Myocardial Infarction with Non-Obstructive Coronary Arteries (MINOCA)

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Angiographic Findings in Acute MI

Pioneering DeWood Studies
• Early angiography in MI patients

• STEMI: ‘open artery hypothesis’
  thrombolytic therapy
  primary PCI

• NSTEMI:  atherothrombosis
  early anti-thrombotic
  revascularisation

• MINOCA:  insignificant atheroma
  natural history?
  role of therapy?

Adapted from DeWood et al – Q wave (1980) & Non-Q wave (1986) New Engl J Med
The What, When, Who, Why, How and Where of Myocardial Infarction With Non-Obstructive Coronary Arteries (MINOCA)

Sivabaskari Pasupathy, BSc; Rosanna Tavella, BSc, PhD; John F. Beltrame, BSc, MD, PhD

• **What** is MINOCA?
• **When** to Diagnose MINOCA?
• **Who** is at Risk of MINOCA?
• **Why** diagnose MINOCA?
• **How** to Manage MINOCA?
• **Where** to next for MINOCA?

Pasupathy et al (2015) Circulation J 80:11
What is MINOCA?
Myocardial Infarction with Non-Obstructive Coronary Arteries

• **Acute Myocardial Infarction Criteria**
  - Cardiac biomarker - rise ( > 99th percentile) and/or fall
  - Clinical marker – one of the following
    • ischaemic symptoms
    • new ST/T changes or new LBBB
    • development of pathological Q waves
    • new loss of viable myocardium or RWMA on imaging

• **Non-Obstructive Coronaries**
  - Angiography: Normal (<30%) or mild CAD (≥ 30% but < 50%)

• **No Clinically Overt Cause for ACS Presentation**

Agewall (2016) Eur Heart J
When to Diagnose MINOCA?

- ACS Presentation
- After Angiography - No Obstructive CAD
- No Overt Cause
  - Avoid if classical myopericarditis presentation
Clinical Presentation
55-year old female presented with sudden onset of central chest pain for 2 hours.

Troponin T (Reference Range <29ng/L)
Initial: 99 ng/L
6 Hours: 301 ng/L

Coronary Angiography
No significant coronary stenosis

D-Dimer: Negative
Left Ventriculogram: Normal

ECG
ST elevation in V3-V5

1. Acute Myocardial Infarction
2. Non-Obstructive Coronary Arteries
3. No apparent cause for presentation

MINOCA - 'a working diagnosis'
Myocardial Infarction with Non-Obstructive Coronary Arteries
Who is at Risk of MINOCA?

- Systematic Review to establish:
  - Prevalence
  - Cardiovascular Risk Factors
  - ECG Changes
MINOCA Review - Search Strategy

**PubMed and Embase Database Searches (1966-2013)**
‘Myocardial infarct’, ‘angiogram’, ‘non-obstructive’ (1,897 publications)

Original Infarct angiography Studies (1,033 publications)

MINOCA Studies with Original Data (152 publications)

Study cohort > 100 patients (88 publications)

Consecutive Studies (42 publications)

MINOCA Systematic Review Clinical Studies
- Prevalence – 28 publications (177,432 AMI patients)
- Risk Factors – 15 publications (81,587 AMI patients)
- Prognosis – 8 publications (9,564 AMI patients)

Pasupathy et al (2015) Circulation 131:861
MINOCA Prevalence

- Pooled 28 publications
  - AMI + angio findings
  - consecutive recruit
  - at least 100 patients
  - 177,432 AMI patients

- Overall Prevalence
  7.0% (95% CI: 6%, 8%)

Pasupathy et al (2015) Circulation 131:861
MINOCA Comparative CV Risk Factors

- **Women**: 24% (MINOCA) vs. 21% (MI-CAD)
- **Hyperlipidaemia**: 32% (MINOCA) vs. 32% (MI-CAD)
- **Hypertension**: 45% (MINOCA) vs. 45% (MI-CAD)
- **Smoking**: 39% (MINOCA) vs. 42% (MI-CAD)
- **Diabetes**: 22% (MINOCA) vs. 22% (MI-CAD)
- **Family Hx CAD**: 27% (MINOCA) vs. 27% (MI-CAD)

Pasupathy et al (2015) Circulation 131:861
MINOCA Acute STEMI Presentation

- 10 studies (1,998 patients)
- STEMI 33% (95%CI: 22%, 44%)

Proportion (95% CI) % Weight

| Study              | Proportion (95% CI) | % Weight |
|--------------------|---------------------|----------|
| Rossini, 2013 (29)| 0.21 (0.17, 0.27)   | 11.56    |
| Sun, 2012 (31)     | 1.00 (0.29, 1.00)   | 5.51     |
| Kang, 2011 (38)    | 0.36 (0.31, 0.41)   | 11.57    |
| Uchida, 2010 (39)  | 0.15 (0.02, 0.45)   | 8.25     |
| Frycz-Kurek, 2010 (40) | 0.38 (0.35, 0.41) | 11.73    |
| Ong, 2008 (43)     | 0.07 (0.01, 0.22)   | 10.72    |
| Strunk, 2006 (47)  | 0.53 (0.35, 0.71)   | 9.10     |
| Germing, 2005 (50) | 0.22 (0.10, 0.39)   | 9.91     |
| Hochman, 1999 (52) | 0.64 (0.58, 0.69)   | 11.46    |
| Sharifi, 1995 (54) | 0.00 (0.00, 0.27)   | 10.19    |

Overall (I-squared = 95.4%%, p=0.000) 0.33 (0.22, 0.44) 100.00

Pasupathy (2015) Circ 131:861
Why Diagnose MINOCA?

- **Clinical Recognition**
  - 'False positive STEMI Diagnosis'

- **Evaluation of Underlying Cause**
  - **Non-cardiac:** Pulmonary Embolism
  - **Cardiac:** Myocardial – Myocarditis, CM
    - Coronary – SCAD, Spasm, Emboli
    - Thrombotic – Factor V Leiden

- **Guarded Prognosis**

  Pasupathy et al (2015) Circulation J 80:11
MINOCA  Comparative Prognosis

Korean AMI Registry
• 8,510 consecutive AMI
  ➢ Gp I – MINOCA (n=372)
  ➢ Gp II – 1 or 2 VD (n=6,136)
  ➢ Gp III – LMCA/3VD (n=2,002)

• All-cause mortality at 12 months
  ➢ Gp I  3.1%
  ➢ Gp II  3.2%
  ➢ Gp III 6.5%

Kang et al (2011)
How to Manage MINOCA?

- **Further Assessment:**

| Assessment          | Consider                                      |
|---------------------|-----------------------------------------------|
| Clinical            | Cocaine                                       |
| Angiographic        | SCAD, Spasm, Slow Flow, emboli, LV            |
| Pulmonary Emboli    | D-dimer, CTPA                                 |
| Imaging             | CMRI                                          |
| Other               | Thrombophilia (14%), Spasm (28%)              |

- **Current Therapies**
MINOCA CMR Imaging Studies

- Myocarditis: 33%
- Ischaemic MI: 24%
- Tako-tsubo CM: 18%
- Hypertrophic CM: 3%
- Dilated CM: 2%
- Other: 7%
- No Abnormality: 26%

Pasupathy et al (2015) Circulation 131:861
MINOCA: Current Management Practice

Pooled data from 4 AMI registries

Discharge Medications

Aspirin: MI-CAD (n=39,703) 80% Minocca (n=3,544) 76%
Clopidogrel: MI-CAD (n=39,703) 56% Minocca (n=3,544) 26%
Statin: MI-CAD (n=39,703) 55% Minocca (n=3,544) 39%
Beta-blocker: MI-CAD (n=39,703) 75% Minocca (n=3,544) 61%
CCB: MI-CAD (n=39,703) 9% Minocca (n=3,544) 23%
ACE-Inhibitor: MI-CAD (n=39,703) 44% Minocca (n=3,544) 39%

Patel (2006), Rhew (2012), Hamdan (2012), Larsen (2013) Pasupathy et al (2015) Circulation 131:861
Where to Next for MINOCA?

• Prognosis

• Optimal Assessment Pathway

• Aetiology Targeted Therapies

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ESC working group position paper on myocardial infarction with non-obstructive coronary arteries

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