1958 - Dr F. Mason Sones performed the 1st coronary angiography of the RCA

A Brief History In Time of Cardiac Catheterization

On October 30, 1958, while working in the Cardiac Laboratory on a 26-year-old patient with rheumatic heart disease, Sones was performing a procedure in which contrast dye was to be injected into the aortic root to assess for AR. Just before the dye injection, Sones noticed that the catheter tip had inadvertently entered the man's right coronary artery. Sones asked that the catheter be withdrawn, but before that could be accomplished, a large amount of dye was injected directly into the artery. Sones expected the man's heart to go into fibrillation and prepared to do an emergency open chest massage. But instead of fibrillating, the man's heart went into asystole, and Sones shouted at him to cough, which successfully restarted the heart beating.

American physician whose pioneering work in cardiac catheterization was instrumental in the development of both CABG and interventional cardiology.

Dr F. Mason Sones (Oct 28, 1918 - Aug 28, 1985)

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1st Selective Coronary Angiogram

October 30th 1958

1st in Vivo marker for the presence of obstructing coronary lesions to support or refute the clinical diagnosis of angina pectoris and study of the natural history of patients with CAD.
A Brief History In Time of Cardiac Catheterization

1958 - **Dr F. Mason Sones** performed the 1st coronary angiography of the RCA

1967 - **Dr Melvin Judkins** created the Judkin’s catheter which paved the way for selective coronary angiography to be performed

1967 - **Dr Rene Favaloro** performed the world’s 1st CABG

1977 - **Dr Andreas Gruentzig** successfully performed the world’s 1st PTCA

**Andreas Gruentzig (1939-1985)**

Father of Interventional cardiology

**DREAM** Percutaneous Catheter-based non-invasive treatment of vascular disease in a conscious patient

**1977**

**99% pLAD stenosis**

**Post-PTCA**

The world’s 1st PTCA
1977

Problems with Balloon Angioplasty
★ Frequent coronary dissections and elastic recoil of the artery
★ Acute vessel closure (surgical backup required)
★ Ineffective in calcified lesions
★ Treatment limited to simple lesions only
★ High risk of restenosis (50%)

Not good enough!

1988 - 1993 (The New Device Era)

Frequent complications
Higher restenosis!

Still not good enough!
Evolution of PCI for IHD

1977

1994 - After 6 agonizing years of clinical studies

Sunday, 23 September, 12

Balloon Angioplasty

(Andreas Gruentzig 1977)

...and we’re off and running

Sunday, 23 September, 12

20th century interventional cardiology

1997 > 1 million angioplasties performed worldwide, making angioplasty the most common medical intervention in the world

2001 Almost 2 million angioplasties were performed worldwide, with an estimated increase of 8% annually

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Evolution of PCI for IHD

1977: Balloon Angioplasty
(Andreas Gruentzig 1977)

1994: Bare-Metal Stents
(Reduce peri-procedural abrupt closure & urgent CABG)

Problems with Bare Metal Stents

- 20% Risk of in-stent restenosis & angina recurrence
- Increase need for repeat revascularization

Drug-Eluting Stents

Sunday, 23 September, 12
FIRST Generation DES

In-stent restenosis (20% to 5%)

Reduce neo-intimal proliferative activity

Advances in PCI

Patient Outcomes Have Improved with Advances in Percutaneous Coronary Intervention (PCI)

1990 1993 1996 2005+

Balloon angioplasty Balloon angioplasty with bail-out stenting (Cook stent) Stenting of large vessels (Palmez-Sciortino stent) Distal Protection Brachytherapy DES 2003

200,000 PCI's No Ilib-IIla 400,000 PCI's ~ 5% stents 500,000 PCI's ~ 40% stents 900,000 PCI's ~ 80% stents

~ 40% MACE¹ ~ 30% MACE² ~ 15% MACE³ ~ 6% MACE⁴

Progressive reduction in Major Adverse CV Events [MACE]
Significant reduction
In Target vessel revascularization!

74,154 pts, 18 registries, mean F/U 2.2 years

New Slogan in PCI

Sunday, 23 September, 12
Limitations of Drug-Eluting Stents

2006

Very late stent thrombosis

Do drug-eluting stents increase deaths?

TWO SEPARATE, independent meta-analyses, presented in Hot Line session I, suggested drug-eluting stents (DES) may increase death, Q-wave myocardial infarction (clinical surrogate of in-stent thrombosis) and cancer deaths, bringing the long-term safety of DES firmly into the spotlight. Discussant Salim Yusuf (McMaster University, Canada) hailed the data as one of the most important presentations to come out of this year’s meeting.

"Six million people in the world have been implanted with DES, yet their long-term safety and efficacy is unknown," said Yusuf. "I’ve a feeling we don’t want people reading today is only the

1. Stent thrombosis
Drug Eluting Stents
The Bad and the Ugly

Stent thrombosis
In Drug-Eluting Stents

Lesion factors
- Vessel size/length
- Thrombus
- Plaque characteristics
- Bifurcation
- Calcification
- Total occlusion

Device factors
- Surface
- Drugs
- Polymer
- Stent overlap

Procedural factors
- Dissection
- Incomplete stent apposition
- Stent expansion

Patient factors
- Drug response/interaction
- Gene polymorphisms
- LV function
- Acute coronary syndrome
- Renal failure
- Diabetes

Platelet and coagulation factors
- Coagulation activity
- Inhibition of platelet activity
- Inadequate response and premature discontinuation of antplatelet therapy

0.6%/yr

Delayed endothelial healing
Local inflammation
Impaired endothelial function

Most common cause
Limitations of Drug-Eluting Stents

1. Stent thrombosis
2. Stent fractures
3. Coronary aneurysms
4. Bleeding complications from prolonged DAPT
5. Risks of going for surgery while on 1 year of DAPT
6. Loss of normal vasomotor function of coronary artery
7. Cost (Average $3000/stent)

DES Penetration DECLINES

Fear of INCREASED MORTALITY with DES
Can we do better?

SECOND Generation DES

RESOLUTE
Zotarolimus
Better Drug
Everolimus

BioLinx
Better Polymer
Polymer that dissolves away
VDF + HFP copolymer

Driver
Better Stent
Vision

Sunday, 23 September, 12
PCI - SIGNIFICANT Improvements

DES vs BMS

All-Cause Mortality: All Registries
169,595 patients, 31 registries, mean F/U 2.5 yrs

NO Increase IN MORTALITY
Can we do better?

Device that is simple to use
Reduces restenosis
No stent thrombosis
Good long-term clinical outcomes
Evolution of PCI for IHD

1977
Balloon Angioplasty (Andreas Gruentzig 1977)

1994
Bare-metal Stents (Reduce peri-procedural abrupt closure & urgent CABG)

2003
Drug-eluting Stents (Reduce in-stent restenosis) (20% to <10%)

2009
Drug-eluting balloons
YES

Drug-Eluting balloons
A Novel Technology

Reduces Neo-intimal proliferation that causes restenosis
- Anti-tumor drug that inhibits microtubular cell division

Sequent (Uncoated balloon)
Sequent Please (Paclitaxel-coated balloon)
Drug-Eluting balloons
A Novel Technology

Advantages

* Allows an alternative means of treating stenotic lesions while reducing the incidence of restenosis

* NO STENT = NO STENT Thrombosis

* Lower Bleeding risk - Shorter duration of DAPT

  3 months compared to 12 months for DES

* Allows treatment of small vessels with long diffuse lesions to be treated successfully

* Treatment of In-stent restenosis
Drug-Eluting balloons

Limitations

Subject to the same technical limitations of POBA

1. Risk of acute elastic recoil
2. Risk of coronary dissections
3. Neo-intimal hyperplasia

Reduced by DRUG-ELUTING BALLOON

Is there an ULTIMATE DEVICE TO TREAT CAD?
Evolution of PCI for IHD

<table>
<thead>
<tr>
<th>Year</th>
<th>Technology</th>
<th>Description</th>
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<tbody>
<tr>
<td>1964</td>
<td>Balloon Angioplasty</td>
<td>(Andreas Gruentzig 1977)</td>
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<td>(Reduce peri-procedural abrupt closure &amp; urgent CABG)</td>
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<td>2009</td>
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<tr>
<td></td>
<td>Bio-resorbable Scaffolds</td>
<td></td>
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</tbody>
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**Drug-Eluting Stents**

**The Good**
It revascularizes with minimal restenosis

**The Bad**
Leaves behind a permanent implant that serves no purpose

**The Ugly**
STENT THROMBOSIS (0.6%/yr)
Bioresorbable Scaffolds
A Revolutionary therapy for CAD

VASCULAR REPARATIVE THERAPY (VRT)

Revascularizes
Like a best-in-class DES

Restores
Normal Coronary Vasomotor Function

Resorbs
Returns vessel to its natural, undamaged state without a permanent metallic stent

“ We have a device that does what no other percutaneous interventional coronary device has been able to do before”

Treat the disease and completely dissolve it in a way not possible with permanent implants
Bio-Resorbable Scaffolds

Thank You
For your Kind attention

Any questions
Yau_wei_ooi@ttsh.com.sg
Thank You
For Your Attention

Sunday, 23 September, 12