An Acute Renal Failure Patient with Chest Pain

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Dr. Anthony Tang
Dr. YW Ho

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United Christian Hospital
Hong Kong
Case 1
History

• KKK, 70/M
• Ex smoker, non drinker
• Phx:
  – DM and HT, FU GOPD
  – Hx of PU with partial gastrectomy done
  – ?Burger’s disease, pending workup arranged in O&T clinic
• Medication:
  – Gliclazide 40mg om
  – Adalat retard 20mg bd
  – Zestril 2.5mg daily
  – Aspirin 80mg daily
  – Pepcidine 20mg bd
8/2005

- c/o retrosternal chest pain for 4-5 days
- Radiating to back
- Non exertional
- Occur in the morning with reflux sensation
- No SOB/ orthopnea / PND
- No tarry stool
• **Physical examination on admission**
  - BP 197/103  P 83
  - Peripheral pulse equal and symmetrical
  - CVS: HS I+II, no murmur
  - Resp: chest clear
  - Abd: soft, no mass
  - CNS: power full and equal
  - Cyanotic changes in toes for 3/52

• **CXR:** Cardiomegaly, no widened mediastinum

• **ECG:** SR, LVH by voltage
• **Working Dx:** Chest pain for 1x, Hypertension
• Hb 12.0, WCC 17.3, plt 419

• RFT: Na 132, K 5.5, urea 31.4, Cr 819
  (latest RFT 5 months ago: sCr 113)

• LFT: alb 40, TB 5, ALP 87, ALT 10

• CK 103, Trop T <0.03

• Urine multistix: RBC –ve, WBC –ve
• ARF

• L Renal bruit !!

• Ddx:
  – Aortic dissection
  – ?ACEI induced ARF
  – RPGN
  – Systemic vasculitis
• **Bedside echo:**
  – No pericardial effusion
  – No AR
  – No flap seen at the aortic root
  – Aortic root size normal

• **Urgent CT thorax + abd (plain)**
USG kidneys:
- bilateral renal parenchymal disease, no hydronephrosis.
- Size Lt 10.4cm, Rt: 10.8cm
Progress

• ACEI stopped

Apparent initial improvements
Subsequent investigations:

- WCC 15.4
  - Neutrophil 10
  - Lymphocyte 1.7
  - Monocyte 1.2
  - Eosinophil 2.5
  - Basophil 0.0
- RBC 11.1
- Plt 439
- CK 116
- FBS 5.2
- LDL-C 2.09, TG 1.56
- CRP 101
- ANA +ve <1:40
- RF -ve
- ANCA -ve
- C3 1.09 (0.9-1.8)
- C4 0.65 (0.1-0.4)
- Cryoglobulin -ve
- Anti GBM <2
- Ig pattern: normal
- HBsAg –ve
- anti-HCV –ve
Subsequent investigations (cont.):

- TP **0.16** g/day, CrCl 8ml/min

- MSU:
  - mod WBC, mod RBC, granular cast, no dysmorphic RBC
  - Culture no growth

- “Skin lesion” was later discovered during SR.
◆ Serial RFT

What was happening?
• What will be the next investigation(s)?
• Skin bx: superficial perivascular dermatitis
Serial RFT

Days after admission vs Serum Creatinine level
• What will be the next investigation(s)?
• Renal bx
Case 2
History

- CML, 74/M
- Chronic smoker
- Phx:
  - HT and COPD, FU GOPD
- Medication:
  - Aldomet 500mg tds
  - Neulin SR 100mg bd
  - Ventolin 2 puff qid
  - Becloforte 2 puff bd

- Multiple admissions in 3 months
3/2005

- c/o SOB and productive cough with whitish sputum
- Dx: COPD infective exacerbation
- Treated with Augmentin/ Amoxil/ prednisolone

- sCr 260
- USG kidney was arranged

(appointment: 2 weeks after discharge)
4/2005

- c/o SOB and non exertional chest discomfort
- Elevated JVP and bilateral ankle edema
- ECG: SR, RBBB (old)
- CXR: cardiomegaly with upper lobe diversion
- CK 168, Trop T 0.13→0.3, sCr 256
- ABG: type I resp failure
- Dx: ACS and CHF

- Given lasix, LMWH, nitrate
- u/o 1200ml, sCr 300
- USG kidney: chronic parenchymal disease
- Zestril added for heart failure
5/2005

- c/o diarrhoea for 4 days, passing yellowish loose stool
- Clinically dehydrated
- sCr 535, urea 27.3

- Dx: acute on chronic renal failure, ? secondary to dehydration +/- ACEI
• Cautiously rehydrated
• ACEI stopped

• MSU: no WBC, no RBC, no growth

• USG kidney:
  – no hydronephrosis, LK 9cm, RK 8.3cm

• sCr 551→ 611
Further investigations:

- WCC 11.2
  - Neutrophil 7.5
  - Lymphocyte 1.2
  - Monocyte 0.3
  - Eosinophil 2.1
  - Basophil 0.0
- RBC 11.9
- Plt 278
- CK 73
- FBS 3.7
- ESR 94
- ANA +ve <1:40
- ANCA -ve
- C3 1.23 (0.9-1.8)
- C4 (0.1-0.4)
- Anti GBM 107
- HBsAg –ve
- anti-HCV –ve
- TP 0.11g/day
• Renal bx performed, result pending
• Plasmapheresis was arranged once anti-GBM titre was known

• Stopped on knowing the renal bx result
Case 3
History

- WKO, 67/M
- Ex-smoker, ex-drinker
- **Phx:** HT and T2DM

- **11/2004:**
  - Admitted for retrosternal chest pain
  - CK/Trop T normal
  - sCr 92

- **12/2004**
  - Angina, plan for Cardiac catheterization

- **4/2005**
  - Hypoglycemia
  - sCr 148, TP 0.3, CrCl 29ml/min
  - USG kidney: LK 9.5cm, RK 10.1cm, no obstruction
• **7/2005**
  – Coronary angiogram
    • LM normal
    • RCA: pRCA 50%, mRCA 40-50%
    • LAD: mid LAD long segment 70% stenosis
    • LCx: 10-20% mid LCx disease
  – sCr 157

• **8/2005**
  – PCI to LAD
• 10/2005
  – Exertional chest pain with CHF
  – Toes -- purplish color
  – Acute on CRF
  – sCr 199 ➔ 713
Case 3, Photo taken 1 year after presentation
Further investigations:

- WCC 10.2
  - Neutrophil 5.9
  - Lymphocyte 0.8
  - Monocyte 0.6
  - Eosinophil 2.8
  - Basophil 0.0
- RBC 9.1
- Plt 254
- CK 130, Trop T <0.03
- FBS 5.1
- LDL-C 1.47, TG 0.93
- CRP 10.7
- MSU: no WBC/ RBC
- USG kidney: no obstruction
- ANA +ve 1:40
- RF -ve
- ANCA -ve
- C3 1.21 (0.9-1.8)
- C4 0.39 (0.1-0.4)
- Anti GBM <2
- HBsAg -ve
- anti-HCV -ve
- TP 2.07g/d
• Renal bx was not arranged because of the relatively poor cardiovascular condition
• WCC 15.4
  – Neutrophil 10
  – Lymphocyte 1.7
  – Monocyte 1.2
  – Eosinophil 2.5
  – Basophil 0.0

• RBC 11.1
• Plt 439

• CK 116
• CRP 101
• Urea 31.4
• Cr 819
• Total Protein 0.16g/day

Case 2

• WCC 11.2
  – Neutrophil 7.5
  – Lymphocyte 1.2
  – Monocyte 0.3
  – Eosinophil 2.1
  – Basophil 0.0

• RBC 11.9
• Plt 278

• CK 73
• ESR 94
• Cr 610
• Total protein 0.11g/day

Case 3

• WCC 10.2
  – Neutrophil 5.9
  – Lymphocyte 0.8
  – Monocyte 0.6
  – Eosinophil 2.8
  – Basophil 0.0

• RBC 9.1
• Plt 254

• CK 130
• CRP 10.7
• Cr 710
• Total Protein 2.07 g/day

3 male patients, presented with chest pain, and their renal function deteriorated rapidly.

They had the same diagnosis!
Diagnosis ?
Case 1

Cholesterol embolus within glomerular capillary
Case 1

Glomeulosclerosis and tubular atrophy
Case 1

Glomerulus with wrinkled basement membrane
Case 2
• Renal bx: Cholesterol Emboli
Summary

3 hypertensive male patients, ex-smoker, average age 70.5, presented with chest pain (1 had acute coronary syndrome and received LMWH and 1 had recent endovascular procedure) developed acute renal failure with rapid deterioration due to cholesterol emboli.

Eosinophilia occurred transiently during the clinical course.

All reached end stage renal failure, 2 of them opted for conservative treatment and died within 2 months. 1 opted for helper CAPD and passed away in 1 year.
Cholesterol embolization
(CE or CCE)
• **Incidence**
  – Is the CE the “Cinderella of Nephrology”? 

• **Pathophysiology**
  – Mechanical occlusion
  – Local inflammatory reaction

• **Clinical presentation**
  – Clinical triad + high index of suspicious
  – Risk factors and triggering factor

• **Prognosis and mortality**

• **Management**
  – Prevention
  – Specific treatment: Statin, Iloprost, prednisolone, LDL apheresis…
Renal atheroembolic disease: the “Cinderella of nephrology”

- Cinderella (the patient and their clinical findings) and her shoe (the final diagnosis of atheroembolic disease) are not matched in life

- Mimic other causes of renal impairment
- Different presentation: acute or insidious
- Difficult for diagnosis to be made
  - Diagnosed by characteristic cholesterol clefts
  - Sampling problem: Cholesterol emboli do not uniformly affect the renal arteries
  - Interpretation problem: cholesterol crystal may lodge only in the arcuate vessel and result in downstream non specific ischaemic change

→ Under-recognized entity with a high mortality

Meyrier A. KI (2006) 69, 1308 - 1312
## Incidence Varies

<table>
<thead>
<tr>
<th>Reference</th>
<th>Incidence (%)</th>
<th>Population Under Study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Autopsy studies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kealy\textsuperscript{16}</td>
<td>1</td>
<td>Unselected series (n = 2,126)</td>
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<tr>
<td>Cross\textsuperscript{30}</td>
<td>2.4</td>
<td>Unselected series (n = 372)</td>
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<tr>
<td>Moolenan and Lamers\textsuperscript{31}</td>
<td>0.31</td>
<td>Unselected series (n = 89,075)</td>
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<tr>
<td>Flory\textsuperscript{8}</td>
<td>12.3</td>
<td>Severe aortic atherosclerosis (n = 57)</td>
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<tr>
<td></td>
<td>1</td>
<td>Moderate aortic atherosclerosis (n = 147)</td>
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<tr>
<td></td>
<td>0</td>
<td>No aortic atherosclerosis (n = 63)</td>
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<tr>
<td>Thurlbeck and Castleman\textsuperscript{15}</td>
<td>77</td>
<td>Aortic surgery (n = 22)</td>
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<tr>
<td></td>
<td>31</td>
<td>Nonoperated aneurysm (n = 42)</td>
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<tr>
<td></td>
<td>15.8</td>
<td>Severe atherosclerosis (n = 38)</td>
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<tr>
<td></td>
<td>0</td>
<td>Minimal atherosclerosis (n = 44)</td>
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<tr>
<td>Gore and Collins\textsuperscript{32}</td>
<td>17.6</td>
<td>Subjects $\geq$ 60 y (n = 34)</td>
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<tr>
<td>Ramirez et al\textsuperscript{20}</td>
<td>27</td>
<td>Cardiac catheterization (n = 71)</td>
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<td><strong>Kidney biopsy studies</strong></td>
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<tr>
<td>Jones and Iannacone\textsuperscript{25}</td>
<td>1</td>
<td>Consecutive biopsies (n = 755)</td>
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<tr>
<td>Lie\textsuperscript{24}</td>
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<td>Consecutive biopsies (n = 4,580)</td>
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<td>Preston et al\textsuperscript{33}</td>
<td>3.4</td>
<td>Subjects $\geq$ 65 y (n = 334)</td>
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<tr>
<td>Stone and Fogo\textsuperscript{34}</td>
<td>0.8</td>
<td>Consecutive biopsies (n = 1,219)</td>
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<td></td>
<td>5.5</td>
<td>Elderly subjects (n = 91)</td>
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<tr>
<td><strong>Angiographic studies</strong></td>
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<tr>
<td>Drost et al\textsuperscript{35}</td>
<td>0.15</td>
<td>Cardiac catheterization (n = 4,578)</td>
</tr>
<tr>
<td>Colt et al\textsuperscript{5}</td>
<td>0.18</td>
<td>Cardiac catheterization (n = 3,733)</td>
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<td>Johnson et al\textsuperscript{21}</td>
<td>0.06</td>
<td>Coronary angioplasty (n = 1,579)</td>
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<tr>
<td>Frock et al\textsuperscript{36}</td>
<td>0.1</td>
<td>Angiography (n = 14,998)</td>
</tr>
</tbody>
</table>

\textit{Scolari et al AJKD 2000: (vol 36) p 1089-1109}
Pathophysiology

1. Mechanical occlusion

2. Local inflammatory reaction

The CCE may not be removed by body mechanisms and may persist in the body for an undefined period of time

Meyrier A, KI (2006) 69, 1308 - 1312
Mechanical occlusion

- CE most often originate from the abdominal aorta.

- The clinical presentations depend on the size of the cholesterol crystal emboli and the blood vessels involved.

- CE normally occlude smaller arteries (100–200m in diameter) and arterioles of the lower extremities, central nervous system, kidneys, or mesentery → sometimes resulting in little or only minimal injury

- If obstruction occurs in larger blood vessels → devastating complications with limb or mesenteric ischemia, renal failure or stroke.
Local inflammatory reaction

• **Within 24 hour:**
  – Polymorphonuclear leukocytes infiltrate the involved arterioles

• **24-48 hours:**
  – Mononuclear cell infiltration and giant cell formation with eventual engulfment of the cholesterol crystals

• **2-7 days:**
  – Thrombus formation, endothelial cell proliferation and intimal fibrosis.

• **1-2 months**
  - Crystals may extrude out of the vessel lumen & buried in the adventitia, or remain in the lumen embedded within the organized thrombus

These inflammatory and occlusive processes may lead to ischemia, necrosis or infarction, and can be seen in virtually any organ.
## Clinical presentation

### Dermatological involvement
- Livedo reticularis
- Blue or purple toes
- Gangrenous digits
- Nodules
- Ulcerations
- Fissures
- Petechiae
- Purpura
- Splinter hemorrhage

### Renal involvement
- Uncontrolled hypertension
- Renal failure
- Proteinuria (nephrotic range)
- Microscopic hematuria
- Renal infarction

### Gastrointestinal involvement
- Abdominal pain
- Anorexia
- Diarrhea
- Nausea or vomiting
- Gastrointestinal bleeding
- Bowel ischemia, infarction, perforation or obstruction
- Acute or necrotizing pancreatitis
- Chronic fibrosing pancreatitis
- Abnormal liver function test (transaminases)
- Cholecystitis, chronic acalculous cholecystitis
- Splenic infarct

### Central nervous system involvement
- Transient ischemic attack
- Amaurosis fugax
- Cerebral infarction
- Retinal emboli or Hollenhorst plaque
- Altered mental status
- Mononeuropathy
- Confusion
- Paralysis
- Spinal cord infarction

### Cardiac involvement
- Myocardial infarction or ischemia

### Constitutional symptoms
- Fever
- Weight loss
- Malaise
- Myalgia
- Anorexia
- Muscle tenderness
- Muscle cramps
- Restless leg syndrome

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aorta

Skin

colon

Scolari F et al AJKD 2000: (vol 36) p 1089-1109
Classical triad: livedo reticularis, acute renal failure, eosinophilia

*Livedo reticularis is not pathognomonic Ddx of livedo reticularis

*renal failure can be acute, subacute or chronic*

Scolari F et al AJKD 2000: (vol 36) p 1089-1109
Livedo reticularis

- Antiphospholipid syndrome
- Haematological disorders
  - Hyperviscosity syndromes
  - Macroglobulinemia
- Collagen vascular disease
- Vasculitis (PAN)
- SLE
- Cryoglobulinemia
- SBE
- On steroid
- Normal findings in young health women

Deep cutaneous biopsy is required to confirm the presence of CE

Eosinophilia & Eosinophiluria

Incidence varies,

Eosinophilia, 22 – 73%, transient may not be picked up in retrospective series.

Eosinophiluria

May be a clue to the diagnosis of CCE in the evaluation of acute renal failure

Scolari F et al AJKD 2000: (vol 36) p 1089-1109
Differential diagnosis

Subacute bacterial endocarditis
Nonbacterial thrombotic endocarditis
Antiphospholipid antibody syndrome
Heparin-induced thrombocytopenia
Atrial myxoma
Malignancy
Multiple myeloma
Vasculitis
Warfarin skin necrosis
Thromboembolism
Contrast Nephropathy
Risk factors

Atherosclerosis
  Protruding atheroma ± mobile thrombus (pose the highest risk)
  Diffuse atherosclerosis with PAD and CAD
  Abdominal aortic aneurysm
  Aortic plaque size >4 mm

Advanced age >60 years, Male

Hypertension

Hyperlipidemia

Smoking

Diabetes mellitus

C-reactive protein

Scolari F et al, AJKD Vol 36, No.6 (December) 2000: pp 1089-1109

Triggering factors

Spontaneous
Angiographic or endovascular procedures (including stent deployment)
Vascular surgery
Cardiac surgery
Anticoagulation
Thrombolytic therapy
Trauma

Diagnosis

• Renal biopsy is gold standard for CCE causing ARF

But … Patient may be too ill for renal bx!

• Biopsy of other target organs: skin, muscle, GI tract

• In the presence of specific clinical feature (precipitating events, renal failure and peripheral cholesterol crystal embolization)

→ Dx renal atheroembolic disease without histological evaluation
CCE in dialysis patients

- CCE was reported in 6 patients from a cohort of 200 – 210 patients on chronic dialysis from Oct 2003 – Sept 2005

- All had severe vasculopathy, on PD, HD and HDF

- Predisposing clues: warfarin therapy, angioplasty & femoral artery thrombosis

- Rx: corticosteroid, statins, prostaglandin analogues

# Prognosis and mortality

## Table 3. Clinical and Laboratory Features of Atheroembolic Renal Disease in the Five Largest Case Series

<table>
<thead>
<tr>
<th></th>
<th>Reference</th>
<th>Fine et al²</th>
<th>Lye et al³</th>
<th>Thadhani et al¹¹</th>
<th>Belenfant et al¹²</th>
<th>Scolari et al*</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td></td>
<td>221</td>
<td>129</td>
<td>52</td>
<td>67</td>
<td>52</td>
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<tr>
<td>Spontaneous form (%)</td>
<td></td>
<td>69</td>
<td>40</td>
<td>0</td>
<td>4</td>
<td>21</td>
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<td>Iatrogenic form† (%)</td>
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<td>31</td>
<td>60</td>
<td>100</td>
<td>96</td>
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<td>Radiology procedure (%)</td>
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<td>18</td>
<td>43</td>
<td>96</td>
<td>85</td>
<td>50</td>
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<td>Cardiovascular surgery (%)</td>
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<td>9</td>
<td>5</td>
<td>41</td>
<td>36</td>
<td>15</td>
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<td>Anticoagulation (%)</td>
<td></td>
<td>14</td>
<td>13</td>
<td>37</td>
<td>76</td>
<td>21</td>
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<tr>
<td>Skin lesions (%)</td>
<td></td>
<td>35</td>
<td>43</td>
<td>50</td>
<td>90</td>
<td>96</td>
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<td>GI involvement (%)</td>
<td></td>
<td>10</td>
<td>10</td>
<td>29</td>
<td>33</td>
<td>8</td>
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<td>CNS involvement (%)</td>
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<td>—</td>
<td>12</td>
<td>23</td>
<td>4</td>
<td>8</td>
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<tr>
<td>Retinal emboli (%)</td>
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<td>6</td>
<td>10</td>
<td>25</td>
<td>22</td>
<td>8</td>
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<tr>
<td>Eosinophilia (%)</td>
<td></td>
<td>73</td>
<td>71</td>
<td>22</td>
<td>59</td>
<td>62</td>
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<td>Outcome</td>
<td></td>
<td></td>
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<tr>
<td>CRF requiring dialysis (%)</td>
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<td>28</td>
<td>40</td>
<td>44</td>
<td>61</td>
<td>35</td>
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<tr>
<td>Recovery from dialysis dependence (%)</td>
<td></td>
<td>—</td>
<td>21</td>
<td>26</td>
<td>32</td>
<td>27</td>
</tr>
<tr>
<td>1-Year mortality rate (%)</td>
<td></td>
<td>81</td>
<td>64</td>
<td>87</td>
<td>23</td>
<td>31</td>
</tr>
</tbody>
</table>

*Scolari F et al AJKD 2000: (vol 36) p 1089-1109*
Management

• No effective or proven treatment

• Preventive measures
  – Smoking cessation
  – Avoid anticoagulant
  – Avoid unnecessary angiography and surgical procedures
Management

• **General treatment**
  – BP Control: <140/90, (DM patient <130/80)
  – Lipid Control: LDL-C <100mg/dL (2.6 mmol/L)
    high risk group <70mg/dL (1.8mmol/L)

• **Specific therapy**
  – Statin
  – Iloprost
  – Prednisolone
  – LDL apheresis
    • Patient’s blood is separated into cells and plasma
    • Plasma is diverted over a column containing a material that adsorbs LDL particles and removes it without removing the HDL-C and other blood substances
Improvement in renal cholesterol emboli syndrome after simvastatin

- Case report
- 68-yr old Asian man with proven renal cholesterol emboli
- Progressive renal dysfunction was halted and reversed after treatment with simvastatin in the absence of substantial hypercholesterolaemia
- Simvastatin stabilized cholesterol-rich aortic atherosclerotic plaques which had been showering cholesterol emboli

Improvement in cholesterol emboli syndrome after iloprost therapy

Iloprost (prostacyclin analogue)

- Potent vasodilator and antiplatelet aggregant → stabilizes endothelial integrity and has cytoprotective properties

<table>
<thead>
<tr>
<th></th>
<th>Patient 1</th>
<th>Patient 2</th>
<th>Patient 3</th>
<th>Patient 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>57</td>
<td>75</td>
<td>76</td>
<td>80</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td>Male</td>
<td>Female</td>
<td>Female</td>
<td>Female</td>
</tr>
<tr>
<td><strong>Medical history</strong></td>
<td>Non-Q wave myocardial infarction, congestive heart failure, hypertension</td>
<td>Non-Q wave myocardial infarction, atrial fibrillation, hypothyroidism</td>
<td>Non-Q wave myocardial infarction, hypertension</td>
<td>Anterior wall myocardial infarction, congestive heart failure, hypertension, diabetes mellitus</td>
</tr>
<tr>
<td><strong>Precipitating factors</strong></td>
<td>Coronary angiography</td>
<td>Coronary angiography, warfarin</td>
<td>Coronary angiography, coronary artery bypass graft</td>
<td>Intra-aortic balloon pump, heparin</td>
</tr>
<tr>
<td><strong>Clinical presentation</strong></td>
<td>Leg ulcers</td>
<td>Leg ulcers</td>
<td>Leg ulcers, livido reticularis</td>
<td>Livido reticularis, acute renal failure</td>
</tr>
<tr>
<td><strong>Laboratory data</strong></td>
<td>Eosinophilia</td>
<td>None</td>
<td>Eosinophilia, elevated erythrocyte sedimentation rate</td>
<td>Eosinophilia, eosinophiluria, low C3 complement</td>
</tr>
<tr>
<td><strong>Cholesterol clefts</strong></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><strong>Treatment before iloprost</strong></td>
<td>Aspirin, simvastatin</td>
<td>Aspirin, dipyridamole, cessation of warfarin</td>
<td>Aspirin, dipyridamole, simvastatin</td>
<td>Aspirin, dipyridamole, simvastatin, cessation of heparin</td>
</tr>
<tr>
<td><strong>Pain intensity after iloprost</strong></td>
<td>Decrease</td>
<td>Decrease</td>
<td>Decrease</td>
<td>Decrease</td>
</tr>
<tr>
<td><strong>Degree of pain (visual scale)</strong></td>
<td>10 to 4</td>
<td>4 to 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Narcotic use</strong></td>
<td>Stopped</td>
<td>Stopped</td>
<td>Decreased</td>
<td>Stopped</td>
</tr>
<tr>
<td><strong>Status of leg ulcers</strong></td>
<td>Two toes amputated</td>
<td>Improved</td>
<td>Improved, one necrotic toe</td>
<td>Improved</td>
</tr>
<tr>
<td><strong>Renal function</strong></td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

Use of Steroid in renal cholesterol emboli syndrome

- There were case reports noted improvements in cutaneous lesions with steroids.
- Other reports of success are based on combination treatment with steroid + statin (Simvastatin) or other treatment like LDL apheresis.
- Corticosteroid may upregulate the activations, including phagocytic capacity of Kupffer cells mediated by over-expression of RAGE and scavenger receptors, resulting in efficient clearance of the lipid substances from the blood circulation released from atherosclerotic areas.

Dahlberg PJ et al, Surgery 105, 737 – 46, 1989
Takakuni M et al, Internal Medicine, Vol. 44, No. 10 (Oct 2005) 1060 - 1063
Supportive treatment improves survival in multivisceral cholesterol crystal embolism

- From 1985-1996
- Applied protocol in 67 consecutive atherosclerotic patient

(1) **To avoid CCE recurrence**
- any form of anticoagulant treatment was withdrawn, and aortic catheterization and surgery were proscribed. Corticosteroid 0.3mg/Kg were given to 18/67 patients with laboratory evidence of inflammation +declining general state or new CCEs

(2) **To treat or prevent cardiac failure**
- a high-dose vasodilator regimen was instituted, including angiotensin-converting enzyme (ACE) inhibitors.
- In case of cardiac failure refractory to vasodilators, loop diuretics were added and, if necessary, overhydration was corrected by ultrafiltration/ hemodialysis (11 patients).

(3) **To avoid cachexia,**
- severe metabolic disorders were treated by hemodialysis (41patients), and special attention was given to providing enteral or parenteral nutritional support. Patients with declining general status and laboratory evidence of inflammation, as well as those with new episodes of CCE, were treated with corticosteroids.

Belenfant X et al, AJKD vol 33, 1999: 840-850
In-hospital mortality rate was 16%. Among survivors, 32% had to remain on maintenance hemodialysis therapy for irreversible chronic renal failure.

- 1-year survival rate was 87%, which compares favorably with reports in the literature indicating a first-year survival rate.
- The 4-year survival rate was 52%.

Mortality rate of 64% to 81%. Overall follow-up was 1920 months, ranging from 1 to 74 months.

Belenfant X et al, AJKD vol 33, 1999: 840-850
Acute renal failure due to cholesterol crystal embolism treated with LDL apheresis followed by corticosteroid and candesartan

68/M, HT and DM

Presented with bluish discoloration of toes

Take home message

- CE is frequently **underdiagnosed**—3 CCE patients were diagnosed within months last year.

- Classical cutaneous manifestation and renal failure → **a high index of suspicion** is required

- Skin biopsies should be **deep** and include dermal vessels

- Mortality **high**

- **No** effective treatment

- Prevention is most important
• Advancement in knowledge of the cholesterol embolization permits a correct pre-mortem diagnosis in a significant number of cases.

Cinderella and her shoe can now be well matched during life time.
Thank you