Conflicts of Interest
None
IMAGING

- Coronary artery disease and ischemic heart disease
  - P. Douglas (US) «PLATFORM trial»
  - C.G. Stirrat (UK) «USPIO-enhanced MRI after STEMI»
  - P.F. Teunissen (NL) «PTI PET after STEMI»

- Technological innovations
  - D. Vilades (ES) «Calcium subtraction in MDCT»
  - H. Oe (JP) «Fusion imaging»
  - D. Muraru (IT) «3D printing»

- ESC Guidelines 2015
CLINICAL OUTCOMES OF FFR\textsubscript{CT}-GUIDED DIAGNOSTIC STRATEGIES VERSUS USUAL CARE IN PATIENTS WITH SUSPECTED CAD

P. Douglas (Durham, US), FP 5995
Stable symptoms suspicious for CAD
Planned non-emergent noninvasive test or catheterization

Planned NI test
- Sequential cohorts
  - Standard NI test
    - Exercise ECG
    - Stress nuclear
    - Stress echo
    - Stress MRI
    - CTA
  - CTA + FFR\textsubscript{CT}
  - FFR\textsubscript{CT}
    - No FFR\textsubscript{CT}

Planned ICA
- Sequential cohorts
  - Standard ICA
    - CTA
  - CTA + FFR\textsubscript{CT}
  - FFR\textsubscript{CT}
    - No FFR\textsubscript{CT}

Clinical results available to care team within 24-48 hrs;
Subsequent testing/mgmt per care team per best practises

1° - Cath w/o obstructive CAD (QCA) or FFR ≤ 0.80 at 90 days
2° - MACE: death, MI, UA; vascular events; costs; QOL; rad exposure

P. Douglas (Durham, US), FP 5995
INVASIVE CATHETERIZATION W/O OBSTRUCTIVE CAD PRIMARY ENDPOINT

Planned NI Test

- **Usual Care**
  - NonObs CAD: 6 (6.0)
  - Obs CAD: 13 (12.5)
  - No ICA: 137 (73.3)
  - P = 0.95

- **FFRCT**
  - NonObs CAD: 24 (12.4)
  - Obs CAD: 13 (12.5)
  - No ICA: 24 (12.4)
  - P < 0.0001

Planned ICA

- **Usual Care**
  - NonObs CAD: 6 (6.0)
  - Obs CAD: 13 (12.5)
  - No ICA: 137 (73.3)
  - P = 0.95

- **FFRCT**
  - NonObs CAD: 24 (12.4)
  - Obs CAD: 13 (12.5)
  - No ICA: 24 (12.4)
  - P < 0.0001

P. Douglas (Durham, US), FP 5995
CMR PATHOPHYSIOLOGICAL INSIGHTS INTO MYOCARDIAL INFARCTION

- Myocardial macrophage activity detected with USPIO-enhanced MRI within the infarct core in the first two weeks following acute MI
- Assessment and monitoring myocardial cellular inflammation

- Diagnosis
- Risk stratification
- Novel anti-inflammatory therapeutic interventions

C.G. Stirrat (Edinburgh, UK), FP P2127
A cut-off value of $\geq 0.85$ for PTI was optimal for accurately predicting regional functional recovery.
IMPROVEMENT OF PROGNOSIS?

LV REMODELLING

SMART FUSION IMAGING
Diagnosis

Echocardiography is recommended to evaluate regional and global LV function and to rule in or rule out differential diagnoses.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Class</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Takotsubo</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>Aortic dissection (TOE)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td></td>
<td></td>
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<tr>
<td>Papillary muscle rupture</td>
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<td></td>
</tr>
</tbody>
</table>

Impact of LV dysfunction on 1-year survival after acute MI.

Results from the HORIZONS-AMI Study
Peri-infarct Zone Pacing to Prevent Adverse Left Ventricular Remodeling in Patients with Large Myocardial Infarction

Results from the PRomPT Trial

Gregg W. Stone, MD
Eugene S. Chung, Branislav Stancak, Jesper H. Svendsen, Trent M. Fischer, Fred Kueffer, Thomas Ryan, Jeroen Bax, and Angel Leon, for the Post-Myocardial Infarction Remodeling Prevention Therapy (PRomPT) Trial Investigators

Stone GW et al. Eur Heart J 2015; DOI: http://dx.doi.org/10.1093/eurheartj/ehv436, FP 7065

ALBATROSS

Aldosterone Lethal effects Blockade in Acute myocardial infarction Treated with or without Reperfusion to improve Outcome and Survival at Six months follow-up


On behalf of the ALBATROSS investigators

Cyclosporine before PCI in Patients with Acute Myocardial Infarction

Cyclosporine before PCI in Patients with Acute Myocardial Infarction


REPERFUSION INJURY

Myocardial ischemia in absence of reperfusion
Infarct size, 70%

Myocardial ischemia with reperfusion
Reperfusion reduces infarct size by 40%
Part of the remaining 30% infarct is due to lethal reperfusion injury and is therefore preventable

Myocardial ischemia with reperfusion and cardioprotection
Preventing lethal reperfusion injury reduces infarct size by a further 25%, realizing the full benefits of reperfusion

REPERFUSION INJURY CAN BE PREVENTED BY CYCLOSPORINE
CIRCUS TRIAL: EXPERIMENTAL DESIGN

STEMI

Coronary angiography

e-randomization

CicloMulsion®: (2.5 mg/kg, IV bolus)

LAD occluded (TIMI 0-1)

PCI

Initial Echo

Discharge

Final Echo

• 18 years
• symptom on set < 12 hrs
• ST shift ≥ 0.2 mV in two contiguous anterior leads
• LAD as culprit artery with TIMI flow grade: 0 – 1

1 year

CicloMulsion® (Neurovive Pharmaceuticals): lipid emulsion of cyclosporine (no cremophor content)

M. Ovize (Lyon, FR) FP1173
CIRCUS TRIAL CLINICAL ENDPOINTS
Death Or HF < 1 YR, CK RELEASE & LVEF

- Cyclosporine
- Control

Baseline vs One year

M. Ovize (Lyon, FR) FP1173
TECHNOLOGICAL ADVANCES
ADVANCES IN MDCT POST-PROCESSING: CORONARY ARTERY CALCIUM AND METAL STENT SUBTRACTION BY 320-ROW MDCT

Adquisition methodology

- **Single breath-hold**
  - Voltage: 100 Kv
  - 0.5 mm slice thickness

- **Precontrast CTA**
- **Contrast CTA**

- **SureStart**
- **30''**

- **Contrast injection**

- **Comparison**: Precontrast CTA - Contrast CTA = Subtraction CTA
Conventional CTA  
Subtraction CTA  
Invasive coronary angiography
SMART FUSION IMAGING

Clinical application in cardiovascular medicine (proto-type)

Magnetic sensor system

Position sensor

Smart Fusion probe (PST-25BT/PST-30BT)

H. Oe (Okayama, JP), FP P4503
Clinical application in cardiovascular medicine (proto-type)
COMBINATION OF LGE-MRI AND MIBG SPECT TO IMPROVE RISK STRATIFICATION OF HF PATIENTS

**n = 86**
Follow-up 21.5 months
22% met primary endpoint: ICD shocks/VT/cardiac death

<table>
<thead>
<tr>
<th>Event Description</th>
<th>HR</th>
<th>CI 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Late HMR ≤ 1.32 &amp; LGE &lt; 9.13%</td>
<td>3.16</td>
<td>1.01-9.12</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>3.27</td>
<td>1.8-9.11</td>
</tr>
<tr>
<td>LGE ≥ 9.13</td>
<td>9.96</td>
<td>1.40-11.15</td>
</tr>
</tbody>
</table>

P. García-González (Valencia, ES), FP P181
3D PRINTING

- Tricuspid geometry challenging with 2D imaging
- Feasibility of 3D printing of TV from transthoracic 3D echocardiography

D. Muraru (Bologna, IT), FP P2550
2015 PH guidelines: main messages for cardiologists

1. PH is defined only at rest. Exercise only to assess functional severity.

2. Ultrasound assessment of PH cannot be limited to sPAP but should categorize as probability for PH, leading to specific management.
Echocardiographic probability of pulmonary hypertension in symptomatic patients with a suspicion of pulmonary hypertension according with PTRV & additional signs

<table>
<thead>
<tr>
<th>Peak tricuspid regurgitation velocity (m/s)</th>
<th>Presence of other echo “PH signs”</th>
<th>Echocardiographic probability of pulmonary hypertension</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤2.8 or not measurable</td>
<td>No</td>
<td>Low</td>
</tr>
<tr>
<td>≤2.8 or not measurable</td>
<td>Yes</td>
<td>Intermediate</td>
</tr>
<tr>
<td>2.9–3.4</td>
<td>No</td>
<td>Intermediate</td>
</tr>
<tr>
<td>2.9–3.4</td>
<td>Yes</td>
<td>High</td>
</tr>
<tr>
<td>&gt;3.4</td>
<td>Not required</td>
<td></td>
</tr>
</tbody>
</table>

### A: The ventricles

- Right ventricle/left ventricle basal diameter ratio > 1.0
- Flattening of the interventricular septum (left ventricular eccentricity index > 1.1 in systole and/or diastole).

### B: Pulmonary artery

- Right ventricular outflow Doppler acceleration time <105 m/sec and/or midsystolic notching
- Early diastolic pulmonary regurgitation velocity >2.2 m/sec

### C: Inferior vena cava and right atrium

- Inferior cava diameter >21 mm with decreased inspiratory collapse (<50% with a sniff or <20% with quiet inspiration)
- Right atrial area (end-systole) >18 cm²
- PA diameter >25 mm
### Diagnostic management according to echocardiographic probability of PH in patients with symptoms compatible with PH, with or without risk factors for PAH or CTEPH

<table>
<thead>
<tr>
<th>Echocardiographic probability of PH</th>
<th>Without risk factors or associated condition for PAH or CTEPH&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Class&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Level&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Alternative diagnosis should be considered</td>
<td>IIa</td>
<td>C</td>
</tr>
<tr>
<td>Intermediate</td>
<td>Alternative diagnosis, echo follow-up, should be considered</td>
<td>IIa</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>Further investigation of PH may be considered&lt;sup&gt;d&lt;/sup&gt;</td>
<td>IIb</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>Further investigation of PH (including RHC&lt;sup&gt;d&lt;/sup&gt;) is recommended</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>Echocardiographic probability of PH</td>
<td>With risk factors or associated conditions for PAH or CTEPH&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>Echo follow-up should be considered</td>
<td>IIa</td>
<td>C</td>
</tr>
<tr>
<td>Intermediate</td>
<td>Further assessment of PH including RHC should be considered&lt;sup&gt;c&lt;/sup&gt;</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>High</td>
<td>Further investigation of PH&lt;sup&gt;d&lt;/sup&gt; including RHC is recommended</td>
<td>I</td>
<td>C</td>
</tr>
</tbody>
</table>

CTEPH = chronic thromboembolic pulmonary hypertension; Echo = echocardiographic; PAH = pulmonary arterial hypertension; PH = pulmonary hypertension; RHC = right heart catheterization.

<sup>a</sup>Class of recommendation.  <sup>b</sup>Level of evidence. These recommendations do not apply to patients with diffuse parenchymal lung disease or left heart disease.  <sup>c</sup>Depending on the presence of risk factors for PH Group 2, 3 or 5. Further investigation strategy may differ depending on whether risk factors/associated conditions suggest higher probability of PAH or CTEPH – see diagnostic algorithm.
Role of Imaging

A. Diagnosis

- TTE is recommended as the first-line imaging modality in suspected IE.  
  Class: I  Level: B

- TOE is recommended in all patients with clinical suspicion of IE and a negative or non-diagnostic TTE.  
  Class: I  Level: B

- TOE is recommended in patients with clinical suspicion of IE, when a prosthetic heart valve or an intracardiac device is present.  
  Class: I  Level: B

- Repeat TTE and/or TOE within 5–7 days is recommended in case of initially negative examination when clinical suspicion of IE remains high.  
  Class: I  Level: C

- Echocardiography should be considered in Staphylococcus aureus bacteraemia.  
  Class: IIa  Level: B

- TOE should be considered in patients with suspected IE, even in cases with positive TTE, except in isolated right-sided native valve IE with good quality TTE examination and unequivocal echocardiographic findings.  
  Class: IIa  Level: C

If initial TOE is negative but high suspicion for IE remains, repeat TTE and/or TOE within 5–7 days.
Major Diagnostic Criteria

- Vegetations
- Abscess / Pseudoaneurysm
- New dehiscence of prosthetic valve
Role of Imaging - other

- **Multislice CT**: abscess, pseudoaneurysms, perivalvular extension, fistulae, concomitant pulmonary disease

- **CMR**: cerebral lesions

- **Nuclear imaging**:
  - SPECT/CT and PET CT
  - Radio labelled white blood cell SPECT CT & PET CT
Diagnosis of IE
ESC 2015 modified criteria

**Major criteria**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1. Blood cultures positive for IE</td>
<td>1. Predisposition such as predisposing heart condition, or injection drug use.</td>
</tr>
<tr>
<td></td>
<td>2. Fever defined as temperature ≥38°C.</td>
</tr>
<tr>
<td></td>
<td>3. Vascular phenomena (including those detected by imaging only): major arterial emboli, septic pulmonary infarcts, infectious (mycotic) aneurysm, intracranial haemorrhage, conjunctival haemorrhages, and Janeway’s lesions.</td>
</tr>
<tr>
<td></td>
<td>4. Immunological phenomena: glomerulonephritis, Osler’s nodes, Roth’s spots, and rheumatoid factor.</td>
</tr>
<tr>
<td></td>
<td>5. Microbiological evidence: positive blood culture but does not meet a major criterion as noted above or serological evidence of active infection with organism consistent with IE.</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
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<th></th>
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</thead>
<tbody>
<tr>
<td>2. Imaging positive for IE</td>
<td></td>
</tr>
<tr>
<td>a. Echocardiogram positive for IE:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Vegetation;</td>
</tr>
<tr>
<td></td>
<td>2. Abscess, pseudoaneurysm, intracardiac fistula;</td>
</tr>
<tr>
<td></td>
<td>3. Valvular perforation or aneurysm;</td>
</tr>
<tr>
<td>b. Abnormal activity around the site of prosthetic valve implantation detected by ¹⁸F-FDG PET/CT (only if the prosthesis was implanted for &gt;3 months) or radiolabelled leukocytes SPECT/CT.</td>
<td></td>
</tr>
<tr>
<td>c. Definite paravalvular lesions by cardiac CT.</td>
<td></td>
</tr>
</tbody>
</table>

**Possible:** 1 Major + 1 minor or 3 minor

**Definite:** 2 Major or 1 Major+3 minor or 5 minor

**Rejected:** Firm alternative, symptom resolution, no path evidence
Diagnostic algorithm for IE
ESC 2015 modified criteria

Clinical suspicion of IE

Modified Duke criteria (Li)

Definite IE
Possible/rejected IE but high suspicion
Rejected IE Low suspicion

Native valve
Prosthetic valve

1. Repeat echo (TTE + TOE)/microbiology
2. Imaging for embolic events
3. Cardiac CT

1. Repeat echo (TTE + TOE)/microbiology
2. 18F-FDG PET/CT or Leucocytes labeled SPECT/CT
3. Cardiac CT
4. Imaging for embolic events

ESC 2015 modified diagnostic criteria

Definite IE
Possible IE
Rejected IE
Combination of anatomical and functional data with FFRCT on CAD improves referral of patients for invasive CAG

Novel pathophysiological aspects of myocardial infarction

LV dyssynchrony after CRT is associated with worse prognosis

Integration of myocardial scar and innervation imaging refines the risk stratification of HF patients

Fusion imaging and 3D printing growing fields