Liver Assessment and Recovery Centre (ARC) – Pilot Manual.

Donor Hospital to Liver ARC

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1. Summary of changes

New

2. Introduction

Liver perfusion at an Assessment and Recovery Centre (ARC) is the process whereby a deceased donor liver is transported to a dedicated facility separate from the accepting transplant centre. At the ARC, the liver will undergo ex-vivo machine perfusion, which allows the liver to be maintained under controlled physiological or hypothermic conditions to assess function, improve preservation, and allow potential reconditioning prior to transplantation.

The Liver Assessment and Recovery Centre Pilot aims to:

- Test the feasibility and safety of providing a national liver machine perfusion service to support increased deceased donor liver utilisation
- Establish the logistics and governance arrangements for this new organ journey pathway
- Generate mechanisms for robust audit and data collection to be able to monitor ARC performance and impact
- Create a sense of national ownership of the ARC programme as a service provided by some, for the benefit of all.

3. Glossary

Term	Definition
Liver Assessment and Recovery Centre (ARC)	Specialist centre who will undertake liver machine perfusion on behalf of the accepting transplant centre.
Normothermic Machine perfusion (NMP)	An ex-vivo organ preservation method where a deceased donor liver is continuously perfused at normal physiological temperature with oxygenated perfusate, enabling ongoing metabolism, bile production, and functional assessment prior to implantation.
Hypothermic Oxygenated Perfusion (HOPE)	An ex-vivo liver preservation method in which the organ is continuously perfused at hypothermic temperature with an oxygenated perfusate, aiming to support mitochondrial function, reduce reperfusion injury, and improve post-transplant outcomes.
Abdominal Normothermic Regional Perfusion (A-NRP)	Technique to restore the circulation to the abdominal organs in situ following circulatory arrest for the purpose of transplantation
Donor after Brainstem Death (DBD)	Deceased donor who donates organs following confirmation of death by neurological criteria
Donor after Circulatory Death (DCD)	Deceased donor who donates organs following confirmation of death by circulatory criteria

4. Roles and responsibilities

Role	Responsibility in ARC pathway
Transplant Coordinator - Accepting transplant centre	Transplant Coordinator – Accepting transplant centre communicates between Hub Operations, SN and Liver ARC to coordinate acceptance and transport of donated liver
Transplant Coordinator – ARC	Mobilises ARC perfusion team and continues to support communication between Liver ARC Clinical lead / liver ARC perfusionist / Transplant centre - Accepting Centre and Accepting Transplant Surgeon
Accepting transplant centre	Transplant centre that has accepted donor liver for a recipient. Will need to maintain communications between Hub Operations, ARC centre to support transplant pathway.
Accepting Transplant Surgeon	Liver Transplant Surgeon from the transplant centre who makes the decision to accept liver for transplant for their recipient.
Liver ARC Lead Surgeon	Leads the liver perfusion team at the Liver ARC. Liaises with Accepting Transplant Surgeon to support decision to transplant. Undertakes or oversees the assessment of donor liver pre-perfusion, cannulation of liver and placing on NMP (and HOPE if indicated) circuit.
Liver ARC Organ Preservation Practitioner	Organ Preservation Practitioner to set up and prime HOPE and NMP circuit, initiate perfusion and monitor perfusion indices and liver physiology.
Hub Operations	Hub Operations provides a link in the transplant process between the Organ Donation Services Teams, the National Organ Retrieval Service, and transplant centres. Hub Operations supports the organ donation and transplantation community by matching and allocating organs from deceased donors.
Specialist Nurse (SN)	Nurse who supports potential donor families and the operational processes of deceased organ donation.
NMP escort	Competent individual from the liver ARC who will escort the liver on NMP from the ARC to the Accepting Transplant Centre

5. Eligibility and Exclusion Criteria for Liver to ARC

5.1 Donor referral, consent/authorisation and assessment
5.2 Liver ARC eligibility criteria
5.3 Liver ARC exclusion criteria
5.4 Considerations

5.1 Donor Referral, Consent/Authorisation and Assessment

SN will follow established processes for deceased donor referral, approach, consent/authorisation and characterisation. There is no change to these processes for the ARC pilots.

5.2 Liver ARC Eligibility criteria

- DBD and DCD livers at point of fast track
  - Centre can accept via an ARC.

  or
  - ARC can accept liver to perfuse at ARC with aim of reoffer once all transplant centres have declined the liver offer.

- Agreement or decision from ARC Consultant that liver would benefit from ex-vivo machine perfusion prior to transplant.

5.3 Liver ARC Exclusion criteria

- Request for ARC during routine offering
- Livers deemed unsuitable by the ARC team.
- Super rapid recovery DCD (no NRP) if travel time from donor hospital to ARC > 5hours (DBD & NRP DCD no limit)
- Super rapid recovery DCD (no NRP) if anticipated cold ischaemia time > 8 hours.
- All centres declined on blood group

5.4 Considerations

Organ acceptance is based clinical judgement and can vary between Clinicians and Transplant Centres.

ARC will be rostered on for ARC activity. ARC must inform Hub Operations if they are unexpectedly unavailable in their rostered-on period.

An ARC team must include a Lead Surgeon, Transplant Coordinator, Organ Preservation Practitioner, and competent Escort to accompany the liver on OrganOx *Metra* to Accepting Transplant Centre.

6. Liver Offering and Allocation

6.1 Liver ARC availbility
6.2 Offering
6.3 Transplant Centre referral to ARC
6.4 Liver accepted by ARC with no recipient (as 8th centre)

6.1 Liver ARC availability

A Liver ARC rota will be available to Hub Operations, identifying which ARC centre is on call and the dates and times during which they are on call.

The Liver ARC must communicate to Hub Operations by telephone to confirm the ARC is operational at the beginning of the rostered-on call period, and again to confirm closure at the end of the rostered-on call period. For an ARC to be available on call they must have full complement of staff available to coordinate, undertake perfusion, and escort the liver.

The Liver ARC must inform Hub Operations if the ARC becomes unexpectedly unavailable during their rostered-on call period.

6.2 Offering

Hub Operations will offer livers according to POL196 – *Deceased Donor Liver Distribution and Allocation.*

Transplant Centres should discuss ARC availability and location at time of offering with Hub Operations.

If a liver is declined by all centres for direct transplant, Hub Operations will proceed to fast track offering, in line with POL196. This can be pre retrieval, during retrieval or post retrieval.

Liver transplant centres will be able to respond to a fast-track offer in the following ways:

- Accept - direct transplant
- Accept – subject to ARC assessment
- Decline
- No response

The Liver ARC can accept with aim of reoffer after period of perfusion.

Liver will be allocated as per POL196. If there is interest from multiple centres, the liver will be allocated in the following order of priority.

1. Centres accepting for direct transplant.
2. Centres accepting via an ARC.
3. ARC accepting with view to reoffering post perfusion (as 8th centre)

6.3 Transplant Centre referral to ARC

If an Accepting Transplant Centre has accepted via ARC assessment, Hub Operations will inform the Transplant Centre once the liver has been allocated to them.

Accepting Transplant Centre must now refer to the ARC that is closest to the donor hospital. If there is more than one ARC available, Hub Operations can advise which is the closest. 15 min allowed for this referral and decision.

Liver ARC	Liver ARC contact information	Ask for
Addenbrooke's	01223 808550	Liver Transplant Coordinator
Royal Free	020 7794 0500 ext 31207	Liver Transplant Coordinator
Kings	07875 576509	Liver Transplant Coordinator

The ARC clinician can decline the referral if based on their clinical judgement they feel the liver would not benefit from ARC assessment. If this is the case the accepting transplant centre will need to make decision to continue to accept offer without ARC or decline. Accepting Transplant Centre must inform Hub Operations of any changes in decision making.

If the ARC and Accepting Transplant Centre agree for the liver to be assessed at the ARC, then the Accepting Centre Transplant Coordinator must inform Hub Operations.

From this point onwards, the Accepting Centre Transplant Coordinator must lead communications to between Hub Operations, donor hospital, and ARC throughout the rest of the donation process including negotiating theatre time and arranging transport.

It is the responsibility of the Accepting Transplant Centre to ensure their identified recipient has correct consents in place to receive a liver that has undergone machine perfusion.

6.4 Liver accepted by ARC with no recipient (as 8th centre)

If there is more than one liver ARC accepting, then Hub Operations will allocate to the nearest ARC to the donor hospital. Hub Operations will inform the ARC if the liver has been allocated to them.

From this point, the Transplant Coordinator at the ARC must lead communications between Hub Operations and the donor hospital throughout the rest of the donation process, including negotiating theatre time and arranging transport, even though they are not the accepting transplant centre.

7. Retrieval

7.1 National Organ Retrieval Service (NORS) mobilisation
7.2 ARC Mobilisation
7.3 Theatre Communication – Accepting transplant centre via ARC
7.4 Theatre Communication – Accepted to ARC without recipient (as 8th centre)
7.5 Findings during retrieval
7.6 Liver packing

Note

As the liver will be accepted to or via ARC on fast track it is possible this could occur pre retrieval or during retrieval.

7.1 National Organ Retrieval Service (NORS) mobilisation

Hub Operations will inform SN who the accepting centres are prior to SN requesting mobilisation of NORS. SN will agree theatre time with either the Accepting Centre Transplant Coordinator (if accepted and going via an ARC) or ARC Transplant Coordinator (if going directly to ARC) and Hub Operations will mobilise NORS retrieval team as per SOP4574 – *Logistics & NORS Mobilisation*. No additional kit is required for the NORS retrieval team when the ARC is involved.

7.2 ARC Team Mobilsation

Once the ARC Clinican has accepted the liver for ARC assessment, it is down to local processes to ensure the ARC team is mustered and available to receive the liver upon arrival.

7.3 Theatre Communication – Accepting transplant centre via ARC

If the liver has been accepted via an ARC, it is the responsibility of the Accepting Centre Transplant Coordinator to:

- arrange transport of liver from donor hospital to the ARC
- maintain communication with the colleauges in the donor hospital
- maintain communcation with colleagues in the ARC. There should be no requirement for the ARC to communicate directly with the donor hospital

If there are findings at retrieval that require clinician to clinician conversation, then the SN present in theatre can facilitate discussions between the NORS surgeon, the Accepting Transplant Centre surgeon and the ARC Lead Surgeon as a minimum. If possible include Transplant Coordinator.

If there is an unexpected change to the usual pathway e.g. the liver appears better than expected so will no longer go to the ARC, or liver stood down in theatre, it is the responsibility of the Accepting Centre Transplant Coordinator or ARC Transplant Coordinator to update Hub Operations.

7.4 Theatre Communication – Liver accepted by ARC with no recipient (as 8th centre)

If a liver is accepted by the ARC, it is the responsibility of the ARC Transplant Coordinator to:

- arrange transport of liver from donor hospital to the ARC
- maintain communication with colleuages in the donor hospital regarding logistics

If there are findings at retrieval that require a clinician to clinician conversation, then the SN present in theatre can facilitate conversations between the NORS Surgeon and the ARC Lead Surgeon as a minimum.

If there is an unexpected change to the usual pathway e.g. the liver appears better than expected so will no longer go to the ARC, or liver stood down in theatre, it is the responsibilty of the ARC Transplant Coordinator to update Hub Opertaions.

7.5 Findings during retrieval

If on inspection the liver appears better than anticipated, the lead abdominal NORS surgeon and Accepting Transplant Centre and/or ARC lead clinician must have a conversation.

- If accepted by a Transplant Centre via an ARC, the liver can be sent directly to the transplant centre from the donor hospital for direct transplant
- If accepted to the ARC with no recipient (as 8th centre), then this must trigger a fast track via Hub Operations from theatre.

7.6 Liver packing

Liver and associated cross match material, vessels and paperwork are to be packed on ice as instructed in SOP5499 *Theatre Manual for Deceased Organ Donors for Theatre*, and MPD1043 *National Standards for Organ Retrieval from Deceased Donors.*

8. Arrival of Liver at Liver ARC

Once the donor liver arrives at the Liver ARC, the liver and associated samples become the responsibility of the Liver ARC.

Refer to SOP6887 *Liver Assessment and Recovery Centre (ARC)- Pilot Manual-Liver ARC to Transplant Centre* from this point onwards.

Training Plan for Documents:

Type of Change	< Brand New Process >	
Stakeholders who require training	**Trainee new to the process**	**Trainee trained to the previous revision.**
	External to NHSBT document - Liver ARC pilot centres and liver transplant centres. No training to NHSBT employees	n/a>
Knowledge required prior to training	Nil	n/a
Critical aspects of process	< New process to support Pilot liver ARC pathway for processes from the donor hospital to the ARC >	

Training Plan:

	Trainee new to the process	**Trainee trained to the previous revision.**
Recommended Training Method	<Training methods for each role/department identified e.g.: • Read only	<n/a
Assessment	<How assessment of competency is evidenced e.g.: • Email confirmation from liver centre director to NHSBT ARC programme team	<How assessment of competency is evidenced e.g.: • n/a
Cascade Plan	<Who will deliver the *Training Plan*, who will train the trainers e.g.: • <SOP and slide set to be provided to Liver ARC champion network by ARCs team >	< Who will deliver the *Training Plan*, who will train the trainers e.g.: • n/a>

Training Score – Training Plan Risk Matrix (Collapsible – Click ▶ icon to open/close)

Use the *Training Plan Risk Matrix* to identify the training method and assessment required.

The *Process Criticality Score* is determined by the potential impact on donor/patient safety and/or product quality using the table below for guidance:

	Impact on Donor, Patient safety or product quality
1. Negligible	A process whose failure, in full or in part, **cannot** impact product quality, patient/donor safety or the ability to supply products/services.
2. Minor	A process whose failure, in full or in part, **may**: (i) impact other processes thereby indirectly impacting product quality, patient/donor safety (e.g. harm only results where multiple failures in multiple processes align) (ii) result in the discard of a small number of replaceable products and/or

	(iii) result in an inconvenient delay to the supply of products/services (e.g. delay of 1-3hrs of non-urgent product/service).
3. Moderate	A process whose failure, in full or in part, **may**: (i) indirectly impact product quality, patient/donor safety (e.g. harm only results where failures in more than 1 process align) (ii) result in the discard of a medium number of replaceable products and/or (iii) result in a temporary delay to the supply of products/services (e.g. delay of 4-12hours of non-urgent products/services).
4. High	A process whose failure, in full or in part, is **likely** to: (i) directly impact product quality, patient/donor safety (ii) result in the discard of a large number of replaceable products (iii) result in the discard of an irreplaceable product and/or (iv) result in a delay to patient treatment.
5. Very High	A process whose failure, in full or in part, is **certain** to: (i) directly impact product quality, patient/donor safety (ii) result in the discard of a large number of replaceable products (iii) result in the discard of an irreplaceable product and/or (iv) result in a delay to patient treatment.
Process Criticality Score	<3>

The *Criticality of Change Score* is determined by assessing the nature of change(s) and complexity of the process using the table below for guidance.

	Change to Trainee(s)
1. Negligible	An existing process to which no material changes are made. E.g. format changes, minor clarifications of existing practice, fixing typos.
2. Minor	An existing process to which new information is added but where changes to existing knowledge and practices are minimal. E.g. clarifications that tighten existing practices
3. Moderate	An existing process of low complexity with material changes requiring different people to take action and/or people to change the tasks they perform. E.g. new roles/responsibilities, changes to the order of existing tasks, new tasks
4. High	A new process of moderate complexity, OR An existing process of moderate complexity with material changes requiring different people to take action and/or changes to the way tasks are performed. E.g. New roles and responsibilities, changes to tasks and/or the order in which tasks are performed, changes in equipment/materials, changes to values, measures or settings.
5. Very High	A new process of high complexity, OR An existing process of high complexity with material changes requiring different people to take action and/or changes to the way tasks are performed.

	E.g. New roles and responsibilities, changes to tasks and/or the order in which tasks are performed, changes in equipment/materials, changes to values, measures or settings.
Criticality of Change Score	<4>

Training Plan Risk Matrix:

Process Criticality →

Criticality of Change ↓

	1. Negligible	2. Minor	3. Moderate	4. High	5. Very High
1. Low	1	2	3	4	5
2. Moderately Low	2	4	6	8	10
3. Moderate	3	6	9	12	15
4. High	4	8	12	16	20
5. Very High	5	10	15	20	25

	Trainee new to the process	Trainee trained to the previous revision.
Process Criticality Score	<3>	
Criticality of Change Score	<4>	n/a
Training Score	<12>	n/a

Recommended Training Method and Assessment:

Training Score	Level of Risk	Examples of Training Methods	Examples of Assessment
1 - 3	Low	Read only	Record on FRM511 only
4 - 8	Manageable	Email, team brief, word brief	Knowledge/Observation Check & FRM511
9 - 14	Medium/Significant	Formal training package	Knowledge/Observation Check & FRM511 or FRM5076
15 - 25	High	Practical	FRM5076 or equivalent