1926 Herman Blumgard used solutions of radon gas to measure what he called “velocity of the circulation”.

1927 Blumberg and Soma Weiss wrote an article in *Journal of Clinical Investigation*.

1929 Werner Forssmann did the first cardiac catheterization in Eberswalde Germany.

1929 Georg de Hevesy used RBC’s labeled with 32 P to measure RBC volume.

1936 Paul Haun used 59 Fe to measure total body hematocrit.

WWII - traumatic shock stimulated considerable research in cardiology that led to the introduction of 35 S as a tracer of plasma proteins.

1941- Andrew Cournand and Dickinson Richards used cardiac catheterization to measure cardiac output.

1954- Jeff Holter founded the Society of Nuclear Medicine.

1956- Cournand, Richards and Forssmann shared the Nobel Prize.

1958- Hal Anger invented the “scintillation camera”

1960- 99mTc (the nuclear medicine work horse) was commercially developed.

1964 Nuclear medicine stole the show internationally.

1965 Nuclear Medicine took off and Nuclear Cardiology led the way.
Hierarchy of Potential Test Ordering Based on Clinical Presentation

Pre-op Assessment?  
Yes  
No  

Within 3 Months of ACS, No Prior Coronary Angiography?  
Yes  
No  

Prior PCI or CABG?  
Yes  
No  

Prior Imaging?  
Yes  
No  

Ischemic Equivalent?  
Yes  
No  

Asymptomatic?  
Yes  

Table 4,* Figure 5
Table 5
Table 6, Figure 6
Table 3, Figure 4
Table 1, Figure 2
Table 3, Figure 3

Potential Applications for Chest Pain


Potential Applications for Asymptomatic* Patients

Prior Test Results*

Perioperative Evaluation

Thallium – 201 A cyclotron produced potassium (K+) analog, first introduced in the early 1970s.

- Cyclotron Produced
- Physical Half Life- 73.1 hours.
- Emits 2 gamma rays at energies 135 and 167 keV
- $^{201}$Hg x-rays 60 to 80 keV range

$^{99m}$Tc Labeled Agents
- Reactor produced.
- 6 hour physical Half Life.
- Emits 140 keV gamma ray.
Thallium-201 Advantages
- Reperfusion into viable tissue.
- ▲ uptake in lungs after exercise is a marker for CAD.

Disadvantages
- Stress imaging must begin soon.
- Low photon energy
- ▼ Resolution (blur-o-grams)
- Relatively long T ½ 73.1 hours
- Minimized optimal gated SPECT

99m Tc- sestamibi- tetrofosmin Advantages
- Relatively fixed in myocardium
- ▲ count rate = improved resolution
- More suitable photon energy
- Short T ½ 6 hours
- Well suited for gated SPECT images
- Dose allows for first pass acquisition

Disadvantages
- 2 doses are needed
- Hepatobiliary and GI artifacts

- Patient Identifiers
- NPO 4-6 hours
- Caffeine ?
- Medications, Allergies, Asthma
- Beta Blockers, block the effects of adrenaline ↓ HR and BP
- Pacemaker ?
- 12 Lead ECG, Blood Pressure, IV.
- LBBB ?
- Physician, Cardiology Tech, Nuclear Medicine Tech.
- 85% of predicted MHR or Double product of 25,000.
- Exercise is reported in metabolic equivalents (METS).
- Absolute contraindications, Relative contraindications
STRESS TESTING

- Treadmill Exercise
- AHA Guidelines
- ECG, Defibrillator, cardiac emergency pharmaceuticals
- Supervised by properly trained nurses, PA’s, exercise physiologists, and med techs under the direct supervision of a qualified physician.
- Advanced and Basic Life support training.
- Exercise capacity is measured in metabolic equivalents (METS) Bruce protocol.
- Patient selection, patient prep, consent forms, radiation safety.

- Pharmacologic Stress
  - Dipyridamole
  - Adenosine
  - Regadenosine
  - Dobutamine
  - Arbutimine
  - Coronary Vasodilators
  - Cardiac Positive inotropic agents

THALLIUM 201 IMAGING

Procedure 1
1. Administer 4 mCi $^{201}$TI at peak stress.
2. Acquire a stress scan immediately after the $^{201}$TI injection (beginning within 5–7 min).
3. Acquire a 3- to 4-h delayed (redistribution) scan.
4. When a fixed defect is identified, acquire a 24-h delayed (redistribution) scan.

Procedure 2
1. Administer 2.5–3.0 mCi $^{201}$TI at peak stress.
2. Acquire a stress scan immediately after the $^{201}$TI injection (beginning within 5–7 min).
3. Acquire a 3- to 4-h delayed (redistribution) scan.
4. When a fixed defect is identified, administer 1.0–1.5 mCi $^{201}$TI the same day.
5. Perform a rest scan 10 min later.

Procedure 3
1. Administer 4 mCi $^{201}$TI at peak stress.
2. Acquire a stress scan immediately after the $^{201}$TI injection (beginning within 5–7 min).
3. Acquire a 3- to 4-h delayed (redistribution) scan.
4. When a fixed defect is identified, administer 3–4 mCi $^{201}$TI on a subsequent day.
5. Perform a rest scan 10 min later.

Procedure 4
1. Administer 2.5–3.0 mCi $^{201}$TI at peak stress.
2. Acquire a stress scan immediately after the $^{201}$TI injection (beginning within 5–7 min).
3. Immediately after completion of the stress scan, administer 1.0–1.5 mCi $^{201}$TI.
4. Acquire a rest scan 3–4 h later.
LAD ISCHEMIA
VISERAL INTERFERENCE

DIAPHRAGMATIC ATTENUATION
**Dynamic Gated Cardiac Imaging**

- Functional capacity of the heart.
- Ejection Fraction (EF)
- Evaluate wall motion.
- Kinesis- Hypokinesis-Akinesis- Dyskinesis
- Estimate cardiac output.
- Assess diastolic function.
- Evaluate shunts
Cardiac PET Imaging

- Higher resolution
- Myocardial viability
- Stunned or hibernating myocardium
- Fluorine 18
- Rubidium 82
- Nitrogen 13
- Oxygen 15