Management of Aortic Infection: Improved Outcomes with a Multidisciplinary Team Approach and In-Situ Reconstruction Using Biological Conduits

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• No disclosures
Introduction – Magnitude of the problem

Aortic graft infection

• Typically affects 0.5 – 4 % of all aortic devices implanted
• Patients are usually frail with multiple comorbidities
• Carries a mortality risk approaching 100% at 2 years without surgical treatment
• Surgery to explant the infected prostheses can be challenging as no graft is designed to be removed
• Surgical explantation and extra-anatomical reconstruction carries a significant mortality risk (18 - 30 %)

### Diagnosis – a multi-disciplinary approach

<table>
<thead>
<tr>
<th>Major Criteria</th>
<th>Clinical / Surgical</th>
<th>Radiology</th>
<th>Laboratory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pus (confirmed by microscopy) around graft or in aneurysm sac at surgery</td>
<td>Peri-graft fluid on CT scan ≥ 3 months after insertion</td>
<td>Organisms recovered from an explanted graft</td>
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<td>Open wound with exposed graft or communicating sinus</td>
<td>Peri-graft gas on CT scan ≥ 7 weeks after insertion</td>
<td>Organisms recovered from an intra-operative specimen</td>
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<tr>
<td>Fistula development e.g. aorto-enteric or aorto-bronchial</td>
<td>Increase in peri-graft gas volume demonstrated on serial imaging</td>
<td>Organisms recovered from a percutaneous, radiologically-guided aspirate of peri-graft fluid</td>
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<tr>
<td>Graft insertion in an infected site e.g. fistula, mycotic aneurysm or infected pseudoaneurysm</td>
<td>Other e.g. suspicious peri-graft gas/fluid/soft tissue inflammation; aneurysm expansion; pseudoaneurysm formation; focal bowel wall thickening; discitis/osteomyelitis; suspicious metabolic activity on FDG PET/CT; radiolabelled leukocyte uptake</td>
<td>Blood culture(s) positive and no apparent source except AGI</td>
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<tr>
<td>Localized clinical features of AGI e.g. erythema, warmth, swelling, purulent discharge, pain</td>
<td>Other e.g. suspicious peri-graft gas/fluid/soft tissue inflammation; aneurysm expansion; pseudoaneurysm formation; focal bowel wall thickening; discitis/osteomyelitis; suspicious metabolic activity on FDG PET/CT; radiolabelled leukocyte uptake</td>
<td>Blood culture(s) positive and no apparent source except AGI</td>
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<td>Fever ≥38°C with AGI as most likely cause</td>
<td>Other e.g. suspicious peri-graft gas/fluid/soft tissue inflammation; aneurysm expansion; pseudoaneurysm formation; focal bowel wall thickening; discitis/osteomyelitis; suspicious metabolic activity on FDG PET/CT; radiolabelled leukocyte uptake</td>
<td>Abnormally elevated inflammatory markers with AGI as most likely cause e.g. ESR, CRP, white cell count</td>
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**Suspected AGI**
- **1 major criteria only**

**Suspected AGI**
- **any** minor criteria from 2 categories **without a major criteria**

**Confirmed AGI**
- **1 major criteria + any minor/major criteria from a different category**

Case planning and decision making

Stable patient
- Full work-up
- IV ABx
- CT aorta
- PET scan
- Deep veins scan
- Echo
- Lung function test
- Medical optimization

Unstable patient
- Bleeding aorto-enteric fistula
- Rapidly progressing/ruptured mycotic aneurysm

Endovascular repair
- Urgent/Emergency repair
- Stabilization/Resuscitation
- IV ABx

Definitive treatment
- PET scan
- Full work-up when stable
- MDM discussion and case planning
- Explantation and in-situ reconstruction
- Conduits: bilateral SFVs, bovine, composite
- Life-long ABx if not fit for repair
Methods - Study group

16 consecutive patients with aortic infection

14 patients with infected grafts/stent grafts + 2 patients with primary mycotic pseudoaneurysms

Study period: May 2015 – August 2017

Operation performed: Explantation of infected graft/resection + in situ reconstruction with biological conduits

<table>
<thead>
<tr>
<th>Demographic data</th>
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<tr>
<td>Age</td>
<td>68.5 ± 7.3 yrs</td>
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<tr>
<td>Gender</td>
<td></td>
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<tr>
<td>Male</td>
<td>81.2% (13/16)</td>
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<tr>
<td>Female</td>
<td>18.7% (3/13)</td>
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<tr>
<td>Pre-op eGFR</td>
<td>69.5 ± 42.1 ml/min</td>
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<td>Time since index graft implant</td>
<td>3 ± 3.6 yrs</td>
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<tr>
<td>Aorto-enteric fistula at first presentation</td>
<td>18.75% (3/16)</td>
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Study group characteristics

Index (infected) graft type:
- EVAR: 7 (44%)
- Previous open repair: 2 (12%)
- Primary mycotic: 7 (44%)

Primary indication for insertion of index graft:
- EVAR: 8 (50%)
- Previous open repair: 5 (31%)
- Primary mycotic: 3 (19%)
- Mycotic aneurysm: 8 (50%)
- Emergency repair: 3 (19%)
- Elective repair: 5 (31%)
Intra-operative data

44% (7/16) of patients had polymicrobial infections;
63% (10/16) had negative blood cultures but positive intraoperative samples;

All patients completed a course of 6 weeks of IV ABx followed by a course of 6 weeks of oral ABx;
### Intra-operative data

#### Surgical approach type
- Midline laparotomy - anterior approach: 10 (63%)
- Rooftop incision: 5 (31%)
- Lateral retroperitoneal approach: 1 (6%)

#### Intraoperative data

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
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<tr>
<td>Supra-coeliac clamp time</td>
<td>13.1 ± 7.3 mins</td>
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<td>Supra-renal clamp time</td>
<td>32 ± 5 mins</td>
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<td>Total operation time</td>
<td>508 ± 150 mins</td>
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<td>Blood loss</td>
<td>3.5 ± 4.2 L</td>
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<td>Transfusion requirements</td>
<td>9 ± 7 RBC units</td>
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#### Highest clamp location
- Supra-coeliac: 7 (43%)
- Infra-renal: 3 (19%)
- Inter-renal: 3 (19%)
- Supra-renal: 3 (19%)
Intra-operative data

A significant decrease in operative time was observed when bovine conduits were used.
Intra-operative data

Bifurcated neo-aorto-iliac system (NAIS) (bilateral SFV grafts)
Intra-operative data

Composite (bovine pericardium + SFV graft)

Bovine pericardium conduit
Intra-operative data

Explanting previous endografts was technically more challenging than previous open grafts.
Results

The 2 deaths were caused by bleeding from recurrent aorto-enteric fistulae.

30 days mortality 0%

6 months mortality 6% (1/16)

Mean follow-up 13 months

Survival at 13 months 88%
Results

There were 2 reinterventions for bleeding or pseudoaneurysm formation and one reintervention for washout of intrabdominal collections.

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<tr>
<th>No. of patients</th>
<th>AKI</th>
<th>Temporary dialysis</th>
<th>Abdo collections/Wound infection requiring intervention</th>
<th>Hospital acquired pneumonia</th>
<th>AF</th>
<th>MI</th>
<th>Neurological</th>
<th>DVT/PE</th>
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Rates of postoperative complications

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<th>Postoperative LOS</th>
<th>ITU/HDU LOS</th>
<th>9 ± 9 days</th>
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<td>Total postoperative LOS</td>
<td>26 ± 19 days</td>
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Follow-up strategy and outcomes

Follow-up plan for all graft infection cases
(agreed in a joint Vascular and Infectious Disease MDM)

- CTA before discharge
- IV ABx for 6 weeks
- Oral ABx for 6 weeks
- Review in clinic in 6 weeks
- PET scan and clinic review in 3 months
- CTA and clinic review in 6 months
- Yearly PET scans

All 14 survivors underwent check PET scans which confirmed complete resolution (7/14) or much improved uptake (7/14) around the graft.

Median CRP and WCC at the latest clinic follow-up were 5 and 8.

All patients are prospectively monitored via the MAGIC (Management of Aortic Graft Infection Collaboration) database.
Conclusions

Aortic infection

- Management of this condition is best performed by a multi-disciplinary team
- Resection and in-situ reconstruction with biological conduits is feasible, reproducible and has proven to be curative
- Long-term benefits of the repair outweigh short-term perioperative complications
- Longer follow-up is needed to assess the durability of the repair
- Collaborative effort is needed to optimize treatment in high-risk patients
- MAGIC (Management of Aortic Graft Infection Collaboration) Database offers a functional platform to prospectively collect and analyze data
MAGIC
MANAGEMENT OF AORTIC GRAFT INFECTION COLLABORATION (MAGIC)
SERVICE EVALUATION DATABASE

Welcome

Infection complicates aortic graft and endograft deployment in approximately 1-9% of cases. In the absence of good evidence-based guidance, approaches to diagnosis and treatment are inconsistent. Corresponding outcomes are variable but often poor. In response to this, several English NHS Trusts with large vascular services came together in 2012 to form the Management of Aortic Graft Infection Collaboration (MAGIC). Underpinning the range of specialist expertise which is essential to manage these complex cases, it comprises vascular surgeons, infection specialists and radiologists.

Supported by the Vascular Society of Great Britain & Ireland, the MAGIC service evaluation database has been developed to collect high-quality, prospective data on the clinical presentation, diagnosis, treatment and outcome from aortic graft infection. The database complies with NHS patient data security standards and is hosted by the Guy’s & St Thomas’ Biomedical Research Centre. The MAGIC aortic graft infection definition is the first derived by multi-disciplinary expert consensus and is used to determine eligible cases for database entry.

Any vascular unit with a multi-disciplinary approach to managing aortic graft infection is now welcome to join the MAGIC database. Complete the enrolment form and/or for more information email: gst-tr.magicadministrator@nhs.net