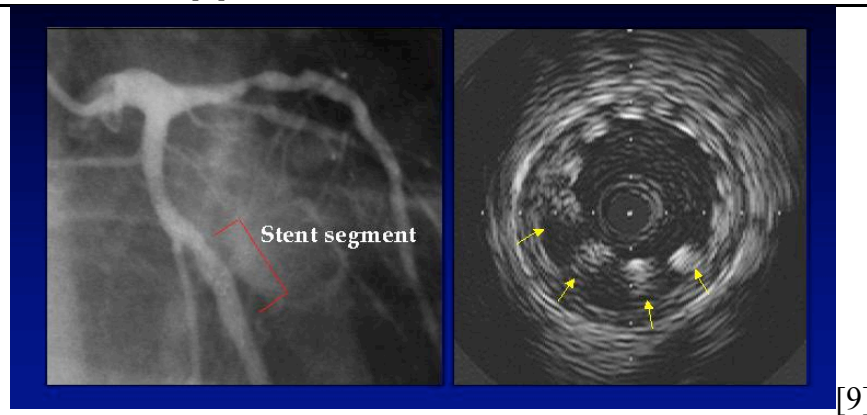


Late Stent Mal-apposition: Need Statement



Left: Angiogram showing stented artery. Right: IVUS image showing stent struts (arrows) not apposed to vessel wall.

Background

Drug-eluting stents, first approved by the FDA in 2003, dramatically reduce the probability that a treated vessel will re-close (restenose) during the critical six-month period after implantation. Previous (bare-metal) stents were associated with a 15% restenosis rate, whereas drug-eluting stents restenose in less than 5% of patients. Industry estimates predict 82% DES penetration into the US market by 2005[1]. These stents promise to significantly reduce or eliminate the problem of restenosis, but early studies show an 8.5% incidence of late stent mal-apposition in DES recipients (see figure), in which some fraction of the stent struts become disengaged from the vessel wall[2]. The cause of this effect is unknown, but physicians have proposed that the stent drug may cause necrosis or apoptosis in the cells adjacent to it, causing the vessel to remodel away from the stent.

It is believed that, if left untreated, stent mal-apposition could lead to thrombosis or vessel rupture. In fact, recent FDA guidance [3] suggests that there is a significantly higher incidence of sub-acute thrombosis and death in drug-eluting stent recipients as compared to bare-metal stent recipients. While this increased incidence has not been positively associated with late stent mal-apposition, it may play a role.

Market

- Over 1.2 million stents were implanted in 2002 in the US
- Currently a \$1.5B - \$2.5B annual market in the US alone
- Market is expected to grow to \$5B for Drug-Eluting Stents
- Late stent mal-apposition occurs in 8.5% of DES (one study)
 - In bare-metal stents, 0 – 4.4% in various studies
- An improved stent could address the full \$2.5B-\$5B market if priced competitively
 - Other devices (diagnostic tests, re-apposition catheters, etc.) may only address a smaller market

Need Statements

- A method for preventing subacute thrombosis in DES
- A method for diagnosing late stent mal-apposition in DES
- A stent that reduces the restenosis risk of bare-metal stents while maintaining their low risk of subacute thrombosis

Need Spec

- Improved stent:
 - Must have:
 - Reduces incidence of late mal-apposition
 - Does not increase restenosis rate
 - No increase in adverse events
 - Should have:
 - Comparable cost to existing drug-eluting stents
 - Comparable ease of delivery to existing DES
 - Like to have:
 - Requires only minor modification to existing stent designs
- Diagnostic test:
 - Must have:
 - Accurately diagnoses stent mal-apposition
 - Very few and very minor side-effects
 - Does not adversely effect patient outcomes
 - Should have:
 - Inexpensive
 - Noninvasive
 - Catheterization only if mal-apposed
 - Like to have:
 - Available in physician office
 - Device usable for other maladies
 - Device requires no modification to existing stent designs

Resources

- [1] Deutsche Bank Medical Supplies & Devices Report, 2002
- [2] Published data from SIRIUS trial
- [3] <http://www.diagnosticimaging.com/dinews/2003103001.shtml>
- [4] Choi JW et al., Am Heart J 139(4): 643-648, 2000.
- [5] Metz,JA , Strut registry, Circulation, 1995; 92; 1-546, (Abstract)
- [6] Kozuma K et al., Late stent malapposition occurring after intracoronary beta-irradiation detected by three-dimensional intravascular ultrasound. *J Invasive Cardiol* 1999;11:651-5.
- [7] Shah VM et al., **Background Incidence of Late Malapposition After Bare Metal Stent Implantation.** *Circulation* 2002. **106:** 1753 - 1755.
- [8] Incidence of Incomplete Stent Apposition at Six Month Follow-Up in the Multi Center RAVEL Trial. *Patrick W. Serruys et al., Thoraxcenter, Rotterdam, The Netherlands.*
- [9] http://www.tctmd.com/expert-presentations/multi-slide.html?product_id=1966