My Regeneration: Using Stem Cells to Repair the Heart

Community Medical School
Spring 2013
Case

- 76 year-old man
- Chest pain at home
- 911 called (wife)
- Cardiac arrest on transport to ED
  - Sudden cardiac death ➔ defibrillated
- ED diagnosis
  - Acute myocardial infarction
- Emergency cardiac catheterization
  - Stent to the left anterior descending coronary artery
Case

- Large myocardial infarction (heart attack)
  - Cardiogenic shock
  - 2 months in the hospital
  - Miraculous survival
  - But, he had heart failure the rest of his life
- Lived ~2.5 more years
  - Both he and his family were grateful
My Regeneration: Using Stem Cells to Repair the Heart

• Normal heart
  – Anatomy and physiology
• Heart attack
  – Myocardial infarction
  – Sudden cardiac death
• Cardiac regeneration
The heart, who cares?

Table B. Deaths and death rates for 2011

All causes .......................................................... 2,512,873
Diseases of heart ........................................ 596,339
Malignant neoplasms ........................................ 575,313
Chronic lower respiratory diseases ..................... 143,382
Cerebrovascular diseases .................................. 128,931
Accidents (unintentional injuries) ....................... 122,777
Alzheimer’s disease ........................................... 84,691
Diabetes mellitus .............................................. 73,282
Influenza and pneumonia .................................. 53,667
Nephritis, nephrotic syndrome and nephrosis .......... 5
Intentional self-harm (suicide) ......................... 45,731
Septicemia ...................................................... 35,539
Chronic liver disease and cirrhosis ...................... 33,539
Essential hypertension and hypertensive renal disease .................. 27,477
Parkinson’s disease .......................................... 23,107
Pneumonitis due to solids and liquids ................... 18,090
All other causes .............................................. 512,723
What is the heart, and what does it do?

Anatomy and Physiology

Structure Function
Anatomy of the Heart

Left side, right side, 4 chambers and 4 valves
Normal Anatomy and Physiology

The heart is a muscular pump
Normal Anatomy and Physiology

The heart is a muscular pump
Normal Anatomy and Physiology

Red blood cells and oxygen delivery
Normal Anatomy and Physiology

Valves → unidirectional flow of blood
Normal Anatomy and Physiology

Mitral Valve
Abnormal Mitral Valve
Anatomy and Physiology

Coronary Arteries
Anatomy and Physiology

“Coronary Arteries”
Coronary Atherosclerosis
“Cholesterol blockage”
What is a Heart Attack?

“Myocardial Infarction”
What is a Heart Attack?

“*Myocardial Infarction*”
Myocardial Infarction
Emergency Treatment
Myocardial Infarction/Heart Attack

Manifestations

Cell death (necrosis) because of lack of oxygen

Ventricular fibrillation
Sudden cardiac death
Myocardial Infarction/Heart Attack

Manifestations

Cell death (necrosis) because of lack of oxygen

Fibrosis
Myocardial Infarction/Heart Attack

Manifestations
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- **Cardiac regeneration**