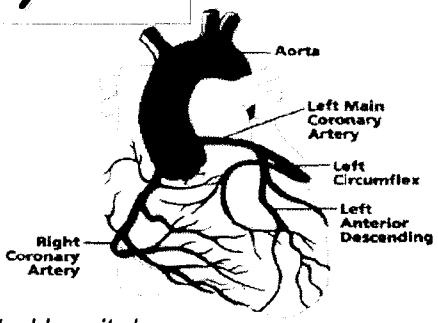
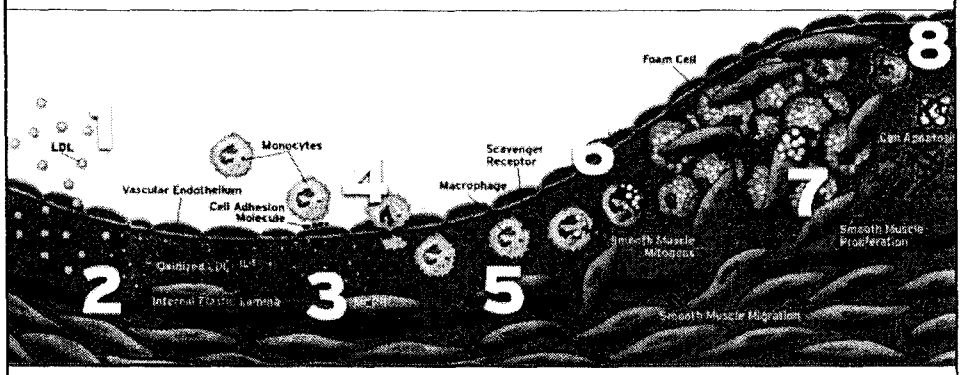
Percutaneous Coronary Intervention for Coronary Artery Disease



In-Whan Seong

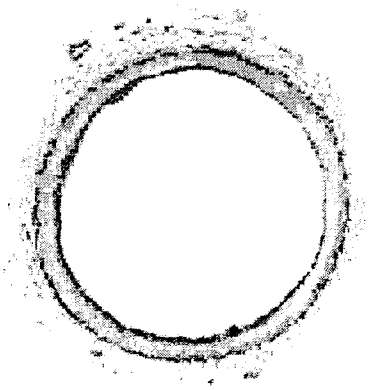
Cardiovascular Center in ChungNam National University Hospital, Dae-Jeon, Korea

Initiation & Evolution of Atherosclerosis



Cardiovascular Center in Chungnam National University Hospital

Atherosclerosis Generation & Plaque Rupture



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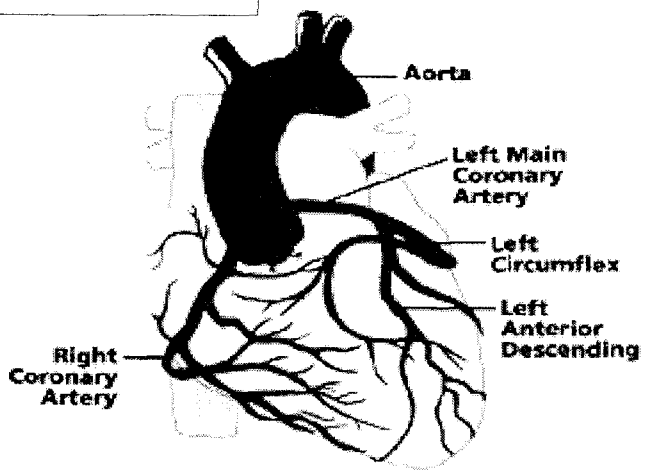
Anatomy of Epicardial Coronary Artery



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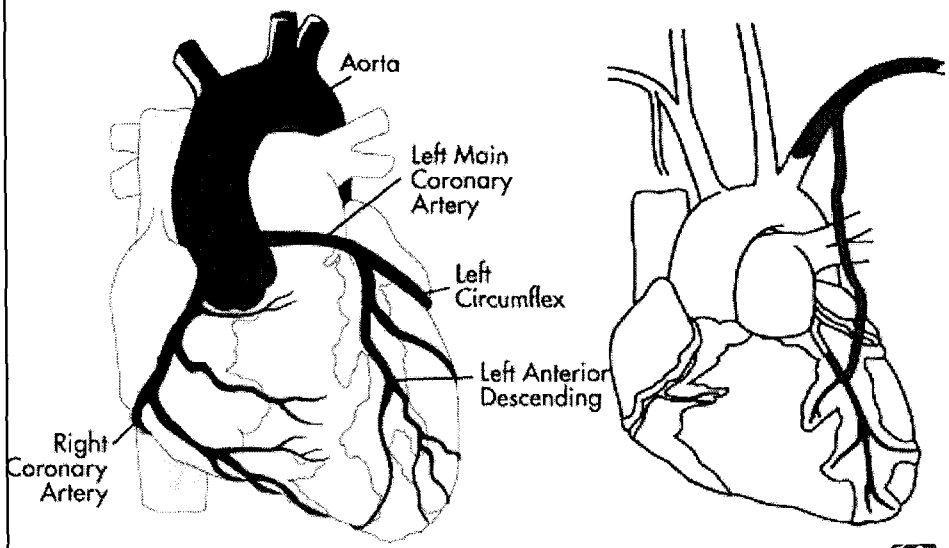
Treatment of Coronary Artery Disease

- Medical treatment
- Percutaneous coronary intervention (PCI)
- Coronary artery bypass graft (CABG)

Cardiovascular Center in Chungnam National University Hospital

CABG



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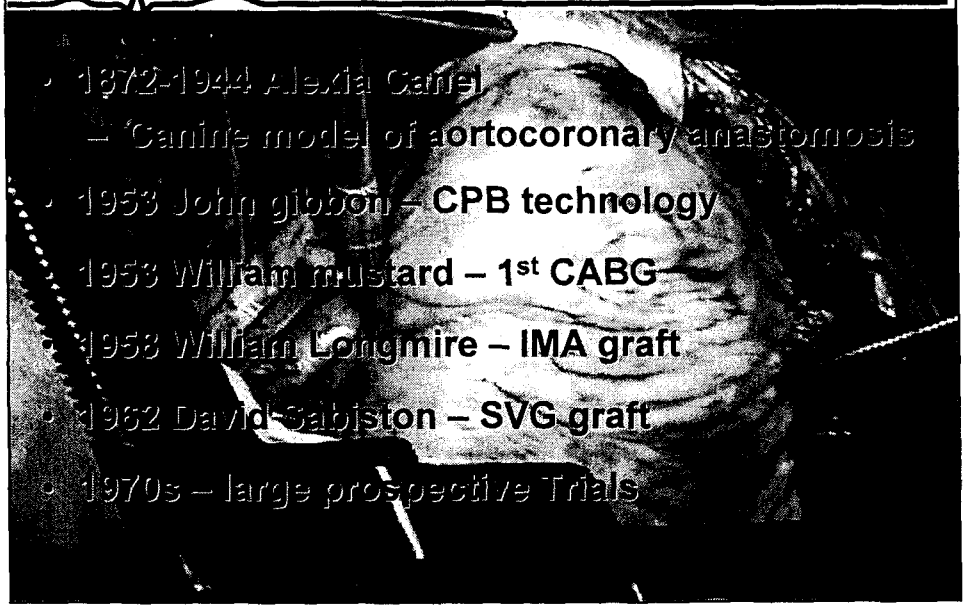
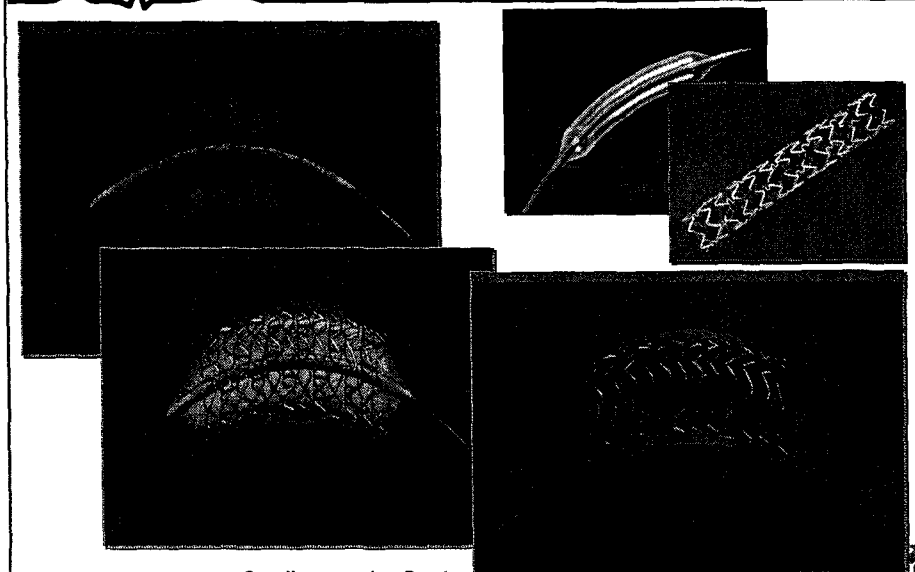
History of Bypass Surgery



- 1872-1944 Alexia Carrel
  - "Canine model of aortocoronary anastomosis
- 1953 John gibbon – CPB technology
- 1953 William mustard – 1st CABG
- 1958 William Longmire – IMA graft
- 1962 David Sabiston – SVG graft
- 1970s – large prospective Trials

PCI

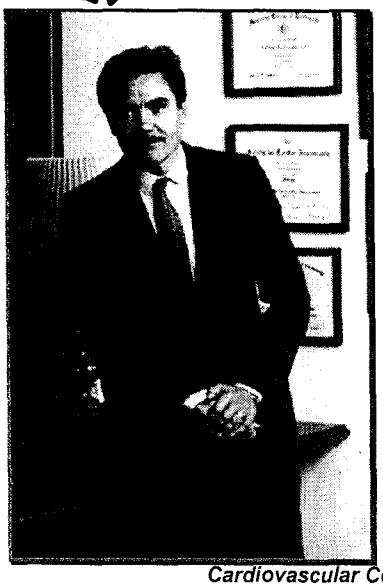


Cardiovascular Center

1967 – Gianturco Coaxial Dilation Catheter

Cardiovascular Center in Chungnam National University Hospital

Andreas Gruentzig



CABG;
Too traumatic an operation for treatment of a localized obstruction

Andreas Gruentzig, 1977

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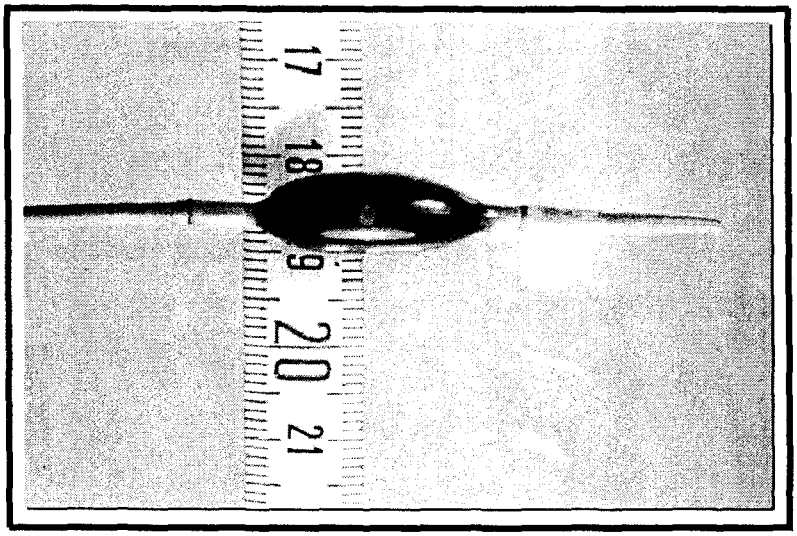
The 1st Balloon Catheter



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1977; The 1st Balloon Angioplasty

Before	Dilated	1 mo later	10 yrs later
			
9-14-77	*9-16-77*	*10-20-77*	*10-20-87*

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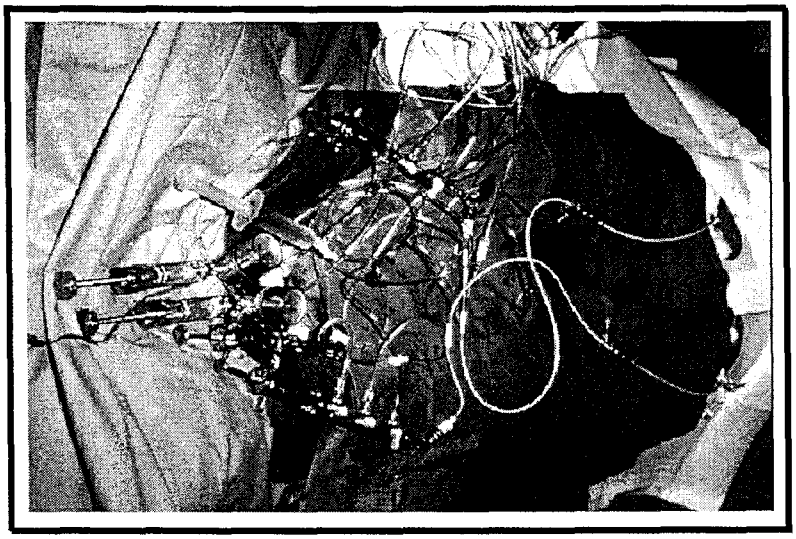
The 1st Abstract

Cardiovascular Center in Chungnam National University Hospital

The 1st Procedure



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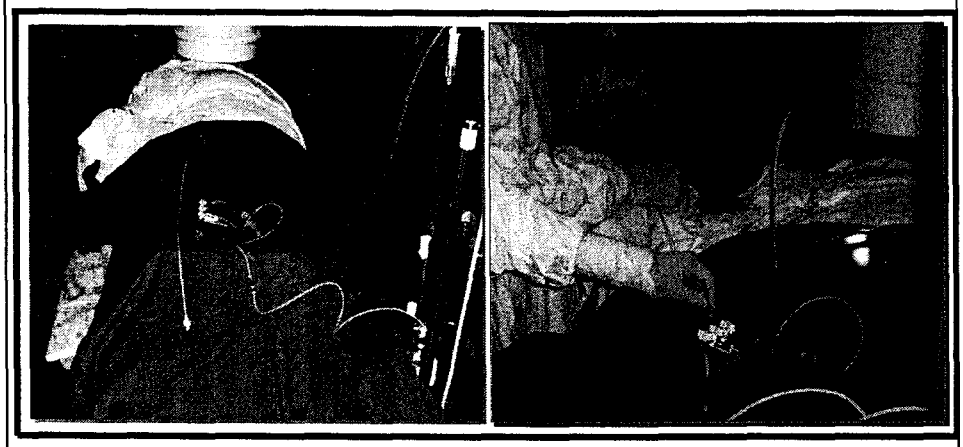
Today's Procedure



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The History of PCI is ...

... the History of Responses to Restenosis

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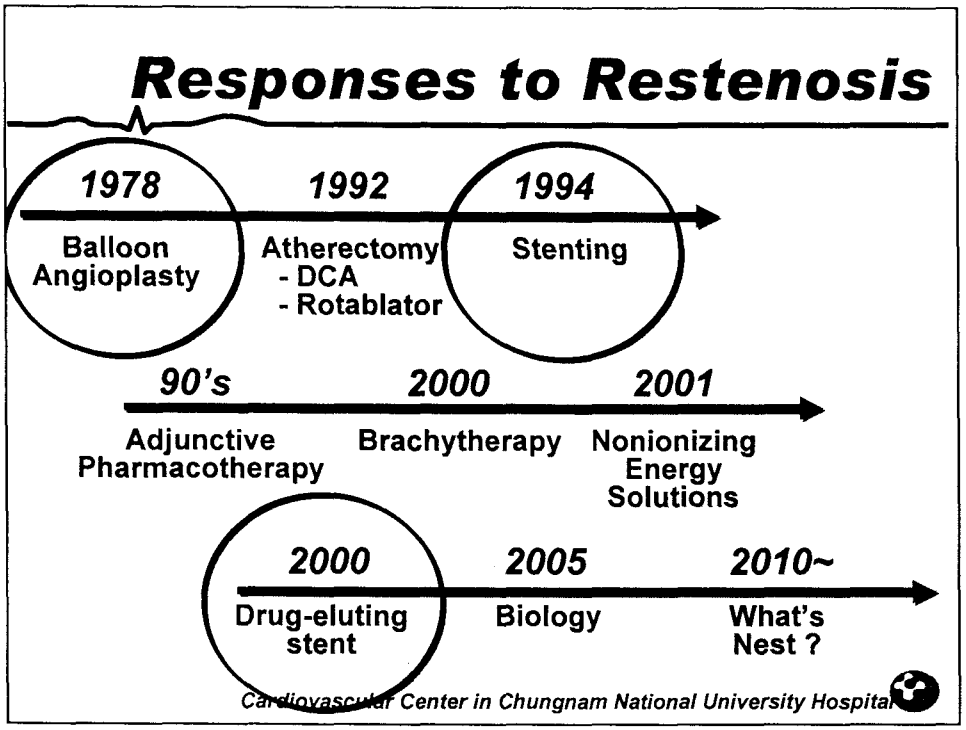
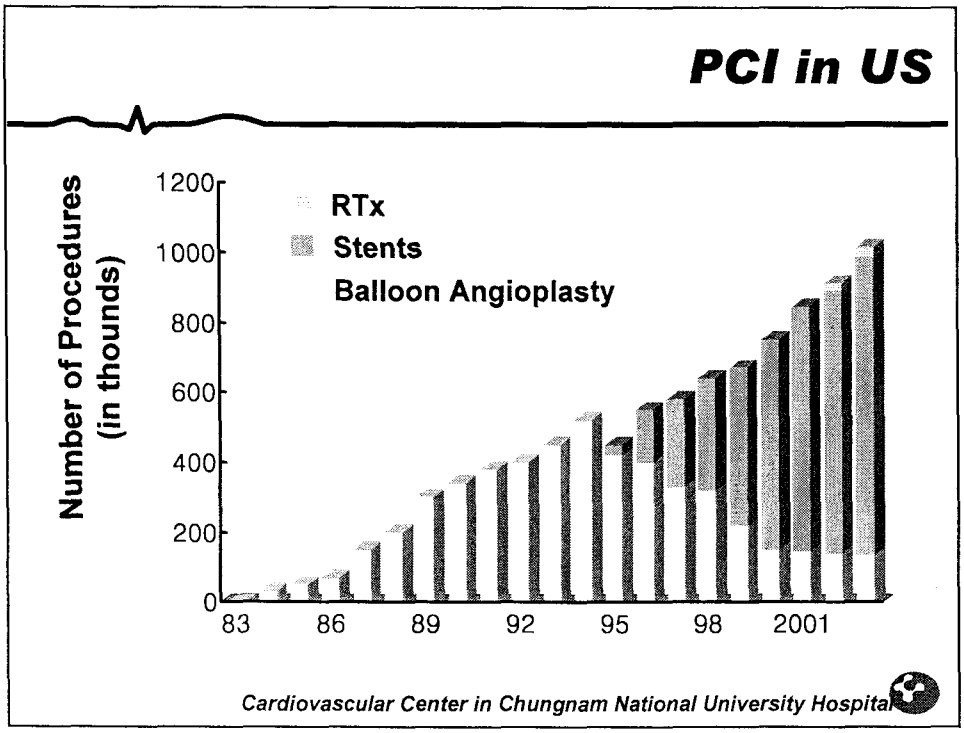
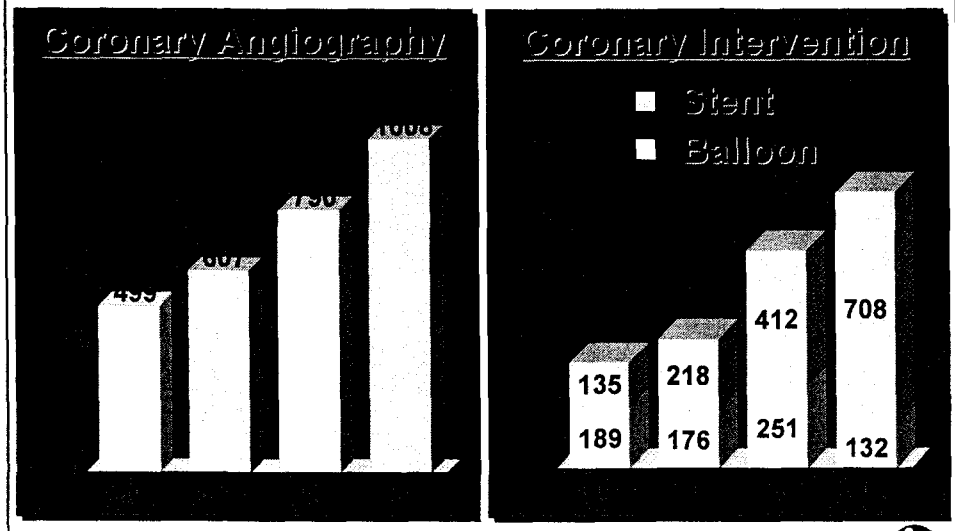

Responses to Restenosis
1978
Balloon Angioplasty
1992
Atherectomy
- DCA
- Rotablator
1994
Stenting
90's
Adjunctive Pharmacotherapy
2000
Brachytherapy
2001
Nonionizing Energy Solutions
2000
Drug-eluting stent
2005
Biology
2010~
What's Nest ?
Cardiovascular Center in Chungnam National University Hospital

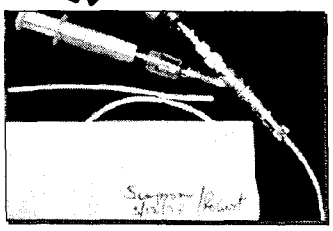

PCI in US
Number of Procedures (in thounds)
1200
1000
800
600
400
200
0
RTx
Stents
Balloon Angioplasty
83
86
89
92
95
98
2001
Cardiovascular Center in Chungnam National University Hospital

PCI in CNUH

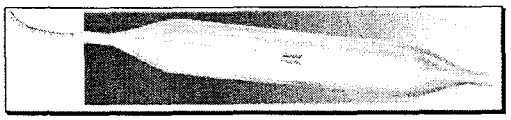


Cardiovascular Center in Chungnam National University Hospital

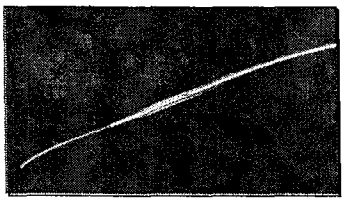
History of Balloon Angioplasty



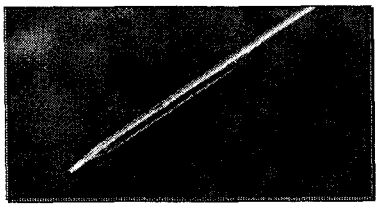
SIMPSON-ROBERT
.055"



SIMPSON ULTRA-LOW PROFILE
.049"



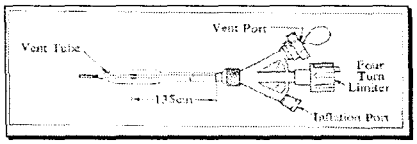
HARTZER MICRO
.045"



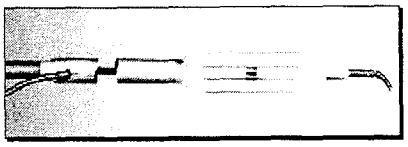
HARTZLER ACX
.035"

Cardiovascular Center in Chungnam National University Hospital

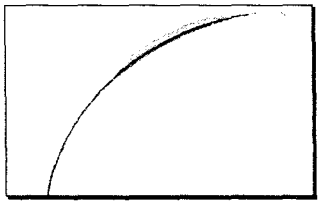
History of Balloon Angioplasty



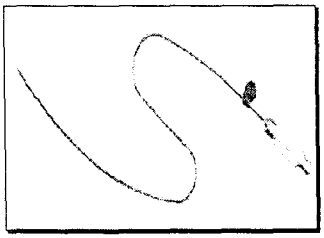
HARTZLER LPS
.033"



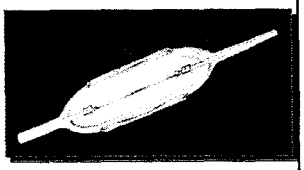
RX .014
.037"



ROCKET
.027"



CROSS SAIL
.024"



Cutting balloon

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Balloon Angioplasty; Summary

- ***Advantages***
  - Minimally invasive
  - Improved deliverability
- ***Disdvantages***
  - Less ability for acute complications;
    Dissection, Acute closure, Perforation
  - Elastic recoil
  - Late restenosis (30~50%)

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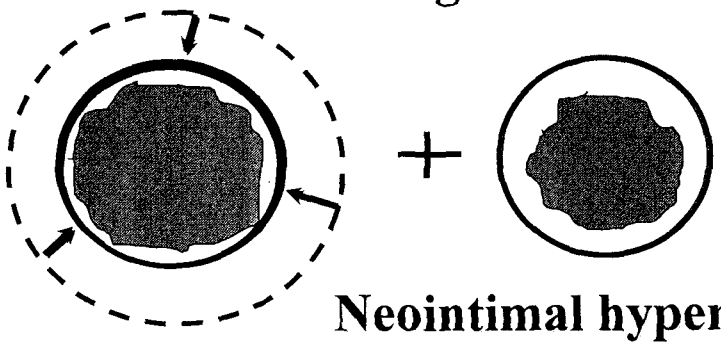
Balloon Angioplasty & Restenosis

Recoil and remodeling



Neointimal hyperplasia

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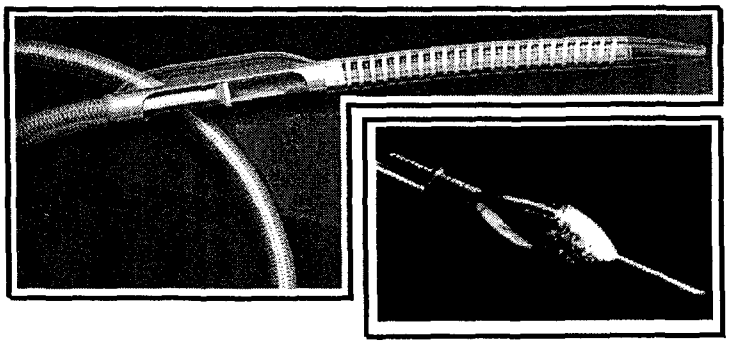
Atherectomy Devices

- *Directional Coronary Atherectomy*
- *Rotational Atherectomy*



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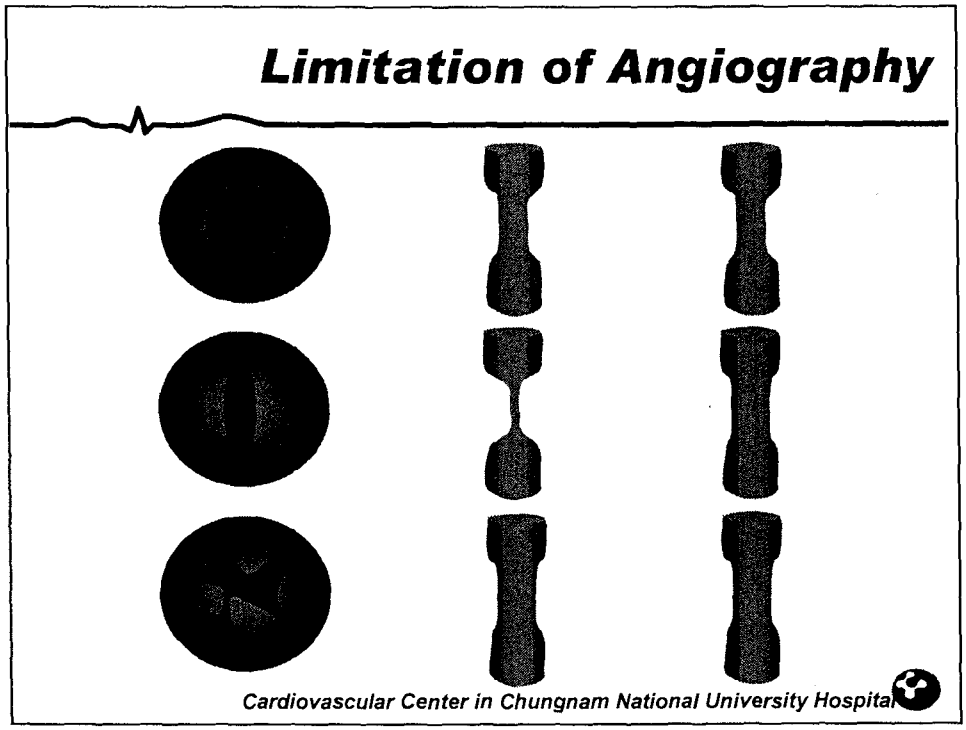
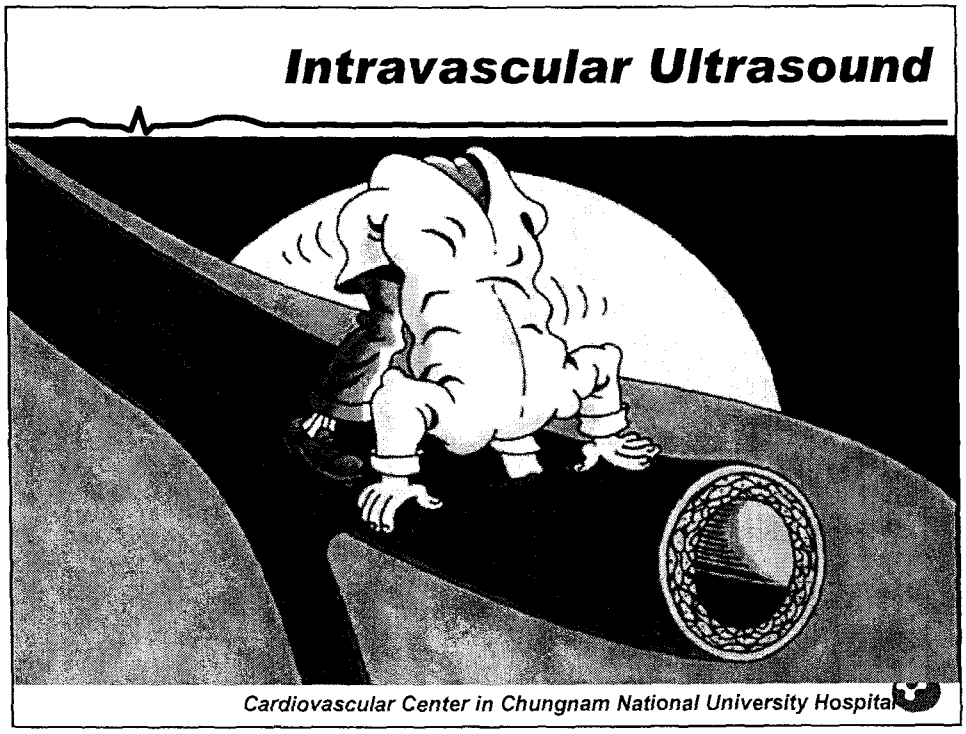
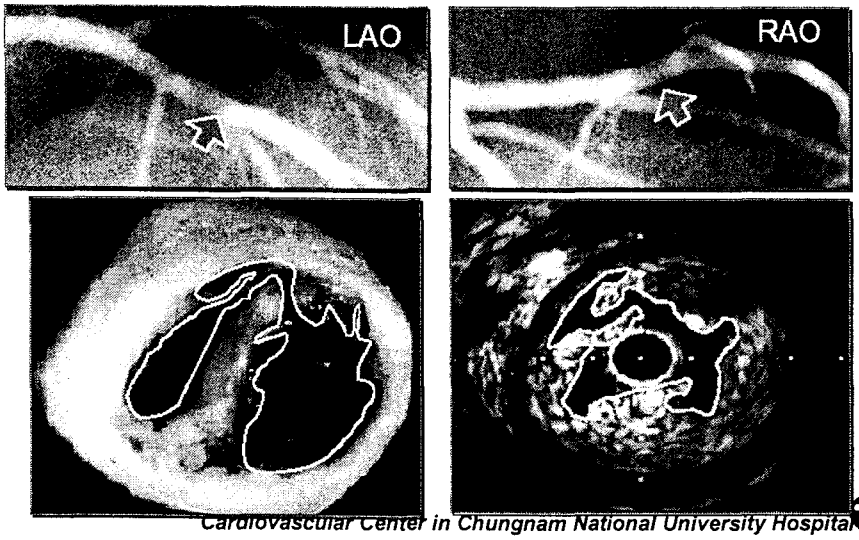

Limitation of Angiography
Cardiovascular Center in Chungnam National University Hospital


Intravascular Ultrasound
Cardiovascular Center in Chungnam National University Hospital

Physiologic Lesion Assessment



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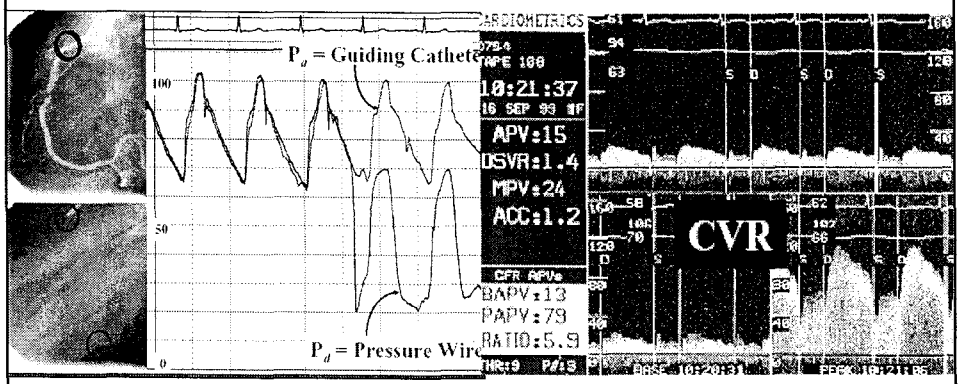
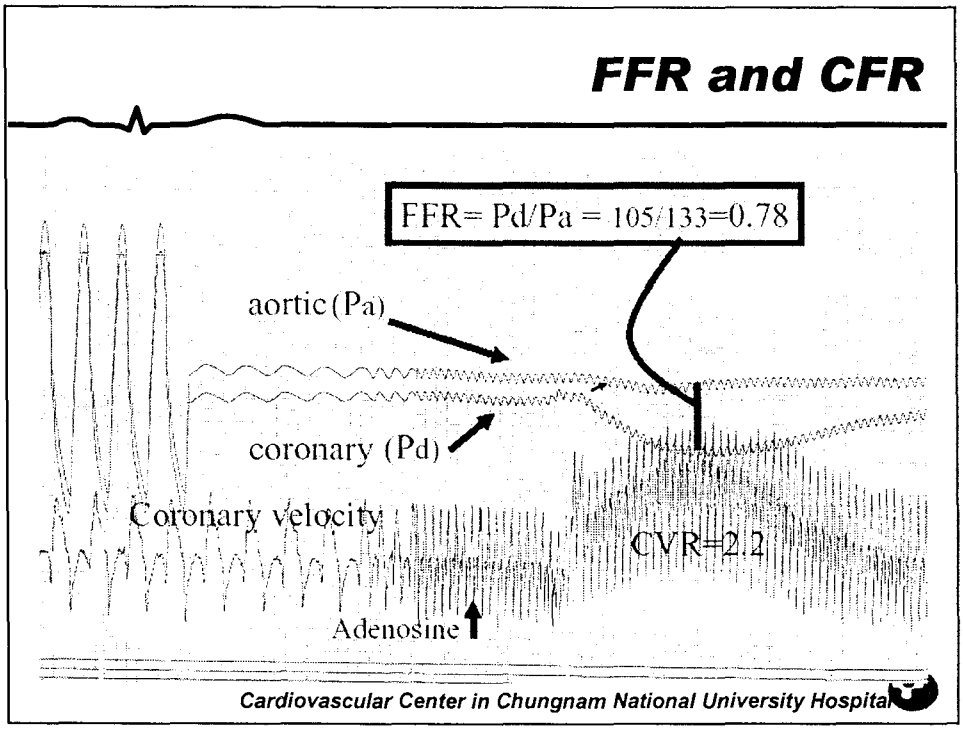
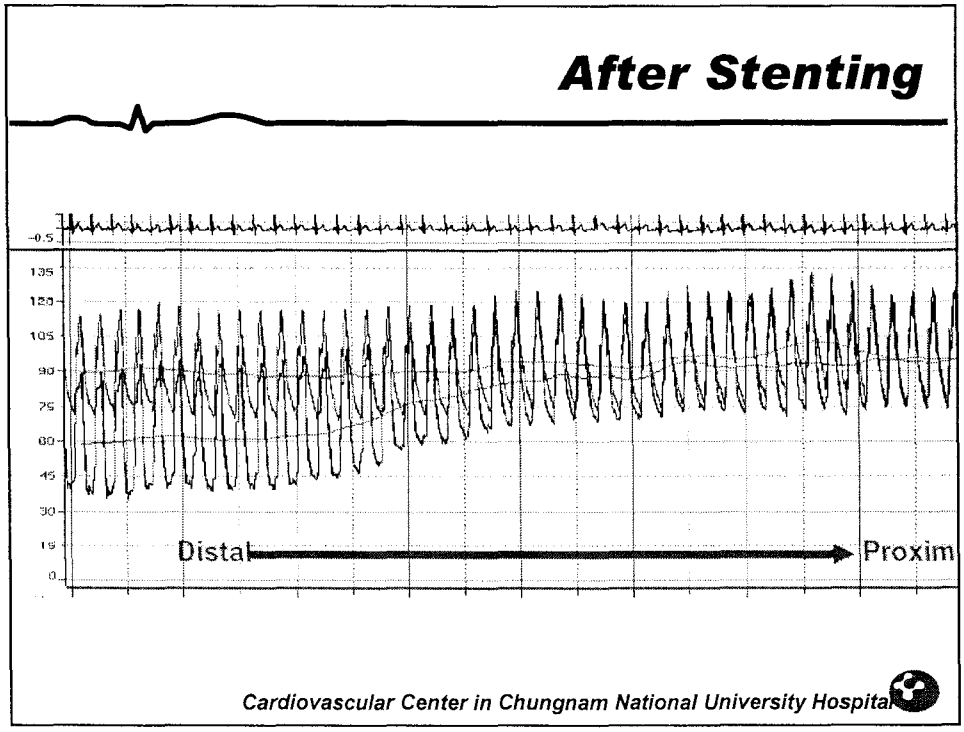
Pressure Wire vs. Doppler Wire

FFR vs. CFR

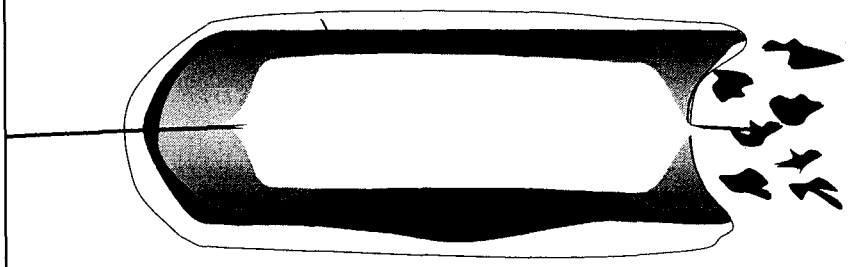


Cardiovascular Center in Chungnam National University Hospital


FFR and CFR
FFR= Pd/Pa = 105/133=0.78
aortic (Pa)
coronary (Pd)
Coronary velocity
CVR=2.2
Adenosine
Cardiovascular Center in Chungnam National University Hospital


After Stenting
Distal
Proxim
Cardiovascular Center in Chungnam National University Hospital

Distal Protection Device



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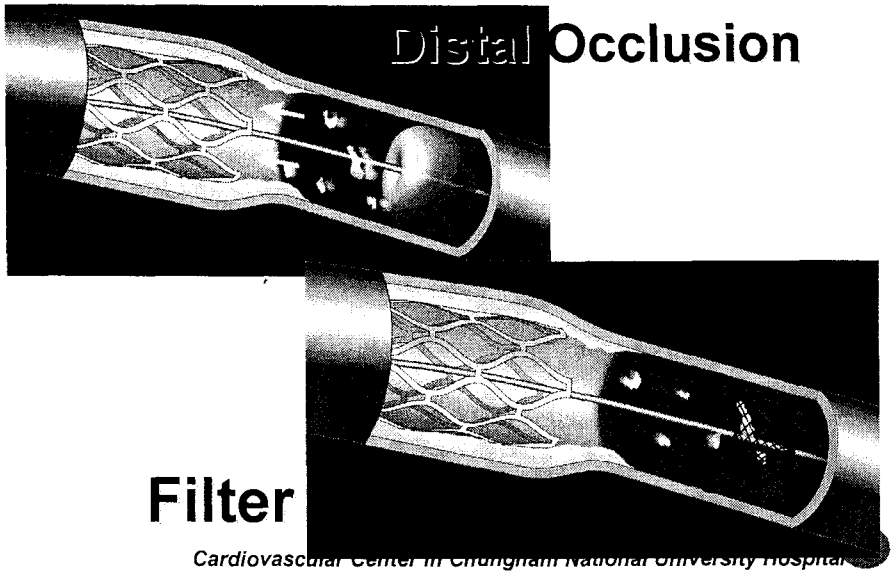
Distal Protection Device



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Stents

- ***Advantages***
  - Improve lumen gain
  - Seal dissection
  - Prevent elastic recoil
- ***Disdvantages***
  - Subacute thrombosis (0.5~1%)
  - Late restenosis (20~40%)

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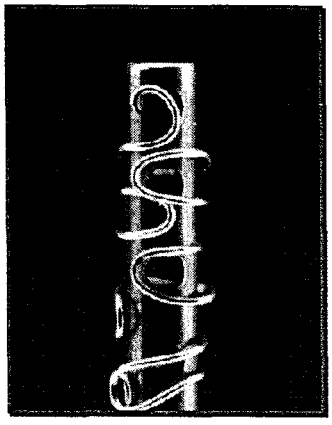
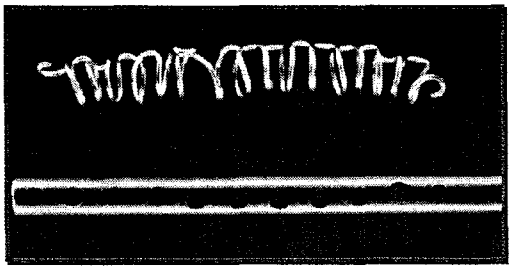
The Gianturco-Rubin I Stent





The 1st Coronary Implant 1987

FDA Approved 1993

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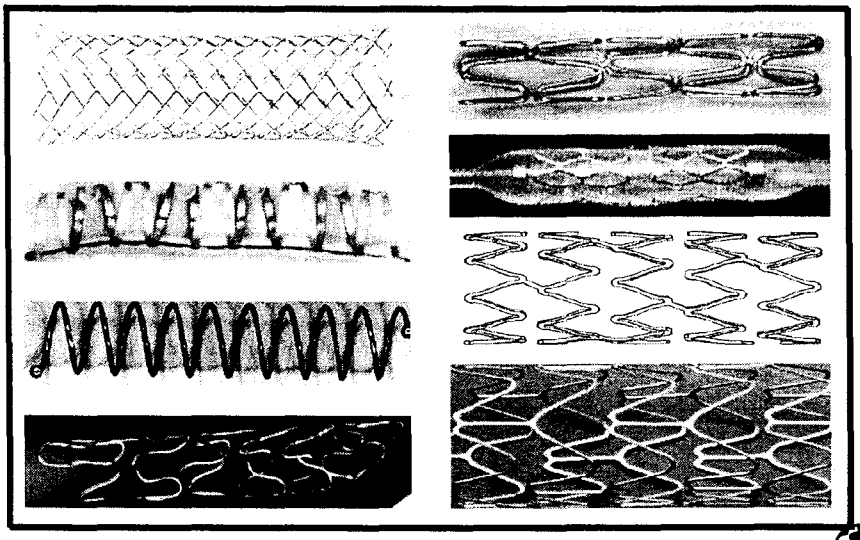
Various Stents



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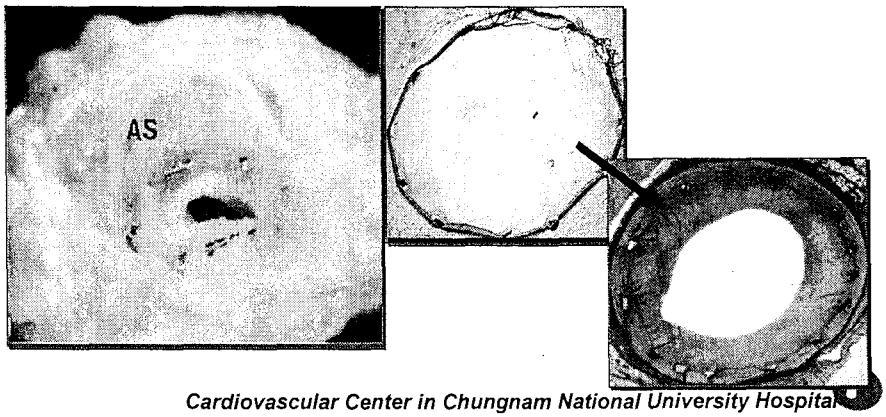
In-Stent Restenosis

is the most serious problem
(20-40%)



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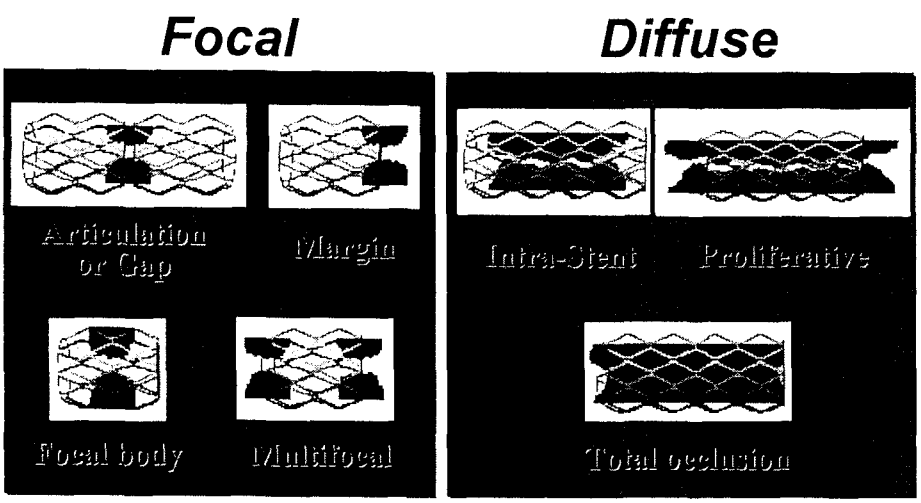
Patterns of In-Stent Restenosis



Proposed by R Mehran et al. *Circulation* 1999;100:1872-8

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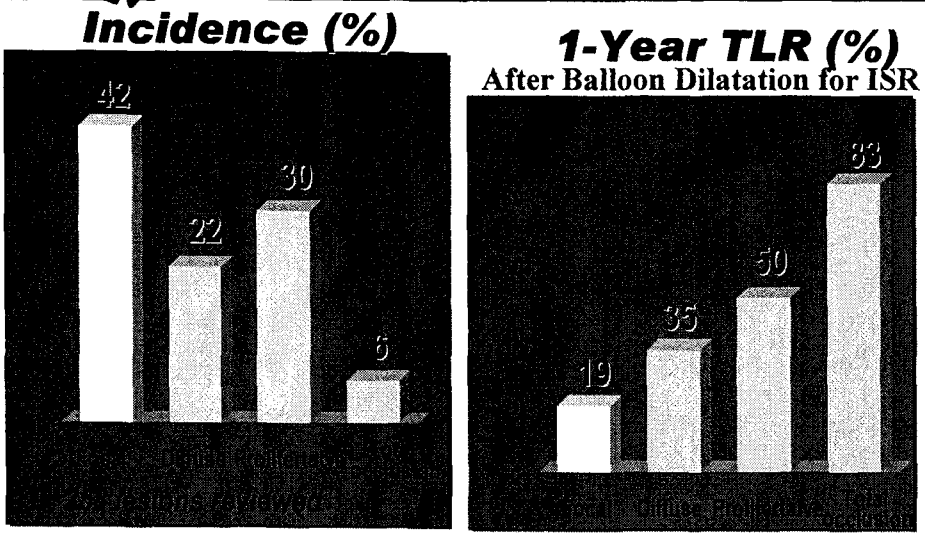
Incidence and Outcome of ISR



R Mehran et al. *Circulation* 1999;100:1872-8

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In-Stent Restenosis

Treatment Strategies

- Balloon PTCA
- Debulking ?
- Stent Again
- Drugs
- XRT and Antisense
- Cutting Balloon
- Intracoronary Brachytherapy
- Drug-eluting stent

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In-Stent Restenosis

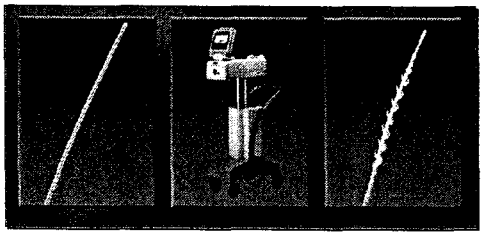
Survived Strategies

- Intracoronary Brachytherapy
- Drug-eluting stent

Cardiovascular Center in Chungnam National University Hospital

Mechanism of Radiation *to Prevent Restenosis*

- Target : Adventitial myofibroblast
- Inhibition of neointima and negative remodeling



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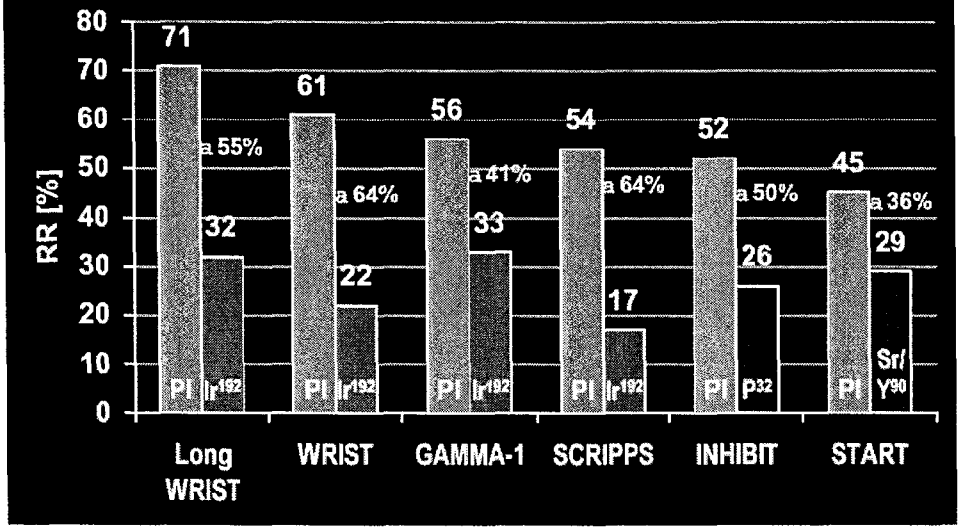
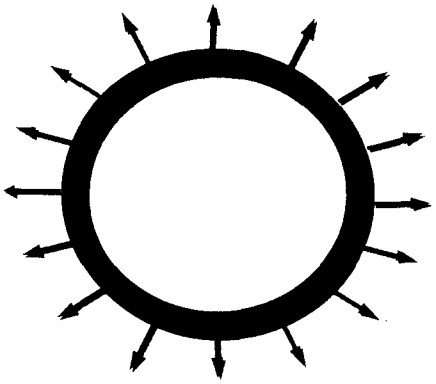
Brachytherapy to Treat ISR

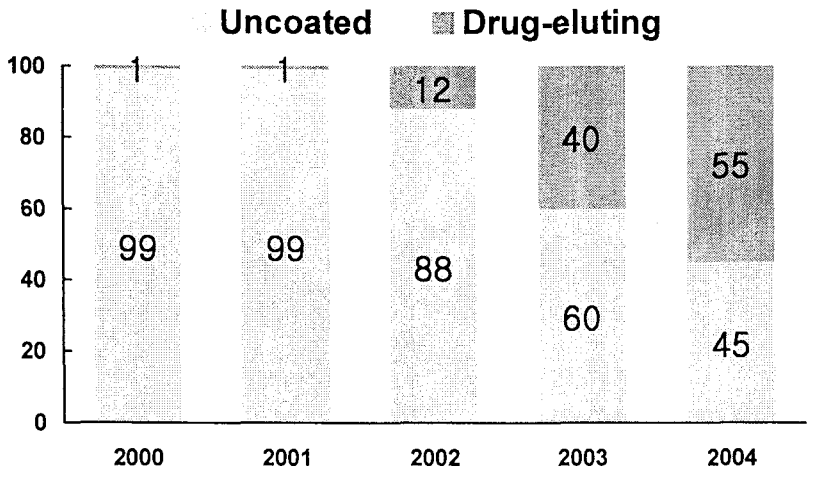
Reduction of Re-ISR



Drug-Eluting Stent



European Stent Market



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Drugs

Antineoplastic	Paclitaxel (Taxol™)
	Taxol derivative (QP-2)
	Actinomycin D
	Vincristine
Antithrombins	Hirudin and iloprost
	Heparin
Immunosuppressants	Sirolimus (Rapamycin ™)
	Tranilast
	Dexamethasone
	Tacrolimus (FK506)
Collagen synthetase inhibitor	Halofuginone
	Propyl hydroxylase
	C-proteinase inhibitor
Angiopeptin, VEGF	

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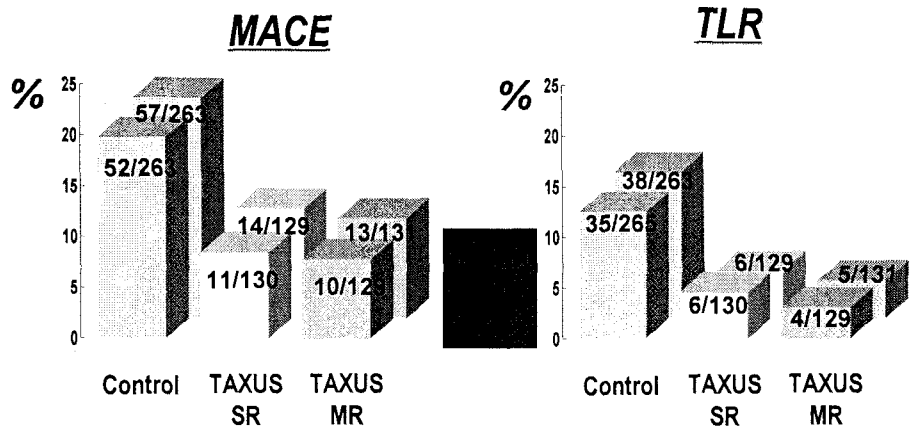
TAXUS II – *6 & 12 mo MACE & ISR*



A Colombo, 2003 ACC

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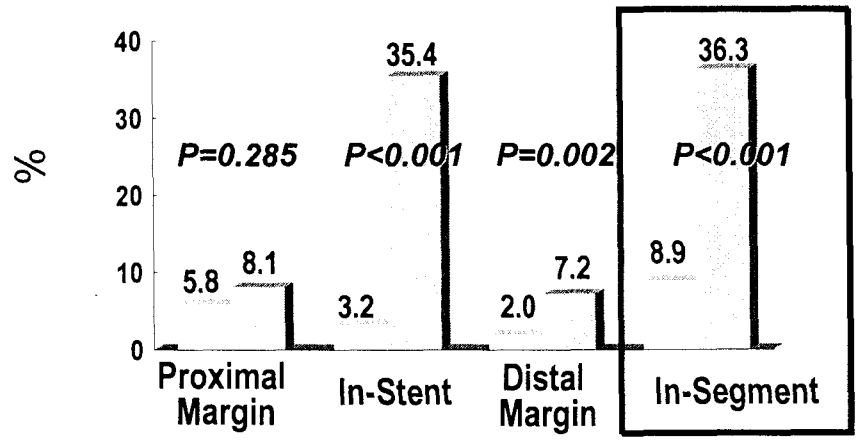
SIRIUS - *Restenosis (%)*



☐ Sirolimus (n=533) ☐ Control (n=525)

TCT 2002

Cardiovascular Center in Chungnam National University Hospital

What's Next after DES ?

- Vulnerable plaque
- Gene therapy
- Stem cell transplantation
- Angiomyogenesis
- Magnetic resonance, non-fluoroscopic imaging
- Bioresorbable implants
- Specialized treatments for bifurcation lesions
- Recanalization of chronic total occlusions

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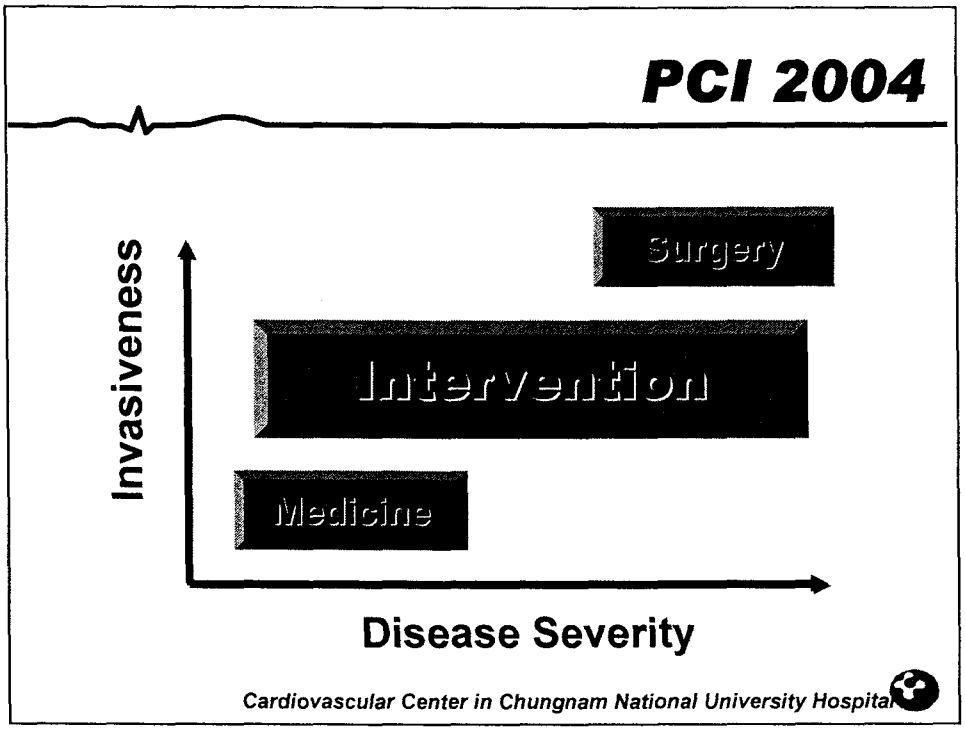
PCI 2004
Surgery
Intervention
Medicine
Invasiveness
Disease Severity
Cardiovascular Center in Chungnam National University Hospital