Angioplasty Summit – TCTAP 2011 Apr 26, 6:20PM ~ 6:40PM

Innovation in Medicine

- The Korean Approach -

Bon-Kwon Koo, MD, PhD, FACC Seoul National University Hospital, Seoul, Korea





Global health care market

- 3,200 billion dollars/year (2009)
 - Pharmaceutical and medical device: 1,100 billion dollars
 - Medical service: 2,100 billion dollars
- 2.3 times bigger than IT market



Health care market: Global vs. Korean

	Pharmaceutical (2009)	Device (2009)	Medical service (2008)
Global	837 billion	224 billion	2,180 billion
Korean	15.5 billion	3 billion	50.5 billion



Korean market is rapidly growing!

- Annual increase in total medical cost per person
 - 11.6%/year
 - Highest in OECD countries (OECD average: 6.7%)
- Annual increase in drug cost per person
 - 11.3%/year
 - 2nd highest after Ireland (13.6%)



5

Korean market is rapidly growing!



Asian Market is rapidly growing!

Annual increase in pharmaceutical market



Asian Market is rapidly growing!

Proportion of Asian market

(Korea/China/India)





Korean as an Innovator



Innovative person



Bright Creative Liberal Sensitive Intuitive

Math Olympiads Score

1. Singapore

- 2. South Korea
- 3. China
- 4. Hong Kong
- 5. Japan

The New York Times

November 14, 2007

MATH

States vs. Countries in Math



Trends in International Mathematics and Science Study(TIMMS)

Average science scores of 8th grade students (2007)

Country	Average score
TIMSS scale average	Tunisia: Health Special: Zodiac: Power is in Kids and No really, what's
Singapore	the streets concussions your sign?
Chinese Taipei	
Japan	
Korea, Rep. of	TUE
England ³	TRUTH
Hungary	TIGER
Czech Republic	MOMS A mother's memoir
Slovenia	on tough-love parenting unleashed an international debate.
Hong Kong SAR ^{1, 3}	onto something?
Russian Federation	
United States ^{3, 4}	
Lithuania ²	

iPhone type vs. HYUNDAI type





Creative Liberal Sensitive Intuitive Logical Hard working Target oriented Analytical

The theory of 10,000 hours

... 10,000 hours of practice is required to achieve the level of mastery in anything. 10,000 hours is the equivalent to roughly 3 hours per day, or 20 hours per week, of practice over



From This is Your Brain on Music by Daniel Levitin.

The theory of 10,000 hours









From Outliers by Malcom Gladwell



Cultural legacies

Rice paddy



Wheat field



Skill oriented Work throughout the year > 10,000 hours of work a year 10-20 times more labor-intensive than equal size of corn or wheat field Very exacting

More mechanically oriented

Cultural legacies

Rice paddy



"Don't depend on heaven for food, but on your own two hands carrying the load."

"No one who can rise before dawn 360 days a year fails to make his family rich." Wheat field



"If God does not bring it, the earth will not give it."

Best in medical practice and research



The NEW ENGLAND JOURNAL of MEDICINE



ORIGINAL ARTICLE

Effect of celecoxib on restenosis after coronary angioplasty with a Taxus stent (COREA-TAXUS trial): an open-label randomised controlled study

Bon-Kwon Kao, Yong-Seok Kim, Kyung-Woo Park, Han-Mo Yang, Dong-A Kwon, Jin-Wook Chung, Joo-Yong Hahn, Hae-Young Lee, Jin-Shik Park, Hyun-Jae Kang, Young-Seok Cho, Tae-Jin Youn, Woo-Young Chung, In-Ho Chae, Dong-Ju Choi, Byung-Hee Oh, Young-Bae Park, Hyo-Soo Kim

Summary

Background In-vitro and animal experiments have shown that the cyformation of neointima within stents. We aimed to test whether celecc

Methods In a randomised two-centre trial, we enrolled 274 patients we and who had native coronary artery lesions for which implantation of preserve given activity (000 mg driht) and classifered (75 mg driht) 12

Seoul



Randomized Trial of Stents versus Bypass Surgery for Left Main Coronary Artery Disease

Seung-Jung Park, M.D., Young-Hak Kim, M.D., Duk-Woo Park, M.D., Sung-Cheol Yun, Ph.D., Jung-Min Ahn, M.D., Hae Geun Song, M.D.,

Jong-Young Lee, M Seung-Whan Lee, M.D. Cheol-Hyun Chung Seung-Woon Rha, M.D



Global clinical research: 182 (2008)
#1 city in medical research in Asia
#3 in the World





competitiveness of Korean industries



Seoul National University Cardiovascular Center

Competitiveness of Korean medical industries

- No product of Korean medical society earns >100 million dollars in a global market
- Trade gap in 2009:
 - Drug: 3.4 billion dollars
 - Medical device: 900 million dollars

Trade balance



Peter J Fitzgerald, MD, PhD, TCT 2010

The Changing US Landscape...



[2] **TUESDAY, SEPTEMBER 21**

\$1.58 as - Mechanisms of Drug Delivery: is There an In Vivo-In Vitro Correlation to Release Kinetics? Jeffrey H, bbet

12:05 re - Featured Lecture: Translational Models of Vascular Thrombows Alan J. Badmon

12:25 m - Emerging Pathology Techniques: Immunistans, Infrared Microscopy, FTIR. and Revond Gulleren Tearren

1249 rs - Discussion with Audience DBA Documente: Aan J. Bactmon. Jethey Hubbell, Cyrotes A. Maryanoff, Dutterno Teamer

Session III. Experimental Animal Model Systems

Modwaroni: Etsuardo Camenzrid. Greg L. Kakubé, Renu Vermanir

198 re - Drazosed Animal Modera: Overview and Practical Applicability for Device Validation Acbert L. Wiletaky

1:15 re - Evaluation of Emerging DEII (PH) Characteristice) in Animal Models: Vescular Territory, Time Points, and Beyond Adam Granmult

1.00 mil- Evaluation of Mechanical Integrity and Degradation Patterns of Broatsprotable Startts in Animal Models Louis E.L. Parkley

145 re - Efficacy Endpoints in Animal Models: Are They Predictors of Concal Success? **Family Written**

200 He - Discussion with Audience G&A Decuesarity: Allem Groothuls. LAUR & L' Parkins

2:29 re - Surrogate Imaging Enciporets in Precinical Research: 5-D Angingraphy. INUS OCT and Beyond Greep L. Kaluns

2:35 He - Challenges for Endorsecular Techniques: Imaging-Histology Correlation Sérgio Waamari

2.50 re - Evaluation of the Mechanical Integrity of Peripheral Stents: Is the Porcine SFA art Adequate Model? Armanulo Tellar, Michael Monant

2.05 re - Precinical Dirategies for the Evaluation and Validation of Perculariecos Valve Technologies Stanton J. Roald

320 re - Discussion with Authence OSA Discussents: Danton J. Rosell. Armandol Tellez, Dargeo Meximent

Session IV, From Bench to Bedside: Translational Lessons Learned from First-in-Human

Studies Moderatory: Assence Abbant. John A. Ormston

240 re - Fitt Clinical Lessons Leatned from Precimical First-Generation DEB Validation Studies

Anisthe About 255 re - When Is a Device Ready for a Flit Study? The Experimentatist's Perspective Julan F. Granada

418 re - Fill Clinical Lessons Learned from Practrical Bludies of Metallic DES Platforms with Bioabsorbable Polymers Campbell Ropers

425 re - Fill Clinical Lessons Learned from Precinical Studies of Peripheral Stants Witkett A. Grav

#48 in - Fild Clinical Leasons Learned from Precinical Studies of Bifurcation Stants John A. Dimator

455 re - Fibi Clinical Lesatms Learned from Precinical Bludies of Bioebscrbable Stents Patrick W. Samurk \$18 m - Discussion with Audience G&A

Discusseris: Assarbhy Abyait! Written A. Grey, Campbel Roperts \$30 m - FH Clinical Leasons Learned from **Precisioni Studies of Pelouteneous Valves**

Atal+ G. Gebrer \$45 re - Discussion

800 m - Adjourn

INTERVENTIONAL INNOVATION NOVEL THERAPIES AND EMERGING DEVICES 8 00 xee 6 35 m

Room 145AB Session I. A Tribute to

Interventional Innovation Advisource: Market III Lann; Paul Hore Organization Joseph R. Carrison Jr. Game Chopes, David J. Calleri, Excert R Education, Pater J Personald. Just C. Parrier Picturel A. Schutz. Charles A. Dimension, John B. Dimpson

In Manuary ... 8.00 as - Honoring the Marmory of Donard S. Barry, MD: From His Friends and Formar Fallows (video Fresentation) Reiserof Karld

#15 or - Distantiation Point-Counterpaint 8:38 se - Innovation is "Alive and Well" in Interventional Cartlevascular Medicina introducing the Stanford Biodeston Model Paul Hick 842 or - immoration is "Drowning" in a Sea of

Economic and Regulatory Hundles Particul & Elburger **Featured Lectures**

8:54 as - The Israell Model of Involvation: "The Startus Nation'

Plan Klumpursk 9d8 av - The Indian Model of Innovation: Reverse Engineering and a Major Information Technology Focus Granel Christel

818 M - The Impact of Precisical Vascular Biology and Computational Models on Device Innovation in Cantleveerular

Eater A. Etsiman

8:30 as - The Impact of Meterial Science and Nanotechnology on Device Innovation In Cantinuescular Matterne (Case Examples) Julo C. Patriat

#42 M - Discussion Session II. Cath Lab of the

Future

Telemanipulation, Robotics. and "Hybrid" Cath Labs Modwatters: Peter J. Pitopenett. Alan C. Y Discussents New S. Klemen, Marute J. Slepion, Mathew Hillions

10:00 are - Hytorid Cath Labs 1; Emerging Concepts and New Technologies Manhaul Millionia

1018 ar - Hybrid Cath Labe 2: Impact of interventional and Burgical Cardiovasc Therapies E. Mariel Tutta

12:29 as - The Sterentaxis Magnetic-Assis Imaging and Telematipulation System: **Current and Future Clinical Indications** (EP and PCR) Next S. Kleenart

10:30 ex - The Harson Catholor-Based Telemanipulation System: Ourrent and Future **Cirvital Indications (EP and PCI)** Alarvet J. Elepter

1840 se - Robotic-Assisted Anginglasty: First-in-Human Experiences with the Corindua Bystem Goog Warsz

1858 av - Discussion

The Israeli Model of Innovation

The Indian Model of Innovation **Reverse Engineering and** Information Technology Focus

Gopal K. Chopra M.D.



Competitiveness of Korean medical industries

	Sales (2009)	Profits (2009)	R&D investment (2009)
Global top 5*	46 billion	25.7%	7400 million
Korean top 5*	0.6 billion	12.5%	26 million
Korean/Global	1.3%	48.6%	0.3%
- 4 -			



* Average value of top 5 pharmaceutical companies

Competitiveness of Korean medical industries



R&D % o	of Sales	
BSC	13%	
St. Jude	12%	
J&J	11%	
Medtronic	9%	
Abbott	9%	



Strategic Centers for Biodesign



Brinton TJ, TCT 2010



30

CASE Combination of imaging and invasive functional test



New England journal of medicine 2010;362: 886-95

Fractional Flow Reserve (FFR) is an accurate method to identify significant stenosis



Proven to significantly improve outcomes and reduce costs by large multicenter trials

But...

Distal Coronary Pressure (Pd) FFR = Proximal Coronary Pressure (Pa)

Has limited adoption owing to the complexity of and the time needed for the invasive procedures

(During Maximum Hyperemia)

Question: How to measure FFR non-invasively?



Non-invasive CT angiography: significant stenosis



Invasive coronary angiography: significant stenosis



Invasive FFR: insignificant stenosis

How to combine CT and FFR?

- Computational Fluid Dynamics -



The concept of non-invasive FFR



The concept of non-invasive FFR



- May 2009: project started
 - rejected by 2 bioengineers as they were too busy..
 - failed to find the business partner



• Feb 2010: Collaboration with CV sim

제 목	Potential collaboration with Cardiovascular Simulation, Inc.
보낸 날짜	2010/02/19 금요일 오전 10:24:25
보낸 사람	"Charles Taylor" <taylor@cvsim.com> 주소록에 추가 】 수신거부</taylor@cvsim.com>
받는 사람	bkkoo@snu.ac.kr,
참 조	"Gilwoo Choi" <giroo@cvsim.com>,</giroo@cvsim.com>
첨 부	

Dear Dr. Koo,

Gilwoo Choi (mu formar PhD etudant at Stanford) providad your a-mail addrage to ma. Gil ie

• Feb 2010: Clinical study started, Finished in Jan 2011





Korea, US, Latvia

The concept of non-invasive FFR



Late breaking first-in-human trials Chairpersons: A. Cribier, R. Erbel, J. Simpson

- BIOSOLVE-I safety and clinical performance of the first drug-eluting absorbable metal scaffold - *M. Haude*
- Discussion
- First-in-man experience with the DES Orsiro in the treatment of patients with single de novo coronary artery lesions (BIOFLOW-I) - *M. Hamon*
- Discussion
- TA-AVI: 3-month first-in-man results with the Symetis Acurate transapical aortic valve - J. Kempfert

Discussion

Diagnosis of ischemia-causing stenoses obtained via non-invasive fractional flow reserve (DISCOVER-FLOW): a prospective multicentre firstin-man study - B.K. Koo

Discussion











This innovative technology has the potential to become the gatekeeper to the cath lab and replace non-invasive studies.....

- Worldwide non-invasive diagnostic test market: 35 billion dollars
- US market: 23M non-invasive studies
- European market: 16M non-invasive studies
- → Expect to begin limited commercial operations in late 2011 and to expand globally on 2012.

Korean Approach

