Dolore toracico e Heart score: Validazione di un processo diagnostico-terapeutico nella popolazione toscana.

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ASL NordOvest Toscana
Pisa
Ospedale Apuane Massa
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### The HEART Score for Chest Pain Patients in the ED

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>History</strong></td>
<td>Highly Suspicious, Moderately Suspicious, Slightly or Non-Suspicious</td>
<td>2 points</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 point</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 points</td>
</tr>
<tr>
<td><strong>ECG</strong></td>
<td>Significant ST-Depression, Nonspecific repolarization, Normal</td>
<td>2 points</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 point</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 points</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>≥ 65 years</td>
<td>2 points</td>
</tr>
<tr>
<td></td>
<td>&gt; 45 - &lt;65 years</td>
<td>1 point</td>
</tr>
<tr>
<td></td>
<td>≤ 45 years</td>
<td>0 points</td>
</tr>
<tr>
<td><strong>Risk Factors</strong></td>
<td>≥ 3 or history of CAD</td>
<td>2 points</td>
</tr>
<tr>
<td></td>
<td>1 or 2 RF</td>
<td>1 point</td>
</tr>
<tr>
<td></td>
<td>No RF</td>
<td>0 points</td>
</tr>
<tr>
<td><strong>Troponin</strong></td>
<td>≥ 3 x Normal Limit</td>
<td>2 points</td>
</tr>
<tr>
<td></td>
<td>&gt; 1 - &lt; 3 x Normal Limit</td>
<td>1 point</td>
</tr>
<tr>
<td></td>
<td>≤ Normal Limit</td>
<td>0 points</td>
</tr>
</tbody>
</table>

Risk factors: DM, current or recent (< 1 month) smoker, HTN, HLP, family history of CAD, & obesity

- Score 0-3: 2.5% MACE over next 6 weeks —> Discharge Home
- Score 4-6: 20.3% MACE over next 6 weeks —> Admit for Clinical Observation
- Score 7-10: 72.7% MACE over next 6 weeks —> Early invasive Strategies

Background
The HEART Pathway is a decision aid designed to identify emergency department patients with acute chest pain for early discharge. No randomized trials have compared the HEART Pathway with usual care.

Methods and Results
Adult emergency department patients with symptoms related to acute coronary syndrome without ST-elevation on ECG (n=282) were randomized to the HEART Pathway or usual care. In the HEART Pathway arm, emergency department providers used the HEART score, a validated decision aid, and troponin measures at 0 and 3 hours to identify patients for early discharge. Usual care was based on American College of Cardiology/American Heart Association guidelines. The primary outcome, objective cardiac testing (stress testing or angiography), and secondary outcomes, index length of stay, early discharge, and major adverse cardiac events (death, myocardial infarction, or coronary revascularization), were assessed at 30 days by phone interview and record review. Participants had a mean age of 53 years, 16% had previous myocardial infarction, and 6% (95% confidence interval, 3.6%-9.5%) had major adverse cardiac events within 30 days of randomization. Compared with usual care, use of the HEART Pathway decreased objective cardiac testing at 30 days by 12.1% (68.8% versus 56.7%; \( P = 0.048 \)) and length of stay by 12 hours (9.9 versus 21.9 hours; \( P = 0.013 \)) and increased early discharges by 21.3% (39.7% versus 18.4%; \( P < 0.001 \)). No patients identified for early discharge had major adverse cardiac events within 30 days.

Conclusions
The HEART Pathway reduces objective cardiac testing during 30 days, shortens length of stay, and increases early discharges. These important efficiency gains occurred without any patients identified for early discharge suffering MACE at 30 days.

<table>
<thead>
<tr>
<th>Score</th>
<th>ROC area</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIMI</td>
<td>0.74</td>
</tr>
<tr>
<td>Sanchis</td>
<td>0.79</td>
</tr>
<tr>
<td>Heart</td>
<td>0.78</td>
</tr>
<tr>
<td>Florence Prediction Rule</td>
<td>0.80</td>
</tr>
<tr>
<td>Bouzas-Mosquera</td>
<td>0.84</td>
</tr>
</tbody>
</table>
Effectiveness of a multidisciplinary chest pain unit for the assessment of coronary syndromes and risk stratification in the Florence area

Alberto Conti, MD,1 Barbara Paladin, MD,2 Simone Toccafondi, MD,4 Simone Magazzini, MD,4 Iacopo Olivotto, MD,4 Ferdinando Galassi, MD,4 Cesco Pieroni, MD,4 Gennaro Sanoro, MD,4 David Antoniucci, MD,5 and Giancarlo Berni, MD† Florence, Italy

<table>
<thead>
<tr>
<th>Location</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substernal, precordial</td>
<td>+3</td>
</tr>
<tr>
<td>Left chest, neck, lower jaw, epigastrium</td>
<td>+1</td>
</tr>
<tr>
<td>Apex</td>
<td>-1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Radiation</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Either arm, shoulder, back, neck, lower jaw</td>
<td>+1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Character</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crushing, pressing, heaviness</td>
<td>+3</td>
</tr>
<tr>
<td>Sticking, pleuritic, pinprick</td>
<td>-1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Associated symptoms</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyspnea, nausea, diaphoresis</td>
<td>+2</td>
</tr>
<tr>
<td>History of angina</td>
<td>+3</td>
</tr>
</tbody>
</table>

A score < 4 is considered as “very low” probability of CAD; a score ≥ 4 as “low-intermediate and high” probability of CAD.
## SEDE DEL DOLORE
- Retrosternale, precordiale
- Emitterace sinistro, collo, mandibola, epigastrio

## IRRADIAZIONE
- Braccia, spalla, dorso, collo, mandibola

## CARATTERISTICHE
- Oppressivo, “a morsa”
- Puntorio, trafittivo, pleuritico

## SINTOMI ASSOCIATI
- Dispnea, nausea, sudorazione

## STORIA DI DOLORE
- Angina

### The Chest Pain Score

<table>
<thead>
<tr>
<th>SEDE DEL DOLORE</th>
<th>Retrosternale, precordiale</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emitterace sinistro, collo, mandibola, epigastrio</td>
<td>+1</td>
<td></td>
</tr>
<tr>
<td>IRRADIAZIONE</td>
<td>Braccia, spalla, dorso, collo, mandibola</td>
<td>+1</td>
</tr>
<tr>
<td>CARATTERISTICHE</td>
<td>Oppressivo, “a morsa”</td>
<td>+3</td>
</tr>
<tr>
<td></td>
<td>Puntorio, trafittivo, pleuritico</td>
<td>+1</td>
</tr>
<tr>
<td>SINTOMI ASSOCIATI</td>
<td>Dispnea, nausea, sudorazione</td>
<td>+2</td>
</tr>
<tr>
<td>STORIA DI DOLORE</td>
<td>Angina</td>
<td>+3</td>
</tr>
</tbody>
</table>

Ma il dolore esofageo ha le stesse caratteristiche!

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Geleijnse ML, *Eur Heart J* 2000
Conti A, *Am Heart J* 2002
A new simple risk score in patients with acute chest pain without existing known coronary disease

The clinical prediction rule, composed of 5 independent prognostic variables (CP score higher than 6, male gender, age older than 50 years, MS, and DM). patients with a risk ranging from 1% to 25% (group C, rule 5-6) (Figs. 3 and 4).
1
se dolore toracico tipico, ECG non diagnostico, cTnI normale non diagnostica, paziente < 65 anni:
AngioTC-Coronarica

2
se dolore toracico tipico, ECG non diagnostico, cTnI normale non diagnostica, paziente ≥ 65 anni:
SPECT Miocardica (Scintigrafia miocardica da stress)

Nel sesso femminile è consigliata comunque angio-TC-coronarica
Successiva eventuale ulteriore definizione diagnostica con SPECT Miocardica

In atto protocollo per appuntamento informatico con radiodiagnostica e medicina nucleare:
il paziente del PS alla dimissione riceve data e ora dell’esame prospettato
Il dolore toracico
Dolore toracico: origine non cardiaca e cardiaca

Chest Pain

Non Cardiac
- PE
- PTX
- Esophageal reflux/rupture

Cardiac
- Aortic disease
- Myo/pericardium
- Coronary disease
- Coronary spasm
- Obstructive CAD
  - Stable angina
  - ACS
Il quintetto mortale

1. Infarto miocardico
2. Pneumotorace (iperteso)
3. Dissecazione aortica
4. Embolia polmonare
5. Rottura esofagea

...il quintetto temibile

1. Pericardite
2. Reflusso gastro-esofageo
3. S. Tako-tsubo
4. Herpes Zoster
5. Pleuro-polmonite
Dolore toracico: origine non cardiaca

Alternative diagnoses in patients discharged after CPU management with no evidence of CAD (n = 870).

Conti A, Am Heart J, 2002
sindrome extraesofagea

- Tosse
- Laringite
- Asma
- Erosioni dentali

Spesso associata ai sintomi tipici ma anche isolata.
Sindrome Laringea?

**IL REFLUSSO LARINGOFARINGEO**

<table>
<thead>
<tr>
<th>Segni faringo-laringei potenzialmente associati al GER</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Edema ed iperemia mucosa laringea</td>
<td>Stenosi sottoglottica</td>
</tr>
<tr>
<td>Granuloma</td>
<td>Iperemia ed iperplasia linfoide della parete posteriore faringea</td>
</tr>
<tr>
<td>Polipi-noduli laringei</td>
<td>Ulcera da contatto</td>
</tr>
<tr>
<td>Edema di Reinke</td>
<td>Edeme interaritenoideo</td>
</tr>
<tr>
<td>Tumori</td>
<td>Stenosi della porzione posteriore glottide</td>
</tr>
</tbody>
</table>
Edema interaritenoido. a) ligero. b) grave
Granuloma laringeo
Il dolore toracico: etica e genetica
“è più importante conoscere il tipo di persona che ha una malattia piuttosto che il tipo di malattia che ha una persona”

In questa breve frase sta il concetto della medicina personalizzata e della precision medicine.

William Osler
Hetlevik I. Evidence-based medicine in general practice: a hindrance to optimal medical care?
The growing demands for quality and safety in health care have refocused attention on patient outcomes, even if efforts to ensure more consistently positive outcomes sometimes reduce the physician’s prized autonomy.

Shared Decision Making — The Pinnacle of Patient-Centered Care

Michael J. Barry, M.D., and Susan Edgman-Levitan, P.A.

Nothing about me without me.

— Valerie Billingham,
Through the Patient’s Eyes,
Salzburg Seminar
Session 356, 1998
Evolving Medical Practice

**Future Model**

- Genetic Predisposition
- Stratified Population
- Monitoring and Prevention
- Diagnose
- Treatment
- Outcome

**PRECISION MEDICINE**

- Cost-effective healthcare
- Safer Treatments
- Better Patient Outcomes

...management of disease generally follows the old, established paradigm: have risk factors, develop symptoms, get a diagnosis... treat
Telomeres are the extreme ends of eukaryotic chromosomes and are involved in cell cycle control and maintenance of chromosomal stability.

In the West of Scotland Coronary Prevention Study (WOSCOPS) study, the odds ratio for Major Adverse Cardiac Events (MACE) was 2 in placebo patients in the lower two tertiles of telomere length compared with the highest.

Samani NJ, Downloaded from heart.bmj.com on 15 Sept 2008
Telomeres are the extreme ends of eukaryotic chromosomes and are involved in cell cycle control and maintenance of chromosomal stability.

In West of Scotland Primary Prevention Study (WOSCOPS) odds ratio for MACE was x 2 in placebo pts in the lower two tertiles of telomere length versus the highest.

Samani NJ, from heart.bmj.com 2008
Factors affecting telomere length and how these could explain interindividual variation in risk of age-related cardiovascular diseases. The telomere hypothesis postulates that shorter telomeres contribute to a risk of coronary artery disease and other cardiovascular diseases through its impact on cellular senescence. In turn, telomere length is affected by age and a number of other factors whose impact vary between individual subjects.
... the novel 7 CAD-associated loci in the vicinity of the PSRC1 and CELSR2 genes on chromosome 1 (1p13.3), showed a strong association with total cholesterol.

The CAD-associated risk allele A of rs599839 (allele frequency 0.78) was associated with a 0.17-mmol/l (95% CI 0.10 to 0.24 mmol/l) higher serum cholesterol level per allele copy (P = 3.84 × 10−6).

An association of rs599839 with LDL cholesterol was also shown in 1,090 cases with myocardial infarction (P = 0.0026).
The presence of 2 alleles is strongly associated with risk of MI or CAD.

shows the same risk for CAD as the presence of multiple RF for atherosclerosis.
“Tonight, I'm launching a new Precision Medicine Initiative to bring us closer to curing diseases like cancer and diabetes — and to give all of us access to the personalized information we need to keep ourselves and our families healthier.”

President Barack Obama, State of the Union Address, January 20, 2015
• … Although the precision medicine initiative will probably yield its greatest benefits years down the road, there should be some notable near-term successes. In addition to the results of the cancer studies described above, studies of a large research cohort exposed to many kinds of therapies may provide early insights into pharmacogenomics — enabling the provision of the right drug at the right dose to the right patient.

• Opportunities to identify persons with rare loss of function mutations that protect against common diseases may point to attractive drug targets for broad patient populations. And observations of beneficial use of mobile health technologies may improve strategies for preventing and managing chronic
The Precision Medicine Initiative: Data-Driven Treatments as Unique as Your Own Body
Right now, most medical treatments are designed for the average patient.

But one size doesn't fit all, and treatments that are very successful for some patients don't work for others. **Think about it:**

- If you need glasses, you aren't assigned a generic pair. You get a prescription customized for you.
- If you have an allergy, you get tested to determine exactly what you're allergic to.
- If you need a blood transfusion, it has to match your precise blood type.
La medicina basata sulle evidenze ricerca [evidenze relative a malattie a definizione ontologica ben circoscritta](https://doi.org/10.1136/bmj.g22) con studi clinici focalizzati su [pazienti il più possibile privi di altre condizioni cliniche rilevanti](https://doi.org/10.1136/bmj.g22) che risulterebbero “confondenti” per le evidenze ricercate.
Coronary Death and Nonfatal MI

% of patients without events

34% Risk Reduction

p<0.00001

Inclusion Criteria: Prior MI and/or angina pectoris

The Lancet, Vol 344, November 19, 1994
I “nuovi” pazienti

Avoid: Macrolides plus Statin! = Rabdomiolyis
A 78-year-old woman was found unconscious on the floor of her apartment by a neighbor who checked on her. The woman could not remember falling but told doctors that before going to bed she had abdominal pain and nausea and had produced a black stool, after which she had palpitations and felt lightheaded.

Dr. Michael Stern reported in the June issue of Emergency Medicine.
Her medical history included

- **High blood pressure** (ACE-inhib)
- **Coronary artery disease** (ASA and Beta-blocker)
- **Atrial fibrillation** (Warfarin)
- **Congestive heart failure** (Diuretic)
- **Hypercholesterolemia** (Statin)
- **Osteoarthritis** (NSAD).

She also had
- a **cold** with a **productive cough**....

For each condition, she had been prescribed a different drug, and she was taking a few over-the-counter remedies on her own.
A complex system is a system composed of interconnected parts that as a whole exhibit one or more properties (behavior among the possible properties) not obvious from the properties of the individual parts.
Etimologia della complessità

• Complesso, complicato e semplice sono termini che vengono tutti dalla stessa radice indoeuropea: plek- (parte, piega, intreccio). Da plek- derivano, in latino:

• Il verbo plicare = piegare
  Il verbo plectere = intrecciare
  Il suffisso -plex = parte

• La parola semplice = sine ple:
Etimologia della complessità

Ovvero: complicato (con pieghe)
Può essere “spiegato”

• Da cum- + plicare deriva: 
  Complicatus
  Ovvero: complicato (con pieghe)
  Può essere “spiegato”

• Da cum- + plectere deriva: 
  Complexus
  Ovvero: complesso
  (con intrecci)
  Non può essere “spiegato”

• Da sine- + -plex deriva: 
  Simplex
  Ovvero: semplice
  (senza pieghe)
  Non è complicato, né complesso
Construction of mindlines

From Guidelines ...to Mindlines

Practitioners’ "mindlines"

Meetings

each other

"reps"

"The centre" (eg DHI)

patients

experience

opinion/leaders:

"they say:"

reading/updates

teachers/training

infrastructure

General

Individual

Patient's view

BMJ 30 Oct 2004
Linee guida

- uno stimolo per il medico skilled
  (formato, acculturato, aggiornato)

- una trappola (pastoia) per il medico impreparato
EVIDENZE ?
La complessità di un elemento clinico:

- Polmonite
- Embolia polmonare
- Esacerbazione BPCO
- Insufficienza cardiaca
- Decondizionamento fisico
- Anemia
- Dispnea, tosse
- Versamento pleurico
• Embolia polmonare
• Insufficienza cardiaca
• Polmonite
• Esacerbazione di BPCO
• Versamento pleurico
• Anemia
• Decondizionamento fisico

DICPNEA

TICAGRELOR
Ethnic differences in response to drugs?
Ethnic Differences in Cardiovascular Drug Response
Potential Contribution of Pharmacogenetics

Julie A. Johnson, PharmD

Figure 1. Average warfarin dose requirements, by ethnicity, to maintain a therapeutic INR. Reproduced from Dang et al, with permission from the Annals of Pharmacotherapy.
ALLHAT
Cumulative Event Rates for the Primary Outcome
(Fatal Coronary Heart Disease or Nonfatal Myocardial Infarction)

Enrollment criteria
Hypertension + 1 risk factor
(previous MI, or other CVD,
LVH, type 2 diabetes,
smoking, HDLChol <35 mg/dl)
ALLHAT

Effects of ACE inhibitor based and Diuretic based treatments on Blood Pressure and Outcomes

Chlortalidone vs Lisinopril

Outcomes $\text{RR (95\% CI)}$

- All cause mortality $1.00 (0.94-1.06)$
- Myocardial infarction $0.99 (0.91-1.08)$
- Stroke $1.19 (1.02-1.30) *$
- Heart failure $1.20 (1.09-1.34) *$

$* = p<0.01$

35% of enrolled patients were blacks

ALLHAT Collaborative Research Group. JAMA. 2002; 288: 2981-97
Chlortalidone vs Lisinopril

<table>
<thead>
<tr>
<th></th>
<th>Stroke</th>
<th>BP (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All patients</td>
<td>15%</td>
<td>-2 mmHg</td>
</tr>
<tr>
<td>Blacks</td>
<td>40%</td>
<td>-4 mmHg</td>
</tr>
</tbody>
</table>

ALLHAT—All Hit or All Miss? Key Questions Still Remain

Franz H. Messerli, MD, and Michael A. Weber, MD

... black patients did not do well when randomized to lisinopril; most glaringly, the incidence of stroke was 40% higher than while receiving chlorthalidone.

The American Journal of Cardiology Vol. 92 August 1, 2003

ALLHAT Collaborative Research Group. JAMA. 2002; 288: 2981-97
esiste una differenza nella presentazione della coronaropatia fra uomo e donna?

Gender differences in response to drugs?
Chest Pain in Acute Myocardial Infarction
Are Men From Mars and Women From Venus?

Louise Pilote, MD, MPH, PhD

In 1995, John Gray published a book entitled *Men Are From Mars, Women Are From Venus.* The premise of this book was that men and women have fundamentally different psychological differences that make them experience the world and respond to situations in widely distinct ways. Could the same be true when it comes to chest pain in acute myocardial infarction (AMI)? Dissonance remains in the medical literature, in the minds of the clinicians, and in the public at large. For example, does evidence exist to support whether men and women have fundamentally different presentations of AMI?

Several studies have shown that the symptom at presentation in men and women differs. Women present with more symptoms than men, particularly chest pain, but the prevalence of noncardiac symptoms is higher in women. Women with chest pain are less likely to have a diagnosis of AMI in the emergency department. With the above points in mind, Bhatt et al. asked whether detection of chest pain characteristics were collected in the emergency department through interviews by trained physicians who were blinded to the electrocardiography and cardiac troponin test results. All patients underwent electrocardiography and cardiac troponin testing. Levels of cardiac troponin at presentation and serially thereafter were measured if clinically indicated. All medical records were reviewed twice for adjudication of the final diagnosis by 2 independent reviewers.

...le donne vengono da venere
...gli uomini da marte
Chest Pain in Acute Myocardial Infarction
Are Men From Mars and Women From Venus?

Louise Pilote, MD, MPH, PhD

In 1995, John Gray published a book entitled Men Are From Mars, Women Are From Venus. The premise of this book was that men and women have fundamental psychological differences that make them experience the world and respond to situations in widely distinct ways. Could the same be true when it comes to chest pain in acute myocardial infarction (AMI)? Dissent remains in the medical literature, in the minds of the clinicians, and in the public at large as to whether men and women have fundamentally different presentations of AMI.

Several studies have shown that the most common symptom at presentation in men and women is chest pain. Reports vary in the proportion of patients who present without chest pain, but the prevalence of presentation without chest pain is higher in women. More information on chest pain-associated symptoms and symptoms accompanying presentation without chest pain might prove useful in improving the diagnosis of AMI in women.

With the above premises in mind, Rubini Gimenez et al asked whether detection of sex-specific chest pain characteristics (CPCs) would allow emergency department physicians to diagnose AMI in women more accurately. The authors conducted a large prospective cohort study in 7 European centers (5 Swiss, 1 Italian, and 1 Spanish) to investigate the predictive value of CPCs. From 2006 to 2012, the investigators assembled a cohort of 2475 patients, 796 women and 1679 men, who presented to an emergency department within 12 hours of the onset of acute chest pain. The median age of men was more than 10 years younger that of women (59 vs 70 years), and a higher proportion of men had had a previous AMI (28.2% vs 15.1%) and revascularization (32.9% vs 17.3%). Thirty-four predefined CPCs were collected with regard to the location and size of the area of pain, pain quality, radiation, onset, duration, dynamics, severity, and the aggravating and relieving factors (e.g., response to salicylates). Chest pain characteristics were collected in the emergency department through interviews by trained physicians who were blinded to the electrocardiography and cardiac troponin test results. All patients underwent electrocardiography and chest radiography; levels of cardiac troponin at presentation and serially thereafter were measured if clinically indicated. All medical records were reviewed twice for adjudication of the final diagnosis by 2 independent reviewers.
Il dolore toracico: origine cardiaca e non cardiaca
Il dolore toracico è sintomo di più patologie:

- Cardiache
- Esofagee
- Polmonari
- Muscoloscheletriche
- Nevritiche

...oltre il cuore

- Pirosi: dolore urenle (bruciore) in genere a sede retrosternale (heartburn)

- Rigurgito: comparsa senza sforzo di un liquido acido/amaro in bocca

- Broncopolmonite-polmonite con interessamento pleurico:
  associate a corteo sindromico (tosse, escreato, febbre…)

- Contratture muscolari e artrosi e discopatie dorsali-cervicali
  eventuale blocco motorio, dolore alla torsione

- Herpes Zooster toracico:
  associato a manifestazioni cutanee iperemiche, a chiazze, con aree di soluzione di continuo e secrezione seriosa, croste
L'EGDS è positiva solo se c'è esofagite. La diagnosi può essere clinica.
Diffuse Oesophageal Spasm
Achalasia Of The Oesophagus
Manometria esofagea:
Pirosi e rigurgito? pH metria

- pH metria (delle 24 ore)
Esophageal rupture: Diagnosis

- **CXR:** early shows mediastinal or free peritoneal air
  - Hours to days later: widening of mediastinum, pleural effusion
Imaging
From NACR, 30512...I have your last patient for the night...Jones, 01111111, 54 yo female coming in with chest pain...currently in the ED going to T5
Atypical presentations of GERD

**Pulmonary**
- Asthma
- Bronchitis
- Aspiration pneumonia
- Apnea
- Atelectasis
- Pulmonary fibrosis

**ENT**
- Hoarseness
- Cough
- Globus
- Halitosis
- Vocal cord granuloma
- Laryngeal stenosis
- Laryngeal cancer
- Loss of dental enamel
- Sinusitis, otitis

**Chest Pain**
Sintomi Tipici di MRGE

PIROSI RETROSTERNALE
RIGURGITO ACIDO

Segni e Sintomi Atipici esofagei ed extraesofagei di MRGE

Dolore toracico non cardiaco
Raucedine cronica
Asma e Patologie polmonari
Laringite cronica
Globo faringeo
Tosse cronica
Prevalenza di Segni e Sintomi Atipici di MRGE

Variabile dal 5 al 20% a seconda delle casistiche

- Dolore toracico non cardiaco: 50%
- Raucedine cronica: 78%
- Asma: 82%
- Laringite cronica: 60%
- Globo faringeo: 25-30%
- Tosse cronica: 10-25%

Anormale esposizione a reflusso acido correlata all’asma

![Bar chart showing the percentage of patients with abnormal acid reflux](chart_image)

<table>
<thead>
<tr>
<th>Study</th>
<th>Patients (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ducolone et al.</td>
<td>51</td>
</tr>
<tr>
<td>Nagel et al.</td>
<td>44</td>
</tr>
<tr>
<td>Giudicelli et al.</td>
<td>140</td>
</tr>
<tr>
<td>Sontag et al.</td>
<td>104</td>
</tr>
<tr>
<td>DeMeester et al.</td>
<td>77</td>
</tr>
<tr>
<td>Larrain et al.</td>
<td>105</td>
</tr>
<tr>
<td>Kiljander et al.</td>
<td>107</td>
</tr>
</tbody>
</table>

Prevalenza di lesioni esofagee in pazienti asmatici

Lesioni esofagee

- Normale: 61%
- Lieve: 26%
- Moderato: 8%
- Severo: 5%
...sindrome extraesofagea

- Tosse
- Laringite
- Asma
- Erosioni dentali

Spesso associata ai sintomi tipici ma anche isolata.

La laringite da reflusso è evidenziabile dall’ORL
# Segni faringo-laringei potenzialmente associati al GER

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Edema ed iperemia mucosa laringea</td>
<td>Stenosi sottoglottica</td>
</tr>
<tr>
<td>Granuloma</td>
<td>Iperemia ed iperplasia linfoida della parete posteriore faringea</td>
</tr>
<tr>
<td>Polipi-noduli laringei</td>
<td>Ulcera da contatto</td>
</tr>
<tr>
<td>Edema di Reinke</td>
<td>Edeme interaritenoideo</td>
</tr>
<tr>
<td>Tumori</td>
<td>Stenosi della porzione posteriore glottide</td>
</tr>
</tbody>
</table>
### Sindrome Laringea?

<table>
<thead>
<tr>
<th>Quadri Clinici Diversi di Uno Stesso Processo Patologico</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflusso laringo-faringeo (LFR)</td>
</tr>
<tr>
<td>Reflusso esofageo (GER)</td>
</tr>
</tbody>
</table>

**Sintomi**
- Atipici "extra digestivi"    
  - Tipici "digestivi"

**Insorgenza**
- Diurna     
  - Notturna

**Modalità**
- Posizione eretta
  - Posizione clinostatica

**Meccanismi di danno mucoso**
- UES
  - LES

**Meccanismi di compenso**
- Nessuno
  - Peristalsi, flusso salivaare

**Concausa**
- Traumatismo glottico
  - Connettiviti, m.nerologiche
Edema interaritenoido. a) leve. b) grave
Granuloma laringeo
Pachidermia interaritenoidea

Stenosi sottoglottica
Detection of Esophageal Disorders Potentially Responsible for Symptoms

- **Endoscopy**
  - pH
  - Barium swallow ± manometry
    - Reflux esophagitis
    - Infectious esophagitis
    - Pill esophagitis
    - Esophageal cancer
    - Esophageal stricture/web
    - Achalasia
    - Esophageal spasm
    - EGD-negative GERD
    - Esophageal stricture/web
    - Otorhinolaryngologist
Esophageal Chest Pain Work-Up

- Traditionally
  - Endoscopy
  - pH probe
  - Manometry
  - Provocative testing

- Emerging role for up-front empiricism
  - PPIs Test
Medical Rx Outcomes high-dose (PPIs)

• Relief of symptoms   85-95%
• Healing esophagitis  85-95%
• Prevent complications 80%
• Remission          90%

• High-dose: up to 40 mg bid
• up to 30 mg bid
<table>
<thead>
<tr>
<th>Sintomo</th>
<th>Farmaco e dose</th>
<th>Durata</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dolore toracico</td>
<td>PPI b.i.d.</td>
<td>1-8 sett</td>
</tr>
<tr>
<td>Asma</td>
<td>PPI b.i.d.</td>
<td>≤3 mesi</td>
</tr>
<tr>
<td>Tosse</td>
<td>PPI b.i.d.</td>
<td>1-3 mesi</td>
</tr>
<tr>
<td>Vie aeree superiori</td>
<td>PPI b.i.d.</td>
<td>1-3 mesi</td>
</tr>
</tbody>
</table>

Dolore toracico: sistema complesso

<table>
<thead>
<tr>
<th>Cardiac</th>
<th>Pulmonary</th>
<th>Vascular</th>
<th>Gastro-Intestinal</th>
<th>Orthopaedic</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myopericarditis</td>
<td>Pulmonary embolism</td>
<td>Aortic dissection</td>
<td>Oesophagitis, refux or spasm</td>
<td>Musculoskeletal disorders</td>
<td>Anxiety disorders</td>
</tr>
<tr>
<td>Cardiomyopathies²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tachyarrhythmias</td>
<td>(Tension)-Pneumothorax</td>
<td>Symptomatic aortic aneurysm</td>
<td>Peptic ulcer, gastritis</td>
<td>Chest trauma</td>
<td>Herpes zoster</td>
</tr>
<tr>
<td>Acute heart failure</td>
<td>Bronchitis, pneumonia</td>
<td>Stroke</td>
<td>Pancreatitis</td>
<td>Muscle injury/ inflammation</td>
<td>Anaemia</td>
</tr>
<tr>
<td>Hypertensive emergencies</td>
<td>Pleuritis</td>
<td></td>
<td>Cholecytostitis</td>
<td></td>
<td>Cervical spine pathologies</td>
</tr>
<tr>
<td>Aortic valve stenosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Takotsubo cardiomyopathy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coronary spasm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiac trauma</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dolore toracico: origine non cardiaca e cardiaca

2015 ESC Guidelines for the Management of NSTEACS Eur Heart J.

Alternative diagnoses in patients discharged after CPU management with no evidence of CAD (n = 870).
Chest Pain - Imipramine

- 50 mg nightly for 3 wks
- 52% reduction in chest pain episodes
- Suggested visceral analgesic effect

- 15 healthy male volunteers
- Balloon inflation volume at pain threshold higher on imipramine
Differential cont
Gastrointestinal

• Non-esophageal
  – Biliary
  – Peptic ulcer disease
  – Pancreatitis

• Esophageal
  – Reflux diseases
  – Esophageal spasm
  – Esophageal hypersensitivity
  – Pill esophagitis
  – HIV-AIDS diseases
  – Lye ingestion
  – Achalasia
Impression

• Non-cardiac chest pain most likely of esophageal origin.

• Pathophysiology
  ▪ Pathological acid reflux
  ▪ Non-acid reflux
  ▪ Disturbed Motility
  ▪ Visceral hypersensitivity/Brain-gut interactions
    ▪ Chemoreceptor, mechanoreceptor, thermoreceptor malfunction
    ▪ Altered cerebral processing of sensory data
  ▪ Psychological abnormalities- somatoform disorder
Next Step

What should be done next?
• Endoscopy
• Ambulatory pH monitoring
• Combined Impedance-pH testing
• Esophageal manometry
• Acid suppression therapy.
Endoscopy

- Insensitive- EE only in 5-10% of cases\(^1\).
- Highly specific
- Costly
- Invasive
- Not likely to change management
- Can help identify structural abnormalities associated with GERD, stricture, Schatzki’s ring, hiatal hernia

\(^1\) Cherian et al, Dis Esophagus 1995; 8:129
Ambulatory pH monitoring

- Using endoscopy, a probe is attached to the distal esophagus to measure changes in pH for 48 hours.
- Can be done on or off PPIs.
- Diary allows correlation between symptoms and acid reflux.
- Sensitive and specific
- Can help rule out PPI resistance
- Costly
  - Invasive- greater pt discomfort (occ chest pain)
  - Can miss up to 25% of cases of reflux-not due to “acid”
Esophageal Manometry

- A thin probe is inserted intranasally and advanced into distal esophagus.
- Measurements are recorded as the pt is asked to swallow sips of water.
- Goal is to rule out motility disorders of the esophagus as cause for chest pain.
- Not very sensitive but specific
- Tensilon (Edrophonium) provocation can be used to increase sensitivity but it decreases the specificity by increasing the number of false positives.
- Poorly tolerated by most patients/invasive/costly.
Acid suppression therapy

- Also called the “PPI Test”
- Empiric trial of double dose PPI therapy for 1 to 8 weeks.
- Readily available
- Cheap
- Noninvasive
- Well tolerated with few if any side effects.
- Both diagnostic and therapeutic advantages
Management

• If the PPI test fails, then one should proceed with endoscopy/pH monitoring +/- impedance testing depending on availability.

• Should it be performed on PPI therapy or not? It depends.....
  – Is it GERD?
  – Is it PPI resistance? (up to 20%).¹

Summary

- NCCP is a very common problem with high cost to the healthcare system and significant morbidity to the patient.
- The most common cause of NCCP is GERD.
- An empiric trial of high dose PPI therapy is the single most effective approach to dealing with NCCP.
Differential Diagnosis

- Cardiovascular
- CP related to Hyperadrenergic states
- Chest wall
- Pulmonary
- Mediastinal
- Psychiatric

- GI
  - Esophageal
    - Reflux
    - Rupture
    - Spasm
    - Esophagitis
  - Pancreatobiliary
    - Pancreatitis
    - Cholecystitis
    - Cholangitis
    - Biliary Colic
  - PUD
Non-Cardiac Chest Pain

- More than 50% of patients presenting to ED
  - Sustained concern 1yr after negative LHC
    - 51% unable to work, 47% limited activity, 44% still with perceived CAD
- Esophageal spasms?
  - 910 patients with negative LHC
    - 28% with abnormal motility (10% due to spasms)
- GERD most common cause
  - Abnormal acid exposure in 50% in recurrent noncardiac chest pain
Non-Cardiac Chest Pain

• Esophageal Hypersensitivity
  – Lower threshold for non-cardiac chest pain with intraesophageal balloon distension
    • 24 patients with CP and negative cardiac workup, EGD, Motility studies, 24h pH probe
    • Typical CP reproduced in 83% compared to none in controls
    • Related to altered cerebral processing rather than abnormal receptors
Approach to patient

• Exclude CAD
  – Angiography eliminates life-threatening disease as cause of CP

• Clues for esophageal etiology
  – Pain persistent for > 1 hr
  – Postprandial pain
  – Lack of pain radiation
  – Associated esophageal symptoms (heartburn, regurgitation, dysphagia)
  – Pain relieved by antacid ingestion

• Relief with NTG does not indicate cardiac origin
  – Out of 459 patients, 39% relieved (35% with, 41% w/o)
• Definition: Symptoms or complications resulting from the reflux of gastric contents into the esophagus or beyond, into the oral cavity (including larynx) or lung.
• Further classified as the presence of symptoms without erosions on endoscopic examination (non-erosive disease or NERD) or GERD symptoms with erosions present (ERD)

Guidelines for the Diagnosis and Management of GERD, Katz, et al; *Am J Gastroenterol* 2013;108:308-328
Symptoms and Epidemiology

- Prevalence of 10-20% of Western world
- Clinically troublesome heartburn is seen in about 6% of the population
- Regurgitation was reported in 16%
- Distinguishing cardiac from non-cardiac chest pain is required before considering GERD as a cause of chest pain.
- Although the symptom of dysphagia can be associated with uncomplicated GERD, its presence warrants investigation for a potential complication including an underlying motility disorder, stricture, ring, or malignancy
Symptoms and Epidemiology

- Extraesophageal symptoms: chronic cough, asthma, chronic laryngitis, other airway symptoms
- Atypical symptoms including dyspepsia (38%), epigastric pain, nausea, bloating, and belching may be indicative of GERD but overlap with other conditions.
- QOL: increase time off work, decrease physical functioning, nocturnal > daytime symptoms, sleep disturbances
Symptoms and Epidemiology

- Symptom frequency does not change with age
- Symptom intensity decreases after age 50
- Aging increases prevalence of erosive esophagitis (LA Grades C and D)
- Barrett’s Esophagus increases in prevalence after age 50 (Caucasian males); M > F
- Men: more Erosive Esophagitis; Women: more NERD
- Esophageal Adenocarcinoma 8:1 male to female
- GERD associated with increased BMI, waist circumference, wt gain, ERD, and Barrett’s Esophagus
Diagnosis

• Made by combination of:
  – Symptom presentation
  – Objective testing with endoscopy
  – Ambulatory reflux monitoring

• Heartburn and regurgitation correlates poorly with presence of Erosive Esophagitis
  – Sensitivity 30-76%; Specificity 62-96%

• Empiric PPI trial
  – Sensitivity 78%; Specificity 54%
Diagnosis

• Non-cardiac chest pain
  – Generally associated with GERD
  – Generally responds to aggressive acid suppression
  – Cost-effective (when cardiac cause excluded)
    • Response greater than placebo in patients with objective evidence of GERD
      (ERD on EGD and/or abnormal pH monitoring)

• Dysphagia
  – Alarming symptom requiring endoscopy
Il percorso assistenziale: l’algoritmo decisionale (Chest Pain Score e Heart Score)
...the problem: in ED

ECG Normale/Non-Diagnostico
ECG: la chiave della stratificazione del rischio

ECG: normale o non diagnostico

Lab. Emodinamica o UCIC

Osservazione Breve in DEA

alto rischio
>70%

basso rischio
<5-20%

probabilità bassa o intermedia
Number and percent distribution of emergency department visits with corresponding standard errors, by the 20 leading principal reason for visit: United States, 2006

<table>
<thead>
<tr>
<th>Principal reason for visit and RVC code</th>
<th>Number of visits in thousands</th>
<th>Standard error in thousands</th>
<th>Percent distribution</th>
<th>Standard error of percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>All visits</td>
<td>119,191</td>
<td>5,276</td>
<td>100.0</td>
<td>...</td>
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<tr>
<td>Stomach and abdominal pain, cramps and spasms</td>
<td>8,057</td>
<td>442</td>
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<td>Chest pain and related symptoms</td>
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<td>401</td>
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<td>0.2</td>
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<tr>
<td>Fever</td>
<td>4,485</td>
<td>277</td>
<td>3.8</td>
<td>0.2</td>
</tr>
<tr>
<td>Headache, pain in head</td>
<td>3,354</td>
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<td>2.8</td>
<td>0.1</td>
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<tr>
<td>Back symptoms</td>
<td>3,304</td>
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</tr>
<tr>
<td>Shortness of breath</td>
<td>3,007</td>
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</table>
• **CP or equivalent symptoms represents 4-9% of all ED visits**
  • Gibler BW AHA 2001 8%
  • Conti A AHJ 2002 9%
  • Goodacre SW BMJ 2002 4%
  • Christenson J MAJ 2004 7%
CP or equivalent symptoms represents 4-9% of all ED visits

- Only 30% of patients with CP have AMI or ACS (50% of admitted)

Lee NEJM 2000
• CP or equivalent symptoms represents 4-9% of all ED visits

• Only 30% of CP patients have AMI or ACS (50% of admitted)

• **Admission rate 40-60%**
  - Gibler BW AHA 2001 60%
  - Conti A AHJ 2002 40%
  - Goodacre SW BMJ 2002 57%
CP or equivalent symptoms represents 4-9% of all ED visits

Only 30% of CP patients have AMI or ACS (50% of admitted)

Admission rate 40-60%

Morbidity/Mortality for missed AMI is high 20% < 24h

Lee, Am J Cardiol 1987
Storrow, Ann Em Med 2000 (Missed AMI: 2-5%)

Storrow, Ann Em Med 2000, Rusnak, Ann Em Med 1989:
(20-40% of reimbursement is due to malpractice of CAD, no variations throughout years!)
In these patients mortality is double than other admitted
Effetto **Bullying:**

l’organizzazione e il management esercita pressione nei confronti dei dipendenti per raggiungere i targets adottando comportamenti al limite del lecito ed eticamente discutibili
Triage of Patients with Acute Chest Pain and Possible Cardiac Ischemia: The Elusive Search for Diagnostic Perfection

Lee Goldman, MD, and Ajay J. Kirtane, MD*
State-of-the-Art Evaluation of ED patients with potential ACS

<table>
<thead>
<tr>
<th>Clinical Feature</th>
<th>Likelihood Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Increased likelihood of AMI</strong></td>
<td></td>
</tr>
<tr>
<td>Described as pressure</td>
<td>1.3 (1.2–1.5)</td>
</tr>
<tr>
<td>Pain in chest or left arm</td>
<td>2.7*</td>
</tr>
<tr>
<td>Chest pain radiation</td>
<td></td>
</tr>
<tr>
<td>To right arm or shoulder</td>
<td>4.7 (1.9–12)</td>
</tr>
<tr>
<td>To left arm</td>
<td>2.3 (1.7–3.1)</td>
</tr>
<tr>
<td>To both left and right arm</td>
<td>7.1 (3.6–14.2)</td>
</tr>
<tr>
<td>To both arms or shoulders</td>
<td>4.1 (2.5–6.5)</td>
</tr>
<tr>
<td>Chest pain most important symptom</td>
<td>2.0*</td>
</tr>
<tr>
<td>Chest pain associated with exertion</td>
<td>2.4 (1.5–3.8)</td>
</tr>
<tr>
<td>Worse than previous angina or similar to prior AMI</td>
<td>1.8 (1.6–2.0)</td>
</tr>
<tr>
<td>History of MI</td>
<td>1.5–3.0†</td>
</tr>
<tr>
<td>Nausea or vomiting</td>
<td>1.9 (1.7–2.3)</td>
</tr>
<tr>
<td>Diaphoresis</td>
<td>2.0 (1.9–2.2)</td>
</tr>
<tr>
<td>Third heart sound</td>
<td>3.2 (1.6–6.5)</td>
</tr>
<tr>
<td>Hypotension (systolic BP &lt;80 mmHg)</td>
<td>3.1 (1.8–5.2)</td>
</tr>
<tr>
<td>Pulmonary crackles</td>
<td>2.1 (1.4–3.1)</td>
</tr>
</tbody>
</table>

| Decreased likelihood of AMI |                           |
| Pleuritic chest pain | 0.2 (0.1–0.3)             |
| Described as sharp | 0.3 (0.2–0.5)              |
| Positional chest pain | 0.3 (0.2–0.5)              |
| Reproduced by palpation | 0.3 (0.2–0.4)             |
| Infra mammary location | 0.8 (0.7–0.9)              |
| Not associated with exertion | 0.8 (0.6–0.9)            |
Effectiveness of a multidisciplinary chest pain unit for the assessment of coronary syndromes and risk stratification in the Florence area

Alberto Conti, MD, Barbara Paladini, MD, Simone Toccafondi, MD, Simone Magazzini, MD, Iacopo Olivotto, MD, Ferdinando Galassi, MD, Cesco Pieroni, MD, Gennaro Santoro, MD, David Antoniucci, MD, and Giancarlo Berni, MD° Florence, Italy

Table 1. Clinical chest pain score

<table>
<thead>
<tr>
<th>Location</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substernal, precordial</td>
<td>+3</td>
</tr>
<tr>
<td>Left chest, neck, lower jaw, epigastrium</td>
<td>+1</td>
</tr>
<tr>
<td>Apex</td>
<td>−1</td>
</tr>
<tr>
<td>Radiation</td>
<td></td>
</tr>
<tr>
<td>Either arm, shoulder, back, neck, lower jaw</td>
<td>+1</td>
</tr>
<tr>
<td>Character</td>
<td></td>
</tr>
<tr>
<td>Crushing, pressing, heaviness</td>
<td>+3</td>
</tr>
<tr>
<td>Sticking, pleuritic, pinprick</td>
<td>−1</td>
</tr>
<tr>
<td>Associated symptoms</td>
<td></td>
</tr>
<tr>
<td>Dyspnea, nausea, diaphoresis</td>
<td>+2</td>
</tr>
<tr>
<td>History of angina</td>
<td>+3</td>
</tr>
</tbody>
</table>

A score < 4 is considered as "very low" probability of CAD; a score ≥ 4 as "low-intermediate and high" probability of CAD.
Dolore toracico alla presentazione…STEACS

Clinica: alta sensibilità, bassa specificità…necessità di ECG
2012, Eur Heart J ESC Guidelines for the management of AMI in patients presenting with ST-segment elevation.
2015, Eur Heart J ESC Guidelines for the management of ACS in patients presenting without persistent ST-segment elevation.
ECG: chiave della stratificazione del rischio

Lab. Emodinamica o UCIC

Osservazione Breve in DEA

ECG: normale o non diagnostico

alta rischio
>70%

basso rischio
<5-20%

probabilità bassa o intermedia
Incidence of ACS in patients with normal or nonspecific ECG is 5% to 28%.

New ECG abnormalities increases the UA risk of 14-43% and AMI risk of 25-73%.

JE Hollander Circulation 2016; 134: 547-564
- Chest pain or arms, back, jaws,
- lasting longer 15 minutes,

associates with

- nausea, vomiting, sweating, breathlessness, or haemodynamic instability.

New onset CP or deterioration in stable angina.
Do not use people's response to nitrates.
Do not assess symptoms of an ACS differently in men and women, or in ethnic groups.
Enzimi cardiaci:
Troponina I e T diventano rilevabili nel siero 3-6 ore dopo IMA, il picco è prevedibile a 12-24 ore, e possono rimanere elevate fino a 14 giorni.

Le Troponine sono quindi solitamente testate a 6 e 9 ore dopo l'insorgenza del dolore. Il test può essere ripetuto nel caso di sospetto clinico suggestivo fino a 12-24 ore

Possibile un rapido rule-out se disponibile Troponina ad alta sensibilità (con 2 soli prelievi a distanza di 3 ore: base-ingresso e 3 ore dopo).

Chest pain of recent onset, NICE Clinical Guideline (March 2010).
Algorithm for the use of high-sensitivity cardiac troponin levels suggested in the 2011 ESC NSTEMI guidelines

Mueller C. Eur Heart J 2014;35:552-556
## CP in the ED: which tests?

<table>
<thead>
<tr>
<th>Invasive</th>
<th>Costly</th>
<th>High-dose rad.</th>
<th>Angiography (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not invasive</td>
<td>Costly (High)</td>
<td>High-dose rad.</td>
<td>MSCT (5)</td>
</tr>
<tr>
<td>Not invasive</td>
<td>Costly (High)</td>
<td>Low-dose rad.</td>
<td>Stress-MPI (4)</td>
</tr>
<tr>
<td>Not invasive</td>
<td>Low-cost</td>
<td>no rad.</td>
<td>Stress-Echo (2,3)</td>
</tr>
<tr>
<td>Not invasive</td>
<td>Very low-cost</td>
<td>no rad.</td>
<td>ETT (1)</td>
</tr>
</tbody>
</table>

**Gold Standard:** angiography

### References

4. NEJM vol 344,n°24 June 14, 2001

**Definitions:**
- **Costly:** High-cost
- **Invasive:** High-radiations
- **Radiations:** Low-cost, no radiations

**Abbreviations:**
- MSTC: multi slice computer tomography
- SPECT: single photon emission computed tomography
- ETT: exercise tolerance test
• Increasing imbalance between infinite demand and finite resources
• Fundamental changes in diagnostics

Today’s Dilemma:
• Choosing rational vs. rationed care
Choosing rational

“Diagnostic value of testing in CP patients”

- Clin (clinical parameters)
- Ex-ECG (Stress)
- Echo (resting)
- Echo (Stress)
- SPECT (stress)
Exercise-MPI Imaging and Exercise-Echocardiography?

Choosing rationed care

![Graph showing true-positive ratio vs false-positive ratio for imaging (ECHO), SPECT, No Imaging, and ECG. The graph indicates a 20% increase in true-positive ratio for imaging compared to ECG.]
Exercise-ECG, stress-MPI, stress-Echo, MSCT-CTA: MA in 431 studies

<table>
<thead>
<tr>
<th>Test Accuracy (First Authors, Year [Ref. #])</th>
<th>No. Studied</th>
<th>Methods</th>
<th>Sensitivity, %</th>
<th>Specificity, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECG (Gaibazzi et al., 2011 [12])</td>
<td>11,691</td>
<td>MA of 68 studies</td>
<td>67</td>
<td>72</td>
</tr>
<tr>
<td>SPECT (Heijenbrok-kal et al., 2007 [5])</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise</td>
<td>5,786</td>
<td>MA of 55 studies</td>
<td>88</td>
<td>69</td>
</tr>
<tr>
<td>Adenosine</td>
<td>2,132</td>
<td>MA of 11 studies</td>
<td>91</td>
<td>81</td>
</tr>
<tr>
<td>Dipyridamole</td>
<td>1,434</td>
<td>MA of 58 studies</td>
<td>90</td>
<td>75</td>
</tr>
<tr>
<td>Dobutamine</td>
<td>1,066</td>
<td>MA of 102 studies</td>
<td>84</td>
<td>75</td>
</tr>
<tr>
<td>Echo (Heijenbrok-kal et al., 2007 [5])</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise</td>
<td>7,787</td>
<td>MA of 48 studies</td>
<td>83</td>
<td>84</td>
</tr>
<tr>
<td>Adenosine</td>
<td>1,194</td>
<td>MA of 14 studies</td>
<td>79</td>
<td>92</td>
</tr>
<tr>
<td>Dipyridamole</td>
<td>9,341</td>
<td>MA of 23 studies</td>
<td>72</td>
<td>95</td>
</tr>
<tr>
<td>Dobutamine</td>
<td>18,142</td>
<td>MA of 16 studies</td>
<td>81</td>
<td>84</td>
</tr>
<tr>
<td>CTA (Meijboom et al., 2007 [8])</td>
<td>33</td>
<td>Diagnosis confirmed with invasive CA</td>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>12-month cardiac event rates</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Strategy</th>
<th>CTA (13)</th>
<th>ECG (12)</th>
<th>SPECT (11)</th>
<th>Echo (11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>517</td>
<td>536</td>
<td>5,945</td>
<td>2,900</td>
</tr>
<tr>
<td>Initial negative diagnostic test, %</td>
<td>0.95</td>
<td>2.97</td>
<td>0.58</td>
<td>1.03</td>
</tr>
</tbody>
</table>

CA = coronary angiography; CTA = computed tomographic angiography; ECG = electrocardiography; Echo = echocardiography; MA = meta-analysis; SPECT = single photon-emitting computed tomography.

c Meijboom WB, 64-Slice CT coronary angiography in patients with non-ST elevation ACS. Heart 2007;93:1386 –92.

Priest VL, JACC Cardiovascular Imaging 2011; 4(5)
Exercise-ECG, stress-MPI, stress-Echo, MSCT (CTA)?

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Diagnosis of CAD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sensitivity (%)</td>
</tr>
<tr>
<td>Exercise ECG</td>
<td>45–70</td>
</tr>
<tr>
<td>Exercise stress echocardiography</td>
<td>80–85</td>
</tr>
<tr>
<td>Exercise stress SPECT</td>
<td>73–92</td>
</tr>
<tr>
<td>Dobutamine stress echocardiography</td>
<td>79–83</td>
</tr>
<tr>
<td>Dobutamine stress MRI</td>
<td>79–88</td>
</tr>
<tr>
<td>Vasodilator stress echocardiography</td>
<td>72–79</td>
</tr>
<tr>
<td>Vasodilator stress SPECT</td>
<td>70–91</td>
</tr>
<tr>
<td>Vasodilator stress MRI</td>
<td>67–94</td>
</tr>
<tr>
<td>Coronary CTA</td>
<td>95–99</td>
</tr>
<tr>
<td>Vasodilator stress PET</td>
<td>81–97</td>
</tr>
</tbody>
</table>

Clinical pre-test probabilities in patients with stable chest pain.

<table>
<thead>
<tr>
<th>Age</th>
<th>Typical angina</th>
<th></th>
<th>Atypical angina</th>
<th></th>
<th>Non-anginal pain</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
<td>Women</td>
</tr>
<tr>
<td>30-39</td>
<td>59</td>
<td>28</td>
<td>29</td>
<td>10</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>40-49</td>
<td>69</td>
<td>37</td>
<td>38</td>
<td>14</td>
<td>25</td>
<td>8</td>
</tr>
<tr>
<td>50-59</td>
<td>77</td>
<td>47</td>
<td>49</td>
<td>20</td>
<td>34</td>
<td>12</td>
</tr>
<tr>
<td>60-69</td>
<td>84</td>
<td>58</td>
<td>59</td>
<td>28</td>
<td>44</td>
<td>17</td>
</tr>
<tr>
<td>70-79</td>
<td>89</td>
<td>68</td>
<td>69</td>
<td>37</td>
<td>54</td>
<td>24</td>
</tr>
<tr>
<td>&gt;80</td>
<td>93</td>
<td>76</td>
<td>78</td>
<td>47</td>
<td>65</td>
<td>32</td>
</tr>
</tbody>
</table>

*Rischio intermedio se paziente compreso tra 15-85%*

*Probabilities of obstructive coronary disease shown reflect the estimates for patients aged 35, 45, 55, 65, 75, and 85 years.*
### CP in the ED: which tests?

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Cost</th>
<th>Radiations</th>
<th>Gold Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invasive</td>
<td>High</td>
<td>Yes</td>
<td>Angiography</td>
</tr>
<tr>
<td>Not invasive</td>
<td>High</td>
<td>No</td>
<td>MSCT</td>
</tr>
<tr>
<td>Not invasive</td>
<td>Low</td>
<td>No</td>
<td>Stress-MPI</td>
</tr>
<tr>
<td>Not invasive</td>
<td>Low</td>
<td>No</td>
<td>Stress-Echo</td>
</tr>
<tr>
<td>Not invasive</td>
<td>Very low</td>
<td>No</td>
<td>ETT</td>
</tr>
</tbody>
</table>

**Notes:**
- **Costly?**
- **Invasive?**
- **Radiations?**

Gold Standard: Angiography

**References:**
4. NEJM vol 344,n°24 June 14, 2001

**Acronyms:**
- MSCT: multi slice computer tomography
- SPECT: single photon emission computed tomography
- ETT: exercise tolerance test
ECG: chiave della stratificazione del rischio

ECG Normale/Non-Diagnostico
Du Mulin 1750: Principi di Terapia della Sindrome
Finding the Holy Grail Is Not a Short-Term Project

Early instruments had poor clinical uptake because of unacceptably low sensitivity: these include the Goldman Risk score, acute cardiac ischemia time–insensitive predictive instrument (ACI-TIPI), the Thrombolysis in Myocardial Infarction (TIMI) risk score, and Global Registry of Acute Coronary Events (GRACE).

Graal = risk-score?
More recently the North American

...la troponina

Protocol to Assess Patients With Chest Pain Using Contemporary Troponins (Algorithms and the HEART (History, Electrocardiogram, Age, Risk factors, Troponin) Pathway, among others) have incorporated conventional troponins into their clinical decision instruments.
Finding the Holy Grail Is Not a Short-Term Project

the HEART Pathway, which showed 100% sensitivity using 2 sets of conventional troponins

External validation:
the HEART Pathway had a miss rate of 1.7% (95% confidence interval, 1.0–2.9)

(e.g. the hs-cTn 0 h/3 h-algorithm)

Mahler SA. The HEART Pathway RCT. Circ Cardiovasc Qual Outcomes 2015.
### The HEART score for Chest Pain Patients in the ED

<table>
<thead>
<tr>
<th>Factor</th>
<th>Score</th>
<th>Description</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>History</strong></td>
<td></td>
<td>Highly Suspicious</td>
<td>2 points</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moderately Suspicious</td>
<td>1 point</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Slightly or Non-Suspicious</td>
<td>0 points</td>
</tr>
<tr>
<td><strong>ECG</strong></td>
<td></td>
<td>Significant ST-Depression</td>
<td>2 points</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nonspecific repolarization</td>
<td>1 point</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Normal</td>
<td>0 points</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td>≥ 65 years</td>
<td>2 points</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 45 - &lt;65 years</td>
<td>1 point</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≤ 45 years</td>
<td>0 points</td>
</tr>
<tr>
<td><strong>Risk Factors</strong></td>
<td></td>
<td>≥ 3 or history of CAD</td>
<td>2 points</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 or 2 RF</td>
<td>1 point</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No RF</td>
<td>0 points</td>
</tr>
<tr>
<td><strong>Troponin</strong></td>
<td></td>
<td>≥ 3 x Normal Limit</td>
<td>2 points</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 1 - &lt; 3 x Normal Limit</td>
<td>1 point</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≤ Normal Limit</td>
<td>0 points</td>
</tr>
</tbody>
</table>

Risk factors: DM, current or recent (< 1 month) smoker, HTN, HLP, family history of CAD, & obesity

- Score 0-3: 2.5% MACE over next 6 weeks → Discharge Home
- Score 4-6: 20.3% MACE over next 6 weeks → Admit for Clinical Observation
- Score 7-10: 72.7% MACE over next 6 weeks → Early invasive Strategies
Chest pain in the ER: a multicenter validation of the HEART Score (2010)
The HEART score for patients with CP in the ED: a multinational validation study (2013)

The HEART score for Chest Pain Patients in the ED

<table>
<thead>
<tr>
<th>Component</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>History</td>
<td>Highly Suspicious: 2 points, Moderately Suspicious: 1 point, Slightly or Non-Suspicious: 0 points</td>
</tr>
<tr>
<td>ECG</td>
<td>Significant ST-Depression: 2 points, Nonspecific repolarization: 1 point, Normal: 0 points</td>
</tr>
<tr>
<td>Age</td>
<td>≥ 65 years: 2 points, &gt; 45 - ≤ 65 years: 1 point, ≤ 45 years: 0 points</td>
</tr>
<tr>
<td>Risk Factors</td>
<td>≥ 3 or history of CAD: 2 points, 1 or 2 RF: 1 point, No RF: 0 points</td>
</tr>
<tr>
<td>Troponin</td>
<td>≥ 3 x Normal Limit: 2 points, &gt; 1 - &lt; 3 x Normal Limit: 1 point, ≤ Normal Limit: 0 points</td>
</tr>
</tbody>
</table>

Risk factors: DM, current or recent (< 1 month) smoker, HTN, HLP, family history of CAD, & obesity

Score 0-3: 2.5% MACE over next 6 weeks → Discharge Home
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# The HEART Score for Chest Pain Patients in the ED

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>History</td>
<td></td>
</tr>
<tr>
<td>Highly Suspicious</td>
<td>2 points</td>
</tr>
<tr>
<td>Moderately Suspicious</td>
<td>1 point</td>
</tr>
<tr>
<td>Slightly or Non-Suspicious</td>
<td>0 points</td>
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<td>ECG</td>
<td></td>
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</tr>
<tr>
<td>Normal</td>
<td>0 points</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>≥ 65 years</td>
<td>2 points</td>
</tr>
<tr>
<td>&gt; 45 - ≤ 65 years</td>
<td>1 point</td>
</tr>
<tr>
<td>≤ 45 years</td>
<td>0 points</td>
</tr>
<tr>
<td>Risk Factors</td>
<td></td>
</tr>
<tr>
<td>≥ 3 history of CAD</td>
<td>2 points</td>
</tr>
<tr>
<td>1 or 2 RF</td>
<td>1 point</td>
</tr>
<tr>
<td>No RF</td>
<td>0 points</td>
</tr>
<tr>
<td>Troponin</td>
<td></td>
</tr>
<tr>
<td>≥ 3 x Normal Limit</td>
<td>2 points</td>
</tr>
<tr>
<td>&gt; 1 - &lt; 3 x Normal Limit</td>
<td>1 point</td>
</tr>
<tr>
<td>≤ Normal Limit</td>
<td>0 points</td>
</tr>
</tbody>
</table>

**Risk factors:** DM, current or recent (< 1 month) smoker, HTN, HLP, family history of CAD, & obesity

- Score 0-3: 2.5% MACE over next 6 weeks —> Discharge Home
- Score 4-6: 20.3% MACE over next 6 weeks —> Admit for Clinical Observation
- Score 7-10: 72.7% MACE over next 6 weeks —> Early invasive Strategies

6 = 20% MACE Observation!
## The HEART Score for Chest Pain Patients in the ED

<table>
<thead>
<tr>
<th>Component</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>History</strong></td>
<td></td>
</tr>
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<td>Highly Suspicious</td>
<td>2 points</td>
</tr>
<tr>
<td>Moderately Suspicious</td>
<td>1 point</td>
</tr>
<tr>
<td>Slightly or Non-Suspicious</td>
<td>0 points</td>
</tr>
<tr>
<td><strong>ECG</strong></td>
<td></td>
</tr>
<tr>
<td>Significant ST-Depression</td>
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<tr>
<td>Nonspecific repolarization</td>
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</tr>
<tr>
<td>Normal</td>
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</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
</tr>
<tr>
<td>≥ 65 years</td>
<td>2 points</td>
</tr>
<tr>
<td>&gt; 45 - ≤ 65 years</td>
<td>1 point</td>
</tr>
<tr>
<td>≤ 45 years</td>
<td>0 points</td>
</tr>
<tr>
<td><strong>Risk Factors</strong></td>
<td></td>
</tr>
<tr>
<td>≥ 3 or history of CAD</td>
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</tr>
<tr>
<td>1 or 2 RF</td>
<td>1 point</td>
</tr>
<tr>
<td>No RF</td>
<td>0 points</td>
</tr>
<tr>
<td><strong>Troponin</strong></td>
<td></td>
</tr>
<tr>
<td>&gt; 3 x Normal Limit</td>
<td>2 points</td>
</tr>
<tr>
<td>&gt; 1 - &lt; 3 x Normal Limit</td>
<td>1 point</td>
</tr>
<tr>
<td>≤ Normal Limit</td>
<td>0 points</td>
</tr>
</tbody>
</table>

### Risk factors:
- DM, current or recent (< 1 month) smoker, HTN, HLP, family history of CAD, & obesity

### Scoring:
- Score 0-3: 2.5% MACE over next 6 weeks → Discharge Home
- Score 4-6: 20.3% MACE over next 6 weeks → Admit for Clinical Observation
- Score 7-10: 72.7% MACE over next 6 weeks → Early invasive Strategies

**Example Calculation:**
- History: Highly Suspicious (2 points)
- ECG: Significant ST-Depression (2 points)
- Age: > 45 - ≤ 65 years (1 point)
- Risk Factors: ≥ 3 or history of CAD (2 points)
- Troponin: > 3 x Normal Limit (2 points)

**Total Score:** 8 points → 80% MACE

**Action:** Admit!
USL NordOvest Toscana protocollo Chest Pain screening
...se “rischio intermedio”

1
se dolore toracico tipico, ECG non diagnostico, cTnI normale non diagnostica, paziente < 65 anni:
AngioTC-Coronarica

2
se dolore toracico tipico, ECG non diagnostico, cTnI normale non diagnostica, paziente ≥ 65 anni:
SPECT Miocardica (Scintigrafia miocardica da stress)

Nel sesso femminile è consigliata comunque angio-TC-coronarica
Successiva eventuale ulteriore definizione diagnostica con SPECT Miocardica

In atto protocollo per appuntamento informatico con
radiodiagnostica e medicina nucleare:
il paziente del PS alla dimissione riceve data e ora dell’esame prospettato
53 pazienti positivi allo screenong con angioTCcoronarica o SPECT o entrambi
Che sono stati riconosciuti con cardiopatia ischemica critica e non critica
...via ringrazio per l’attenzione