Key role of hospital in biomedical research innovation

Qian Wang  MD, PhD
Nanfang Hospital
Southern Medical University
The purpose of biomedical research innovation:

- to discover the secret of life
- to promote human healthy

That will be meaningful only when the biomedical innovation serve preventing diseases, maintaining healthy.
Hospital

- Diseases diagnosis, treatment, preventing
- Health management and promotion
- Most active and focus on Clinical practice, Medical education, Medical research
Hospital and Innovation

- Clinical problems and patient’s needs
- Hard and soft wares for medical innovation
- Lots of clinical resources (data, cases, images, etc)
- Base of clinical trails and commercial exploitation
Clinical problems and patient’s needs

- Severe tissue damage and absence
  ---- Tissue engineering

- Shock and multiple organ dysfunction syndrome (MODS)
  ---- Portal blood analyzer

- Acute myocardial infarction (AMI)
  ---- Electrocardiogram

- Cerebral hemorrhage or thrombosis
  ---- MRI, CT
Hard and soft wares for research innovation

- Humane resource: doctor, nurse, technologist, researcher, manager

- Professional experts: senior doctor, professor
■ Hardware:

Medical machines:
Biochemistry autoanalyzer, Olympus 5421
Blood autoanalyzer, Sysmex 2700, 800i
PET, MRI, CT, Ultrasonic B, X-ray machine

Information systems: HIS, LIS, PACS
Clinical resources
(Nanfang hospital)

- **Out-patients**: 4000-5000 / day
- **In-patients**: 1800-2000 beds
- **Comprehension hospital with different kinds of diseases**
- Clinical laboratory: lab tests data for 10 years stored in the LIS
- Medical imaging department: tens and thousands of images stored in PASC
- Medical records: All the patients stored in HIS
Base of clinical trails and commercial exploitation

- Myocardial markers analyzer
- Diagnosis kits
- Bone matrix materials
- Medical imaging analysis softwares
- New drugs
- Medical equipments
- New therapy methods
Research innovation in Nanfang Hospital, SMU

Bone tissue engineering
clinical application
Bone tissue engineering

- Isolation and culture of osteoblasts
- Extracellular Matrix Material
- Construction and clinical application of tissue-engineered bone
Bone tissue engineering
(tissue construction)

Osteogenesis in muscle
or under skin
Bone tissue construction

Bone defection repair
in small animal

Bone defection repair
in large animal

Compound tissue construction
Bone defect repairing in Rabbit radial with tissue-engineered bone
Tissue-engineered bone construction using bone marrow stromal cells tranfected by BMP-7 gene

Contral group

HA group

BMSCs group

BMP-7 tranfected BMSCs group

bone defect repairing (6 Weeks later)
Tissue-engineered bone construction using bone marrow stromal cells transfected by BMP-7 gene

PLNCX2-BMP7 transfected BMSc repairing bone defect in rabbit radia (X-ray)

Control group

HA group

3 weeks

6 weeks
Tissue-engineered bone construction using bone marrow stromal cells transfected by BMP-7 gene

PLNCX2-BMP7 transfected BMSc repairing bone defect in rabbit radia (X-ray)
Construction of revascularlized tissue-engineered bone

Key role of vascularization

- make the seeding cells alive
- provide more bone growth factors
- accelerate mineral deposit
- remodeling the bone formation
Methods of revascularization

- Sorts of cells seeding
  - endothelial cells + osteoblasts
- Vascular endothelial growth factors
- Application of microsurgery technology
Accelerating osteogenesis and revascularization of tissue engineered bone using fascia flap in Chinese Goats tibia defect repairing
Construction and application of revascularlized tissue-engineered bone

Naked-eyes Observing

CHAP

TE

FF
Construction and application of revascularized tissue-engineered bone

Cross-section of the bone defect
Construction and application of revascularized tissue-engineered bone

Vascular formation observed with ink intravascular injection
Construction and application of revascularized tissue-engineered bone

FF

TE

CHAP

X-ray (4 weeks)
Construction and application of revascularized tissue-engineered bone

The optical density index of X-ray film
Construction and application of revascularized tissue-engineered bone

radionuclide bone imaging, ECT
Construction and application of revascularized tissue-engineered bone

Osteogenesis (HE)

Angiogenesis (HE)
Construction and application of revascularized tissue-engineered bone

Biomechanics of the new tissues and vascular formation
Thank you!