my
two cents...

Once a new technology rolls over you, if you're not part of the steamroller, you're part of the road."  Stewart Brand

Michael D Hibbard MD FACC
Medical Director
Avera Heart Hospital of South Dakota
1967
Mobile ICU in MI

Dr. Frank Pantridge

Royal Victoria Hospital

Goal 15min Dispatch to Arrival

1970 System Replicated in US
1911 August Waller: “I do not imagine that the ECG is likely to have extensive use in the hospital”

1924 Einthoven: Nobel Prize in Medicine

1946 Arthur Vineberg: LIMA to Heart

1948-51 Framingham Massachusetts

1958 1st SK in MI

1960 CPR

1964 Konrad Bloch & Feodor Lynen Nobel Prize in Medicine Lipid Metabolism

1967 Dr. Frank Pandridge Mobile ICU’s Rene Favaloro CABG Cleveland Clinic

1972 Harvey Feigenbaum 1st Echo Text

1976 1st Statin

1980 1st AICD in Man
Goal 15 min
Dispatch to Arrival!!

MI Patient is Here
First Super Bowl Green Bay 35 Kansas City Chiefs 10
Average Cost New House $14,250
Average Yearly Salary $7300
Gas 33 cents/gal

Year End Dow Jones 905
Average Monthly Rent $125
Federal Minimum Wage $1.40/hr
New Car $2750
Reperfusion Goals

EMS-to-Drug < 30min
EMS to Balloon < 90min
Symptom Onset to Reperfusion < 120min
Historical Benefit of Pre-Hospital ECG

Ten Minute Decrease in Door to Drug Time

Fifteen to Twenty Minute Decrease in Door to Balloon Time
EVOLUTION OF ACUTE MI: “WAVEFRONT” PHENOMENON OF NECROSIS

Cross sections of left ventricle after experimental coronary artery occlusion

Duration of occlusion

- 40 min
- 3 h
- 24 h

Necrosis
Ischemic but viable
Non-ischemic

Area supplied by occluded artery

(Source: Reimer et al, Circulation, 1977)
Symptom Onset to Reperfusion Without Pre-hospital ECG
Cardiac Triage

- The consistent use of randomized trial results has been disappointing.
- Treatment in rural settings is less likely to adhere to clinical guidelines.

Since 2004 AHA Guidelines Pre-Hospital ECG Recommended

Used in Fewer than 10%
...and God said:
\[ \varepsilon_0 \oint E \cdot dA = \sum q \]
\[ \Phi_B \cdot ds = \mu_0 \oint j \cdot dA + \mu_0 \varepsilon_0 \frac{d}{dt} \oint E \cdot dA \]
\[ \oint E \cdot ds = -\frac{d}{dt} \oint B \cdot dA \]
\[ \Phi B \cdot dA = 0 \]
...and there was light!
Jon Doe STEMI
The Devil is in the Details
50 Hospitals in South Dakota

133 EMS Agencies in South Dakota
South Dakota
Population 750,000
76,000 Square Miles
ALS w 12 Lead & Transmitting: 8 (6%)
ALS w 12 Leads NOT Transmitting: 19 (14%)
ALS No 12 Lead & NOT Transmitting: 22 (17%)
BLS w 12 Lead NOT Transmitting: 3 (2%)
BLS NO 12 Lead & NOT Transmitting: 81 (61%)

**ALS are primarily part time volunteer service and up to 80% of the time they are BLS.**
66% of STEMI Patients Present to a Hospital without PCI
Can EMS Providers Acquire Pre-hospital ECGs?

Can EMS Providers Reliably Interpret or Communicate Pre-Hospital ECGs?

Can EMS & Hospitals Organize Systems to Effectively Use Pre-Hospital ECG’s?
# Models for Interpreting Pre-hospital ECGs

<table>
<thead>
<tr>
<th>Method of Interpreting Prehospital ECG</th>
<th>Pros</th>
<th>Cons</th>
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| Computer algorithm interpretation     | Rapid, easy  
   No wireless network or technology requirements | False-positive and false-negative rates higher than physician interpretation |
| Paramedic interpretation               | Rapid, easy  
   No wireless network or technology requirements | Requires intensive education and quality assurance program  
   More complex in communities with multiple EMS providers and agencies |
| Wireless transmission and physician interpretation | Theoretically, lowest rate of false-positives and false-negatives  
   Medical oversight can provide guidance on destination hospital and treatment en route | New technology requirement for EMS providers and hospital  
   Reliable wireless network Transmission unit on ambulance  
   Receiver station unit at hospital  
   Smartphones for physicians  
   Requires system to ensure immediate interpretation by physician  
   Transmission failures |
Comparison of Existing Pre-hospital ECG Programs

<table>
<thead>
<tr>
<th>Location</th>
<th>Prehospital ECG Interpretation</th>
<th>Activate Catheterization Lab en Route to Hospital</th>
<th>Bypass Non-PCI Hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boston(^{54,92})</td>
<td>Paramedic interpretation</td>
<td>Yes (activation by emergency department physician based on paramedic interpretation)</td>
<td>Yes (for all patients with “definite STEMI” or “possible STEMI”)</td>
</tr>
<tr>
<td>Los Angeles County(^{76,87})</td>
<td>Computer algorithm interpretation</td>
<td>Yes (activation by emergency department physician based on computer algorithm interpretation)</td>
<td>Yes (for all patients with acute MI)</td>
</tr>
<tr>
<td>North Carolina(^{83})</td>
<td>Mixed (used computer algorithm interpretation, paramedic interpretation, or wireless transmission)</td>
<td>Mixed (activation by paramedics or emergency department physician)</td>
<td>Mixed (paramedics occasionally diverted patients with STEMI to nearest PCI hospital)</td>
</tr>
<tr>
<td>Ottawa(^{85,86})</td>
<td>Paramedic interpretation</td>
<td>Yes (activation by paramedic through a central page operator)</td>
<td>Yes (for all patients with STEMI)</td>
</tr>
</tbody>
</table>

PCI indicates percutaneous coronary intervention; MI, myocardial infarction; and STEMI, ST-segment–elevation myocardial infarction.
Not Simple to Everyone

30d and 1 yr mortality reduced when AMI pts treated by cardiologists than other MD’s

Cardiologist Rx’d pts had higher utilization of cardiac procedures and meds associated w survival
Cardiac Triage

Limitations of Lytic Therapy

A  Failure in 50%

B  Re-occlusion in 20%

ICH in 1-2%

Contra-Indicated 40%

Risk in Elderly

Bleeding
Cardiac Triage
Patients Usually Complicated

- CHF
- Arrhythmias
- LBBB
- Device Therapy
- Peripheral Vascular Disease
- Recent Surgery
- Weather
Cardiac Triage
Cardiac Triage
Two Proposed Models

Pre-Hospital Triage

Bypass Non-PCI Hospital

Inter-Hospital Triage

Advanced Notification & Efficient Transfer non-PCI to PCI

Mistakes Can Have Serious Consequences!!
Cardiac Triage

- Lower mortality in elderly pts admitted to “America’s Best Hospitals”
- Mortality 3.4% vs 5.4% for PCI vs Lytic a 37% relative reduction in death
S.D. hospitals rate high

Good marks reflect low mortality, strong patient satisfaction

By Jon Walker
jwalker@argusleader.com

Heart patients and Uncle Sam both give South Dakota hospitals high scores in a study of mortality rates and customer satisfaction.

The data come from a study of Medicare numbers for last year looking at 46 hospitals in the state and more than 4,600 nationwide.

Most South Dakota hospitals fit the norm for outcomes on heart attacks, heart failure and pneumonia, while receiving high marks for service.

One standout on the list was the Avera Heart Hospital of South Dakota, a 55-bed unit in southwest Sioux Falls. Its low mortality rate for heart attacks, 11.5 per 100 patients, was number 11 in the nation in a comparison of hospitals with best outcomes.

“We’re never happy with that,” said Jon Soderholm, president at Avera Heart. “There should be fewer that die. That’s one reason we’re 11th in the country, because we continue to work on that.”

The Sanford Medical Center in Sioux Falls had a mortality rate of 14.1 for heart attacks and Avera McKennan a rate of 15 per 100, both better than the national rate of 15.9 deaths per 100.

“South Dakota looks pretty good compared to the rest of the

See HOSPITALS, Page 7A
Coop CV Project: 30d Mortality 17% lower if pt admitted directly to experienced center
South Dakota
Talented Cath Lab Staff
Cardiac Triage

Meta analysis of 6 randomized trials: <3 hr tx 42% reduction in death, MI and Stroke w tx PCI
Centralized Communication System Essential
MDH

EMR Theory

EMR = MD2
Life Savers.
Acute Cardiac Syndrome

- 30d Mortality ↓ 30% to 6%
- PCI Superior to Lytic Rx
- Outcome ↑ w CV Specialist
- Outcome ↑ w High Volume
Change will not come if we wait for some other person or some other time. We are the ones we have been waiting for. We are the change that we seek.
Life is Life. Fight for It!  

Mother Teresa