Drug Eluting Stents: Pre & Post DES Vessel Treatment

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April 28-30th 2005
Angioplasty Summit Seoul, Korea
- Malappostion vs residual stenosis
  - SAT vs restenosis
- Pre-treatment
- Stent deployment
- Post-dilatation
- IVUS
- Malappostion vs residual stenosis
  - SAT vs restenosis

- Pre-treatment
- Stent deployment
- Post-dilatation
- IVUS
Drug-eluting stent thrombosis

Thrombosis rate (%)

\[ Y = -1.455 + 0.121X \]
95% CI for $b$: 0.014 – 0.223
\[ R = 0.716; P = 0.031 \]
SIRIUS – IVUS Analysis

Incomplete Stent Apposition

No associated clinical events in any patient with incomplete apposition at baseline or follow-up
Stent underexpansion & residual stenosis vs stent thrombosis after sirolimus-eluting stent implantation

n= 15 SAT after successful SES implantation vs 45 matched controls

<table>
<thead>
<tr>
<th></th>
<th>SAT</th>
<th>No SAT</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSA</td>
<td>4.3mm²</td>
<td>6.2mm²</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Stent expansion</td>
<td>.65</td>
<td>.85</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Residual stenosis</td>
<td>67%</td>
<td>9%</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Plaque burden</td>
<td>62%</td>
<td>46%</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Malapposition</td>
<td>13%</td>
<td>16%</td>
<td>.8</td>
</tr>
</tbody>
</table>

Independent predictors: underexpansion (p = 0.03) and residual stenosis (p = 0.02).

Kenichi Fujii JACC 45: 995-998, 2005
Deployment Pressure vs TVR
TAXUS IV

Pressure
TVR

Kutcher et al AJC 94(6A) 2004
In-Stent Restenosis
Inadequate Initial Stent Expansion

PRE
prior 3mm Stent

Post RA 1.75/2.15mm

Post 3.75mm PTCA
- Malappostion vs residual stenosis
  - SAT vs restenosis
- Pre-treatment
- Stent deployment
- Post-dilatation
- IVUS
Vessel vs Device Considerations

As you go through life
Whatever be your goal
Keep your eye upon the donut
And not upon the hole
Facilitated Angioplasty
Vessel vs Balloon Compliance

PTCA Rota

% Final Sten

Balloon/Artery

PTCA Rota

Efficiency = Final Lumen/Balloon Diameter

*JACC 27:552, 1996
Low Pressure Balloon Inflation

PTCA

3.2mm Vessel
90% Stenosis

2.5mm Burr

\[ F = \frac{\text{Pressure} \times \text{Diameter}}{2 \times \text{Wall Thickness}} \]

\[ \frac{6 \text{ atm} \times 0.32\text{mm}}{2 \times 1.44\text{mm}} = 0.67 \text{ atm} \]

\[ \frac{6 \text{ atm} \times 2.5\text{mm}}{2 \times 0.35\text{mm}} = 21.43 \text{ atm} \]
Cutting Balloon

Cutting Balloon Ultra² Device Atherotome
0.014" Wire
100X Magnification

Coronary Stent Strut

Human Hair

Atherotome

Surgical Scalpel

100 A

300 A
Ostial RCA

PRE

3x10mm Cutting Balloon 12atm

Post Cutting Balloon

Post Rota

2mm Rota

Post 4mm stent
Effects of focused force angioplasty: pre-clinical experience

Meerkin DS, Lee SH, Tio FO, Grube E, Wong SC, Hong MK

J Invas Cardiol 2005;17:203-206
Malappostion vs residual stenosis
  • SAT vs restenosis

Pre-treatment
Stent deployment
Post-dilatation
IVUS
Under Expansion Routinely Occurs (POSTIT)

Optimal stent deployment is only achieved in 29% of patients with current stent delivery systems. With post dilatation, the frequency of achieving optimum stent deployment doubled from 21% to 42%. Minimal stent area increased from 6.6+/- 2.2 to 7.8+/- 2.3 mm² with post dilatation.

### Table 12.1: Inflation Pressure Recommendations

<table>
<thead>
<tr>
<th>Inflation Pressure atm (kPa)</th>
<th>2.50</th>
<th>2.75</th>
<th>3.00</th>
<th>3.50</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 (608)</td>
<td>2.20</td>
<td>2.44</td>
<td>2.71</td>
<td>3.20</td>
</tr>
<tr>
<td>7 (709)</td>
<td>2.27</td>
<td>2.51</td>
<td>2.78</td>
<td>3.27</td>
</tr>
<tr>
<td>8 (811)</td>
<td>2.33</td>
<td>2.58</td>
<td>2.84</td>
<td>3.33</td>
</tr>
<tr>
<td>9 (912)</td>
<td>2.39</td>
<td>2.64</td>
<td>2.90</td>
<td>3.39</td>
</tr>
<tr>
<td>10 (1013)</td>
<td>2.45</td>
<td>2.70</td>
<td>2.95</td>
<td>3.45</td>
</tr>
<tr>
<td>11 (1115)</td>
<td>2.50</td>
<td>2.75</td>
<td>3.00</td>
<td>3.50</td>
</tr>
<tr>
<td>12 (1216)</td>
<td>2.55</td>
<td>2.80</td>
<td>3.05</td>
<td>3.55</td>
</tr>
<tr>
<td>13 (1317)</td>
<td>2.59</td>
<td>2.84</td>
<td>3.09</td>
<td>3.60</td>
</tr>
<tr>
<td>14 (1419)</td>
<td>2.62</td>
<td>2.88</td>
<td>3.13</td>
<td>3.64</td>
</tr>
<tr>
<td>15 (1520)</td>
<td>2.66</td>
<td>2.92</td>
<td>3.16</td>
<td>3.69</td>
</tr>
<tr>
<td>16 (1621)</td>
<td>2.69</td>
<td>2.95</td>
<td>3.19</td>
<td>3.73</td>
</tr>
<tr>
<td>17 (1723)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 (1824)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 (1925)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 (2026)</td>
<td></td>
<td></td>
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</tbody>
</table>

### Table 14.1: Typical TAXUS Express Stent and Balloon Compliance

<table>
<thead>
<tr>
<th>Pressure (Atm)</th>
<th>2.50 mm Stent I.D.</th>
<th>2.75 mm Stent I.D.</th>
<th>3.00 mm Stent I.D.</th>
<th>3.50 mm Stent I.D.</th>
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</thead>
<tbody>
<tr>
<td>9.0 Stent Nominal</td>
<td>2.50</td>
<td>2.75</td>
<td>3.00</td>
<td>3.50</td>
</tr>
<tr>
<td>10.0</td>
<td>2.55</td>
<td>2.81</td>
<td>3.06</td>
<td>3.57</td>
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<tr>
<td>11.0</td>
<td>2.60</td>
<td>2.86</td>
<td>3.12</td>
<td>3.64</td>
</tr>
<tr>
<td>12.0</td>
<td>2.65</td>
<td>2.91</td>
<td>3.17</td>
<td>3.69</td>
</tr>
<tr>
<td>13.0</td>
<td>2.69</td>
<td>2.95</td>
<td>3.21</td>
<td>3.75</td>
</tr>
<tr>
<td>14.0</td>
<td>2.72</td>
<td>2.99</td>
<td>3.26</td>
<td>3.80</td>
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<tr>
<td>15.0</td>
<td>2.76</td>
<td>3.03</td>
<td>3.30</td>
<td>3.85</td>
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<tr>
<td>16.0</td>
<td>2.79</td>
<td>3.06</td>
<td>3.33</td>
<td>3.89</td>
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<tr>
<td>17.0</td>
<td>2.82</td>
<td>3.10</td>
<td>3.37</td>
<td>3.93</td>
</tr>
<tr>
<td>18.0</td>
<td>2.85*</td>
<td>3.13*</td>
<td>3.40*</td>
<td>3.97*</td>
</tr>
</tbody>
</table>

* Rated Burst Pressure. DO NOT EXCEED.
- Malappostion vs residual stenosis
  - SAT vs restenosis
- Pre-treatment
- Stent deployment
- Post-dilatation
- IVUS
Prior Stents

Addtional Stent

Calcified Vessel

PRE

POST high pressure PTCA

PTCA
4.0x9mm
24 atm
Pressure ≠ Dilatation Force
Pressure vs Dilatation Force

Dilatation Force

Stent Delivery Balloon  NC Ranger

Pressure (ATM)

Dilatation Force

0 2 4 6 8 10 12 14 16 18 20 22 24
- Malappostion vs residual stenosis
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