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SUPRA-REGIONAL S.O.P. ON THE ACUTE MANAGEMENT OF AORTIC DISSECTIONS

The objectives

To standardise the management of acute aortic syndrome (AAS), including Type-A aortic dissection (TAAD), Type-B aortic dissection (TBAD), intramural haematoma (IMH).

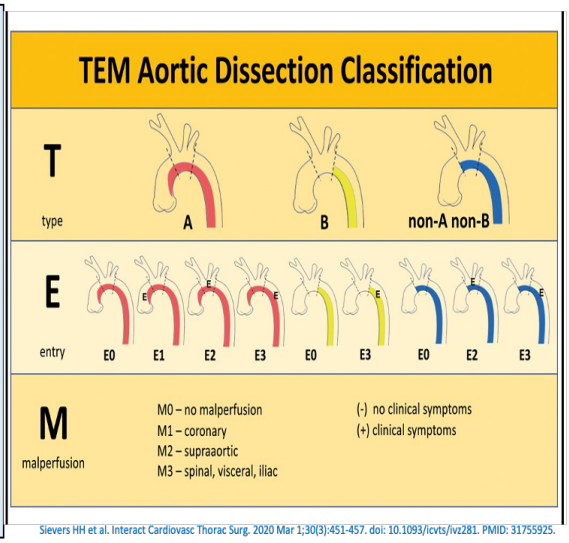
- Minimising the risk of missed or delayed diagnosis.
- Any person with new onset pain consistent with AAS triggers a CT aortogram.
- All patients diagnosed are offered expeditious & appropriate therapy for blood pressure and heart rate control, along with analgesia.
- All patients with AAS involving the ascending aorta and/or arch are reviewed by senior clinicians & discussed with a specialist aortic cardiac service.
- All patients diagnosed with acute AD on CT aortogram are immediately refereed to a specialist aortic centre (cardiac and/or vascular surgery) by a senior ED clinician.
- All people for whom acute AD is an end-of-life event (unsuitable for surgery, or who decline surgery), receive end-of-life supportive care in their local hospital, close to family and friends.

Aortic Dissection (AD) Classification

Type A AD: The dissection involves ascending aorta and/or aortic arch. Immediate surgery is required to replace the ascending aorta/aortic root/aortic arch to prevent myocardial infarction, pericardial tamponade or aortic rupture.
Type Non-A/Non-B AD (treated as TAAD): The initial dissection tear involves the aortic arch and threaten to go retrograde (A) or antegrade (B). There could be transformation of Type B becoming Type A, later on, due to late retrograde dissection. Non-A/Non-B should be treated as TAAD.

Type B AD: The dissection is distal to the left subclavian artery. Immediate management is blood pressure control. Emergency intervention (surgery – endovascular) should be considered if contained rupture, malperfusion or spinal cord ischaemia.

Intramural haematomas: All intramural haematomas involving the ascending aorta and/or the aortic arch should be treated as Type A AD.



Sievers HH et al. Interact Cardiovasc Thorac Surg. 2020 Mar 1;30(3):451-457. doi: 10.1093/icvts/ivz281. PMID: 31755925.

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PRINCIPLES

ACUTE AORTIC DISSECTION IS A TIME CRITICAL DIAGNOSIS

High index of suspicion
Needs awareness through education.

Sudden onset chest, back or abdominal pain worst in severity at onset

- **Aortopathies:** Marfan syndrome, Loeys-Deitz Syndrome, Vascular Ehler-Danlos, Turners Syndrome, Large vessel vasculitis
- **Family history of aortic disease**
- **Known aortic valve disease**
- **Recent aortic procedure**
- **Thoracic aortic dilatation/aneurysm**
- **Aortitis**

Diagnosis by CT scan
CT available immediately 24/7.

Stabilisation
Anti-impulse therapy is critical.

Patient not accepted for transfer to aortic centre

Local admission
Medical management **or** End-of-life care.

Time-critical patient transfers
ACCTS or Category 2 ambulance with suitable medical escort.
(Rarely, air ambulance)
Do not stop anti-impulse therapy during transfer.

Specialist advice
ACCTS/medical escort to contact receiving aortic team.

Deterioration prior to arrival at aortic centre

Specialist aortic centres
24/7 specialist service with cross-cover.

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ED Guidelines for Suspected Acute Aortic Syndrome

- Pain may be migratory or have disappeared by the time patient presents to ED.
- In young patients, aortic dissection may be caused by heavy lifting or cocaine use.
- A history of vomiting is common, this may lead to misdiagnosis.

Suspected Acute Aortic Syndrome

YES

Haemodynamically unstable patient
(or suggestive features of ADD on ECHO: Pericardial effusion, dilated aortic root, intimal flap, aortic regurgitation

YES → **Move to Resus**
Involve senior emergency clinician

NO

Aortic Dissection Detection Risk Score

High Risk Conditions	High Risk Pain features	High Risk Clinical Findings
- **Aortopathies:** (Marfan; Loeys-Deitz; Vascular Ehler-Danlos; Turners Syndromes & Large vessel vasculitis) - **Family history of aortic dissection** - **Known aortic valve disease** - **Recent aortic manipulation** (including cardiac surgery) - **Known thoracic aortic dilatation/aneurysm** - **Known Aortitis**	**Chest, back or abdominal pain** described as: - Abrupt in onset - Severe in intensity - Ripping or tearing	**Evidence of perfusion deficit:** - Pulse deficit - Systolic blood pressure differential (>20mmHg) - Aortic regurgitation murmur (new or previously know) in conjunction with pain - Hypotension or shock

Scoring 0 or 1 point per category.

Score 0 (Low risk)

Score 1 (Intermediate

YES → **Consider CT aorta**
Discuss with senior emergency clinician

Score 2-3 (High risk)

YES

YES

Consider alternative diagnosis
If suspicion of ADD remains, discuss with senior emergency physician.

Urgent CT aorta
Senior emergency clinician

ADD Confirmed
Move patient to resus & Anti-impulse therapy
Refer to specialist aortic centre

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Management of confirmed Acute Aortic Dissection in ED

ADD confirmed on CT

Type-A
(Ascending aorta and/or Arch)

Emergency Referral to Specialist Cardiac Aortic Unit
(By senior emergency clinician)
&
Anti-Impulse Therapy
(Unless palliative pathway)

Type-B
(Distal to left subclavian artery)

Start Anti-Impulse therapy as soon as possible.
Must continue during ACCTS/medically escorted ambulance transfer.

Complicated Type-B

CT findings	Organ malperfusion
- Severe aortic dilatation - Signs of aortic rupture ➢ Haemothorax ➢ Periaortic haematoma ➢ Mediastinal haematoma	- Acute kidney injury - Metabolic acidosis - Rising lactate - Lower limp ischaemia - Paraplegia - Leg pain / paraesthesia / motor deficit

Yes

Emergency Referral to Specialist Aortic Unit
(By senior emergency clinician)
&
Anti-Impulse Therapy
(Unless palliative pathway)

NO

Refer to Specialist Aortic Unit
(By senior emergency clinician)
&
Possible local admission for blood pressure management with input from the local vascular department.

Principles of Anti-Impulse therapy

- **Why:** to stop the dissected aorta from rupturing and further expanding while maintaining organ perfusion.
- **Aim:** to treat hypertension and tachycardia *(acceptable >90%, achievable >95%).*
  - Systolic BP: 100-120mmHg, achieved <30min of diagnosis.
  - Heart rate: 60-75 bpm, achieved <60min of diagnosis.
- **How:** start **intravenous Labetalol (100mg/20ml)**
  - 0.25milligram/kg bolus over 2 min
  - Followed by 2mg/min (or 2ml/min) infusion for 10 mins.
  - Increase to maximum 5 mg/min.
  - Onset 2-5min, duration 2-4 hrs.
  - *Consider Esmolol or Diltiazem if Asthma/COPD.*
- **Why:** to stop the dissected aorta from rupturing and further expanding while maintaining organ perfusion.
- **Monitor:** ideally invasive blood pressure monitoring, hourly neurovascular observations & regular venous blood gases for lactate.

If remains hypertensive following beta-blockade discuss with specialist receiving aortic centre and consider adding other vasodilators.

This protocol should be started as soon as possible and continued during ACCTS / medically escorted ambulance

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For the ED

Making the Diagnosis

Clinicians working in the ED should be made aware of local policies and resources in managing acute aortic dissections (AAD), as part of their induction[2].

In the event of diagnostic uncertainty, the decision to proceed to CT scan should be taken by a senior emergency medicine clinician considering history, examination, and investigations.

If the ED clinician suspects a patient has a AAD it is the role of the ED to request the CT scan. It should be requested stating: 'EXCLUDE or CONFIRM ACUTE AORTIC SYNDROME'.

CT scan protocol for AAD

- Preferably an ECG-gated CT-scan or a CT-scan using fast scan protocol.
- Cannula should ideally be placed in right arm (to avoid arch vessels artefacts).
- In low to intermediate risk patients, without abdominal or lower limb symptoms, then scan the thorax in the first instance.
    - If positive for ADD: scan from neck (common carotid arteries) to groins (common femoral arteries); best scan possible – 2mm slices.
- In intermediate to high-risk patients, scan from neck (common carotid arteries) to groins (common femoral arteries) ; best scan possible – 2mm slices.
- If ADD is diagnosed the images must be immediately transferred to the appropriate aortic centre via the image exchange portal (IEP) using the clinical emergency pathway.

Treating the Patient & Family

• **Move patient to ED resus bay & pain relief:** keeping patient and family informed (print and distribute AAD information leaflet).

• **Early involvement of most experienced ED doctor** and local critical care team**.**

• Keep the patient **"nil by mouth":** until destination management is confirmed and off antiplatelets/anticoagulants.

• **Analgesia** as per RCEM guideline - Morphine sulphate 2-5mg IV every 5-30 minutes.

• **Continuous monitoring** of blood pressure, heart rate and ECG.

• **Anti-impulse therapy**: Use standard protocol overleaf of intravenous Labetalol (UNLESS CONTRAINDICATION) for blood pressure and heart rate control.

• **Check FBC, U&E, Troponin, Lactate, Lipase and ABG**: do not delaying referral or transfer.

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Anti-impulse protocol for ED & ACCTS Escorted Ambulance

IV Labetalol (100mg/20ml)

Onset 2-5min, duration 2-4 hrs

0.25milligram/kg bolus over 2 min

Followed by 2mg/min infusion for 10 mins, increase to maximum 5 mg/min

Blood pressure & heart rate targets *(acceptable >90%, achievable >95%).*

Systolic BP: 100-120mmHg, achieved <30min of diagnosis.

Heart rate: 60-75 bpm, achieved <60min of diagnosis.

If remains hypertensive following beta-blockade discuss with specialist receiving aortic centre and consider adding other vasodilators.

This protocol should be started as soon as possible & continued during ACCTS / medically escorted ambulance transfer.

• **Assess the patient's current clinical state and premorbid level of function:** using information from the patient, relatives, previous imaging and clinic letters.

• **Senior clinician (Consultant / Registrar / Senior Staff Grade) should communicate clearly to the referring service:** help the specialist services to make the right decision.

- Provide full ID details of the patient to facilitate patient registration at accepting centre.
- The following patients must be discussed at consultant level (ED consultant to consultant cardiac or vascular surgeon*) prior to escalation of management:
  - Cardiac arrest with intubation (unlikely to survive).
  - Patients with severe systemic disease (intervention may be of no benefit).
  - Aged ≥85 years or high frailty index (low survival benefit).

Transferring the Patient

• **Call for ambulance & transfer**

- ED should arrange a time-critical, Adult Critical Care Transfer Service (ACCTS) or Category 2 emergency ambulance transfer – AAD patients are critically ill and **must** have suitably trained and experienced clinical escorts.
- Consider air ambulance if remote area with estimated transfer time of >2-3 hours.
- An arterial line should be inserted but must not delay transfer.
- Secure all lines and give antiemetic prior to transfer.
- Patients should not travel with blood products unless already commenced.

• **DO NOT STOP ANTI-IMPULSE THERAPY DURING TRANSFER!**

• **Inform the receiving hospital upon patient's departure and provide an estimated time for arrival (ETA), if possible.**

Contraindications to escalation of management

- **Cardiac arrest** from aortic rupture.
- **Frail or co-morbid patient** who will not survive intervention.
- **Patient choice** not to have an intervention.

Patients unfit / patients' choice (Non-specialist care)

- **Medical management:** Reserved for frail, elderly or people with co-morbidities, 'un-complicated' Type-B AAD and distal IMH.
- **End of life care:** It is usually best delivered in the patient's local hospital.

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South and West Aortic Specialist Services

	Type	Team	Hospital	Contact *	Switchboard Number	ACCTS	Senior Aortic Advice
PLYMOUTH	Type A & Type B	Cardiac Surgery	Derriford Hospital PL6 8DH	Cardiac surgery registrar	01752202082 Bleep: 0771	RETRIEVE 0300 030 2222	Mr James Kuo
BRISTOL	Type A	Cardiac Surgery	Bristol Heart Institute BS2 8ED	Cardiac surgery registrar	01179230000 Bleep: 2325		Mr Cha Rajakaruna
	Type B	Vascular Surgery	Southmead Hospital BS10 5NB	Vascular surgery registrar	01179505050 (connect to on call mobile phone)		Mr Marcus Brooks
OXFORD	Type A	Cardiac Surgery	Oxford Heart Centre OX3 9DU	Cardiac surgery registrar	01865741166 Bleep: 1963	SCAS HCP Thames Valley / Milton keynes: 0300 123 9826 Hampshire IOW Hospitals: 0300 123 9806	Prof. George Krasopoulos
	Type B	Vascular Surgery	John Radcliffe Hospital OX3 9DU	Vascular surgery registrar	01865741166 (connect to on call mobile phone)		Mr Ed Sideso
SOUTHAMPTON	Type A	Cardiac Surgery	Southampton General Hospital SO16 6YD	Cardiac surgery registrar	02380777222 Bleep: 9211		Mr Geoff Tsang
	Type B	Vascular Surgery	Southampton General Hospital SO16 6YD	Vascular surgery registrar	02380777222 Bleep day: 1322 Bleep night: 9990		Mr Ian Nordon
BRIGHTON	Type A	Cardiac Surgery	Sussex Cardiac Centre BN2 5BE	Cardiac surgery registrar	01273 696955 (connect to on call mobile phone)	SECamb **Sussex** 0300 1239163 **Surrey** 0300 1239882 **Kent** 0300 1235814	Mr Damian Balmforth
	Type B	Vascular Surgery	Royal Sussex County Hospital BN2 5BE	Vascular surgery registrar	01273 696955 Bleep: 8004		Prof. Waquar Yusuf

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For the Radiology Departments

(Including outsourcing)

Imaging requirements

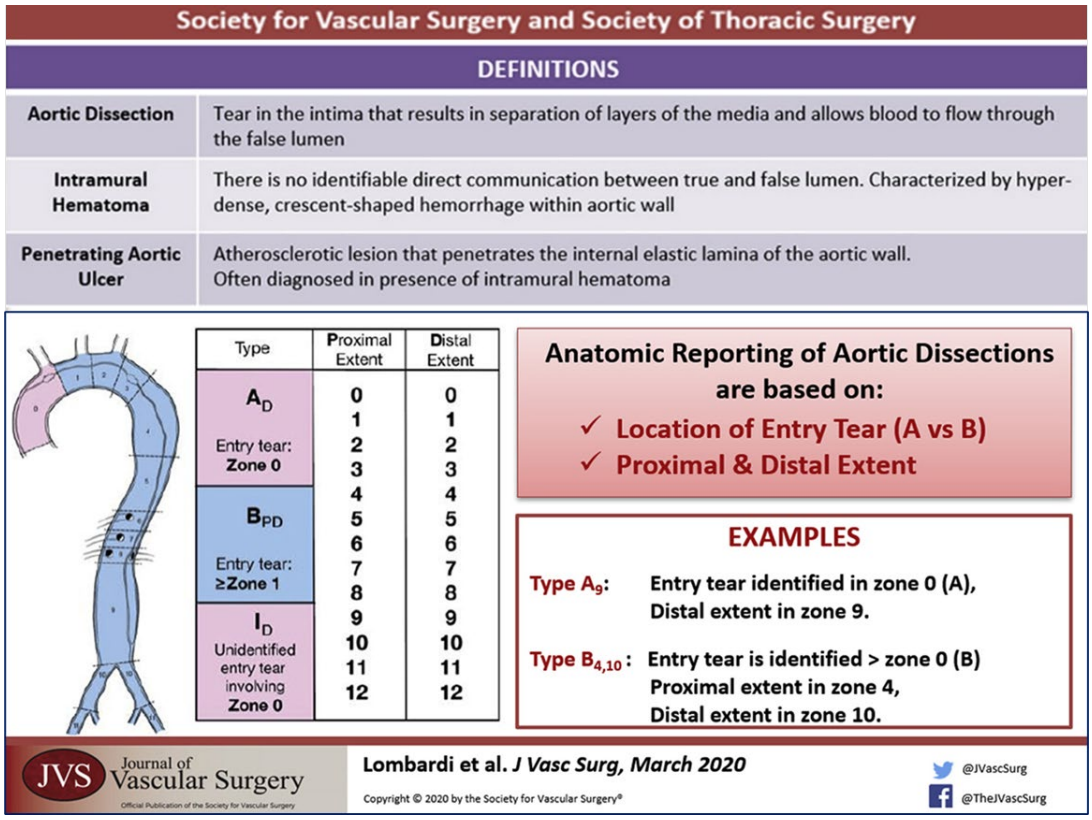
The radiology departments should have capacity to deliver CT-scanning 24/7 using agreed CT protocols and have ability to transfer images to designated aortic services via image exchange portal (IEP).

CT scan protocol for AAD

- Preferably an ECG-gated CT-scan or a CT-scan using fast scan protocol (best possible scan, preferably 2mm or thinner cuts to facilitate reconstruction)
- Cannula should ideally be placed in right arm (to avoid arch vessels artefacts).
- Low to intermediate risk patients: scan the thorax in the first instance.
    - If positive for AD, scan from neck (common carotid arteries) to groins (common femoral arteries) at the same setting without moving the patient out of the scanner or delaying completing the scan.
- Intermediate to high-risk patients: scan from neck (common carotid arteries) to groins (common femoral arteries)
- If AD is diagnosed: make images available for immediately transferred to the appropriate aortic centre via IEP.

Reporting CT images with AD

CT reporting should use agreed reporting guidelines, so the information is communicated in a clear and consistent way.



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For Transfer Teams & Ambulance Services

Patients with diagnosed AAD are critically care patients & require an immediate, time critical transfer to a designated aortic centre.

Use either: Adult Critical Care Transfer Service (where available) or Category 2 emergency ambulance with suitably trained medical escorts.

Rarely, air ambulance transfer may be required (extremely long distances).

Key points for ACCTS and medical escorts

- ADD patients must be treated as critical care patients and require suitably trained clinical escorts. This should be provided by regional ACCTS, where available, or by the referring hospital, if not.
- Patients require continuous monitoring.
- Ensure you have contact details of aortic specialist centre.
- Ensure you follow any clinical advice given by aortic specialist centre.
- DO NOT stop anti-impulse therapy during transfer. In patients whose physiology has not required it, be prepared to start it during transfer, if required.

Deterioration prior to arrival at the designated specialist aortic centre

Contact the receiving centre for advice.

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For all Aortic Specialist Services

No ITU beds is not a reason to turn down an acute AD referral.
(Exceptional circumstances apply)

- Patients with TAAD should go straight to cardiac theatre, if possible.
- If theatre not available or other reasons, transfer patient to ITU/HDU/ED.

ACUTE TYPE-A AORTIC DISSECTION

• **Cardiac surgery and anaesthetic teams**
  - Response time 30min - prepare cardiac theatre.
  - Team to assess patient's benefit from emergency aortic surgery and consent.
  - Make available 4 units of blood group O for immediate use.
  - Register the patient to the Hospital EPR system on ID information from referring centre.
  - Print all relevant patient stickers and ID bands ahead of patients' arrival.

• **Transfer patient immediately to cardiac surgical theatre:** If direct transfer to the receiving unit/department theatre not possible the following options should be explored: ITU/HDU/ED.

• **Blood samples & transfusion lab:** to be sent from theatre & alert blood transfusion of the need for a "blood products" to be available.

ACUTE COMPLICATED TYPE-B AORTIC DISSECTION
(Aortic rupture or spinal cord / mesenteric / lower limb ischaemia)

• **On-call vascular/cardiac surgery and anaesthetic teams**
  - Assess patient's benefit from emergency TEVAR and/or revascularisation and/or laparotomy.
  - Patient consented for surgery.
  - Prepare vascular hybrid theatre or interventional vascular suite.
  - On call radiographer alerted as to possibility of emergency TEVAR.

• **Transfer patient immediately to theatre for definitive procedure**
  - Inform local ED department of the expected arrival of the patient.
  - Avoid, if possible, transfer of patients to ED/ITU/HDU/Wards.

• **If spinal cord ischaemia present**
  - Blood pressure targets relaxed to improve spinal cord perfusion – mean arterial blood pressure (MAP) >80mmHg, using inotropic support if necessary.
  - Keep Oxygen Saturation >94% and Hb>100mg/dl.
  - Maintain supine position.
  - If no improvement, then a spinal drain is inserted and proceed to early MRI-spine.

• **Blood samples & transfusion lab.**

Consider genetic testing for all patients <60 years old.

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Appendix I

Supra-Regional Standard Oppressional Procedures on the Acute Management of Aortic Dissections To support system-wide improvement in acute diagnosis, referral, stabilisation, transfer, and specialist therapies.	
SETTING FOR STAFF	Emergency Departments; Radiology Departments; Adult Critical Care Networks and Transfer Services; Ambulance Services; Maternity Units; Specialist Aortic Services.
PATIENTS	People presenting with AAD, includes intramural haematoma (IMH) and penetrating aortic ulcer (PAU) – there are termed 'acute aortic syndromes'.
AUTHORISING BODY	University Hospitals Plymouth NHS Trust; University Hospitals Bristol and Weston NHS FT; North Bristol NHS Trust; Oxford University Hospitals NHS FT; University Hospitals Southampton NHS FT; University Hospitals Sussex NHS FT; South Western Ambulance Service NHS FT; South Central Amulance Service NHS FT; South East Coast Ambulance Services NHS FT.
ENDORSEMENT	UK-Aortic Society; Aortic Dissection Awareness UK; Think Aorta; Aortic Dissection Charitable Trust.
DISSEMINATION	Medical Directors Southern England Acute Hospital Trusts (excluding London) South Western and South Central Ambulance Services South East Coast Ambulance Services Cardiac Surgery and Vascular Surgery Network Leads (Six Acute Trusts)
SAFETY and COMPLIANCE	All refering and aortic centres should be compliant with the SOP within six (6) months from implementation. Non-compliance after that period should be reported to the AAD clinical governance lead within one (1) week.
AORTIC LEADS	**Plymouth:** Sanjoy Asopa (Cardiac) & Dev Mitipalli (Vascular) **Bristol:** Cha Rajakaruna (Cardiac - BHI) & Marcus Brooks (Vascular - NBT) **Oxford:** George Krasopoulos (Cardiac) & Ed Sideso (Vascular) **Southampton:** Geoff Tsang (Cardiac) & Ian Nordon (Vascular) **Brighton:** Damian Balmforth (Cardiac) & Waquar Yusuf (Vascular)
Regional Network Leads	Mr Marcus Brooks, Consultant Vascular Surgeon, North Bristol NHS Trust. Lead for Southwest Cardiovascular Network AAD Pathway marcus.brooks@nbt.nhs.uk Mr Jonathan Hyde, Consultant Cardiac Surgeon, Uni. Hospitals Sussex NHS FT, Lead for Southcentral Cardiovascular Network AAD Pathway jonathan.hyde@nhs.net Transfer queries: retrieve.transfer@nhs.net
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QUERIES REGARDING THE DOCUMENT	Prof. George Krasopoulos, Consultant Cardiac Surgeon, Oxford University Hospitals NHS FT george.krasopoulos@ouh.nhs.uk

Endorsed by:

Appendix II

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SCAN ME