Changes in this version

Table 1 updated following TOBI-7 release on 4 October 2022

Updated of wording in 2.9.1.9 to reflect that right lobes from donors not meeting split liver criteria should be fast-tracked regardless of whether a fast-track trigger has been met

Policy

This policy has been created by the Liver Advisory Group on behalf of NHSBT.

This policy previously received approval from the Transplant Policy Review Committee (TPRC). This committee was disbanded in 2020 and the current governance for approval of policies is now from Organ and Tissue Donation and Transplantation Clinical Audit Risk and Effectiveness Group (OTDT CARE), which will be responsible for annual review of the guidance herein.

Last updated: August 2022

Approved by OTDT CARE: August 2022

Purpose

The aim of this document is to provide a policy for the allocation and acceptance of organs to adult and paediatric recipients on the UK national transplant list. These criteria apply to all proposed recipients of organs from deceased donors.

In the interests of equity and justice all centres should work to the same allocation criteria.

Non-compliance to these guidelines will be handled directly by NHSBT, in accordance with the Non-Compliance with Selection and Allocation Policies **POL198**.
http://www.odt.nhs.uk/transplantation/tools-policies-and-guidance/policies-and-guidance/

It is acknowledged that these guidelines will require regular review and refreshment. Where they do not cover specific individual cases, mechanisms are in place for the allocation of organs in exceptional cases.

Applicable Documents

- **POL188** – Clinical contraindications to approaching families for possible organ donation
- **POL191** – Guidelines for consent for solid organ transplantation in adults
- **POL193** - Intestinal Transplant Organ Allocation
- **POL195** – Liver Transplantation: Selection Criteria and Recipient Registration
- **POL198** – Non Compliance with Selection and Allocation Policies
- **SOP5413** – Liver and Intestinal Manual – Hub Operations

1. Policy development and overview

1.1. The guidelines set out below are those agreed within the Liver Advisory Group and administered on the transplant community's behalf through OTDT, NHSBT. The principles behind the policies have also been discussed at annual meetings with patient groups. The policies are reviewed by a Core Group, which reports to the Liver Advisory Group (LAG).

1.2. The guidance describes the mechanism by which all livers from deceased donors within the UK are offered to individual patients on the liver transplant list.

1.3. ***How this policy was developed?***

1.3.1. A fixed-term-working-unit (FTWU) was set up in November 2013 to consider core organ offering. The FTWU was asked to investigate a number of different ways to offer organs for liver transplantation to adult elective patients and recommend the system with the lowest number of deaths on the transplant waiting list and with the maximum survival from the point when a patient is registered for their transplant. In November 2014, the FTWU recommended that the LAG should consider transplant benefit-based offering as the optimum; the difference between a patient's expected survival if receiving a particular donated liver and the patient's expected survival without a transplant. Transplant benefit thus integrates elements of a patient's *need* for a transplant and a patient's *utility* from receiving a particular donated liver.

1.3.2. After the disbandment of the FTWU, the Core Group continued developing all other aspects of liver offering additional to the offering to adult elective recipients.

1.4. ***Donors after brain-stem death (DBDs)***

1.4.1. All livers from deceased adult donors whose death has been defined by brain-stem death criteria are offered to a National Transplant List, with decreasing level of priority for super-urgent, hepatoblastoma, combined liver intestinal, combined liver heart, combined liver lung and elective adult and large paediatric cases. Livers from paediatric DBD donors are offered to a National Transplant List prioritised for super-urgent, then hepatoblastoma and combined liver intestinal cases. If the paediatric donor is not placed for high-priority patients, it is offered to elective paediatric and small adult cases from the transplant centre in whose zone the donor occurs. The zonal transplant centre is able to decide to whom on their elective transplant list the liver should be offered. Should the organ not be suitable for any local zonal recipients, the organ is offered in sequence nationally (see section 2.10 Donor zones).

1.4.2. A DBD liver donor may fulfil splitting criteria and, if this is the case, the left lobe will be offered first to transplant centres with paediatric and small adult patients and then either the right lobe or the whole liver offered through the National Liver Offering Scheme when

the offering outcome of the left lobe is known (see section 2.9 Liver splitting).

1.5. ***Donors after circulatory death (DCDs)***

1.5.1. Donors after circulatory death are increasingly used for transplantation. DCD livers carry a higher risk of graft dysfunction and failure. All donors carry some risk but that described with DCDs increases the risk of graft failure approximately two-fold. Despite that, they represent an important resource in view of the increasing disparity between those registered for a transplant and donors that can be used for transplantation.

1.5.2. All potential patients at registration should be informed of the risks associated with DCDs and other donor types and where appropriate specific consent obtained for their use. Guidelines for consent for solid organ transplantation in adults are laid down in **POL191**.

1.5.3. Livers from DCD donors will be allocated to the centre in whose donor zone a DCD appears (see section 2.10 Donor zones). If they do not wish to use the donor, it is first offered to their linked centre (Northern –Edinburgh/ Newcastle/Leeds; Central– Birmingham, Cambridge; Southern – Kings College, Royal Free) and then offered via fast-track. When offered to a super-urgent patient the patient will not be removed from the super-urgent transplant list until it is known that that the DCD donor liver has been retrieved and found to be suitable for transplantation. Centres can accept the offer for any of their patients on their waiting list.

1.5.4. Livers from paediatric DCD donors will be offered in a similar way to livers from adult DCD donors.

1.5.5. Group 1 patients will take priority over Group 2 patients.

1.5.6. If not required regionally the liver will be offered through the fast track scheme to those centres that have registered their willingness to consider offers of livers from DCDs; the acceptance of such offers for Group 1 patients will take precedence over acceptance for Group 2 patients.

1.5.7. No blood group restrictions apply to the use of livers from DCD donors.

2. General considerations

2.1. ***Donor and recipient definitions***

2.1.1. An adult donor for liver is defined as being a patient aged 16 years or over and with a body weight of over 40kg at the time of death.

2.1.2. A paediatric donor is defined as being either a patient aged less than 16 years, or 16 years or over and with a body weight of 40kg or less at the time of death.

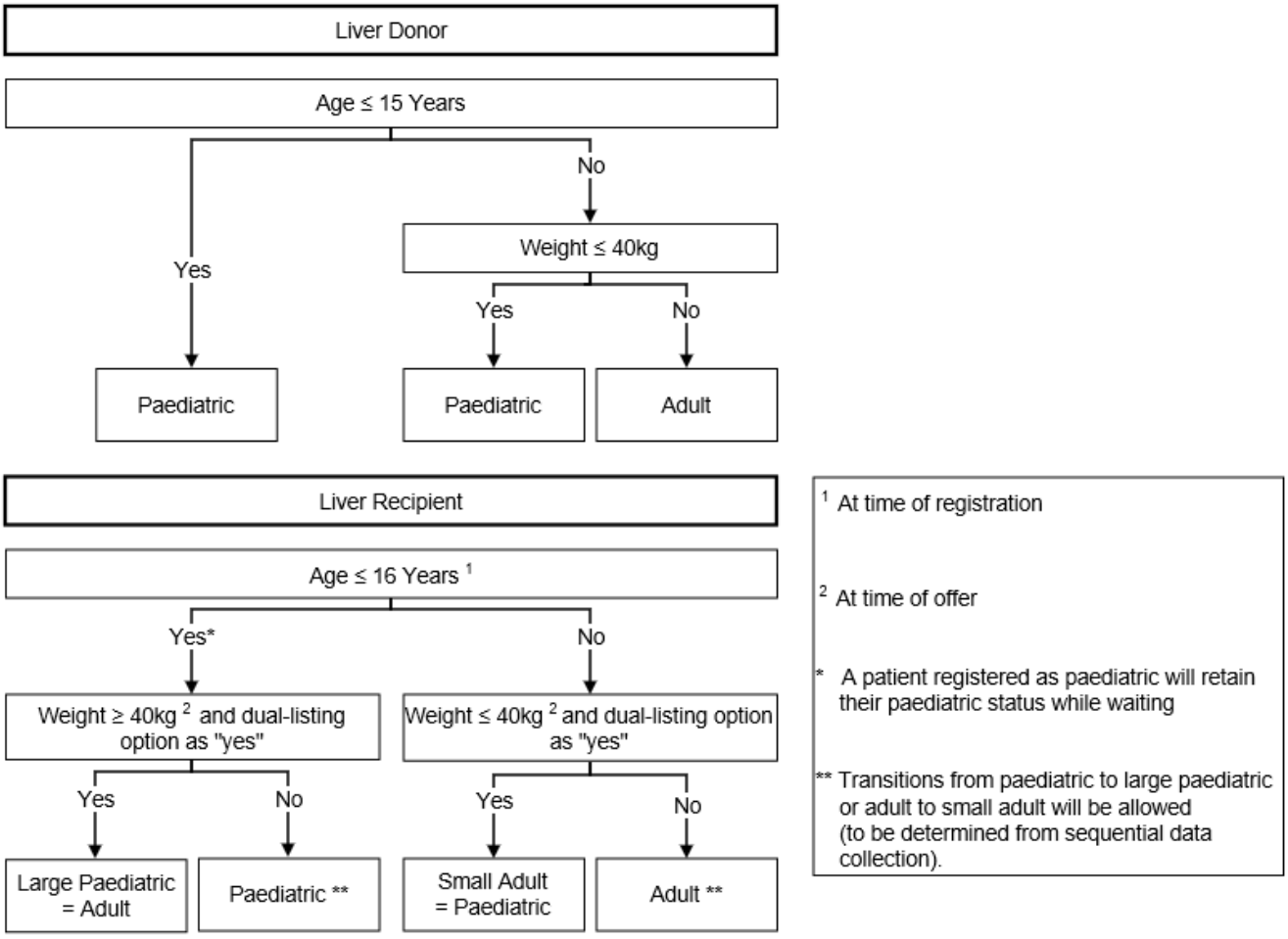
2.1.3. A paediatric liver recipient is defined as a patient aged 16 years or under at the time of registration and not a large paediatric.

2.1.4. A large paediatric liver recipient is defined as a patient aged 16 years or under at the time of registration with a body weight of 40kg or more and dual-listing option specified at the time of offer (specified either at registration or subsequently via sequential data collection).

Large paediatric recipients are considered as both adult and paediatric recipients for offering purposes and therefore have access to both adult and paediatric donor organs.

2.1.5. An adult liver recipient is defined as a patient aged 17 years or over at the time of registration and not a small adult.

2.1.6. A small adult liver recipient is defined as a patient aged 17 years of over at the time of registration with a body weight of 40kg or less and dual-listing option specified at the time of offer (specified either at registration or subsequently via sequential data collection). Small adult recipients have access to both paediatric and adult donor organs.



2.2. *Paediatric cases*

2.2.1. Paediatric donor organs will be offered first to paediatric patients, then to adult patients before being offered to European organ exchange organisations.

2.2.2. Organs from older paediatric donors aged over 12 years may be used for adult patients of small intestine/liver composite grafts and small adult patients of multiorgan heart/lung/liver grafts.

2.3. ***Donor information***

2.3.1. All potential liver donors in the UK or Republic of Ireland must be reported by telephone to Hub Operations once all donor information has been gathered and organs are ready to be matched, offered, and allocated by Hub Operations.

2.3.2. The Core Donor Data Form and the Medical & Social History Questionnaire contain information about a donor that a centre must review when deciding to accept an organ. These forms combined with the HTA A liver form detailing organ retrieval are reviewed by the transplanting surgeon before making a final decision to transplant the organ. Liver Donor Information Form contain the information required for all liver donors and must be used when reporting a case to NHSBT.

2.4. ***Contraindications to donation***

2.4.1. With the increasing disparity between supply of donors and patients registered for a transplant, as well as evolving experience with donors previously considered to be contraindicated, the absolute criteria contraindicating donation changes with time. All donors carry some risks which should be perceived as a continuous spectrum of risk.

2.4.2. To maximise the potential for organ donation, every potential organ donor should become an actual donor where appropriate. However, to prevent families being approached needlessly, it is important to define those characteristics of potential donors that preclude donation in any circumstance.

2.4.3. It should be recognised that it is the responsibility of the recipient surgeon to decide whether to accept an organ and this decision will depend on both donor and recipient factors. Organs from all donors will carry some degree of risk and the risks associated with transplantation must be balanced against the benefits of transplantation and the risks of awaiting a further offer.

2.4.4. The criteria listed below were drawn up by a group of transplant surgeons, physicians, intensive care clinicians and specialist nurses in organ donation and are based on past experience. Each Advisory Group has developed contra-indications for donation for each organ.

2.4.5. As with all guidelines, these should be used with clinical judgement and, if a clinician feels that a person excluded by this list, should be offered the opportunity to donate, then the family should be approached for consent/authorisation.

2.4.6. Donor contraindications to organ donation are reviewed regularly and revised as needed. These criteria define those potential deceased donors where no organ would be accepted for transplantation and so the families would not be approached.

2.4.7. Liver donor contraindications to organ donation can be viewed within the Clinical

contraindications to approaching families for possible organ donation Policy (**POL188** – Clinical contraindications to approaching families for possible organ donation).

2.4.8. Hub Operations will aim to always offer organs where full virological testing (including Hepatitis B surface antigen, Hepatitis C antibody or HIV antibody) has been completed. However, on rare occasions, a liver may be offered before virology results have been received. In this case, a centre can accept an organ pending results with the rule that virology results must be received and reported before retrieval surgery begins.

2.4.9. Livers from donors found to be positive for Hepatitis B surface antigen, Hepatitis B core AB, or for Hepatitis C antibody may be offered by Hub Operations to transplant centres for transplantation (see section 8 Blood-borne Positive Donor Virology Scheme). The final decision to accept the organ lies with the transplant surgeon and the potential recipient.

2.4.10. Where a donor is found to fall into any of the risk categories defined as contraindications to donation for organ transplantation, Hub Operations will actively seek, record and pass on all donor information for the transplant centre to make the decision on the suitability of the donor organ.

2.5. ***Offering time***

2.5.1. Full and provisional offers

Offering times: 45 minutes for all offers

Hub Operations will offer organs in the agreed protocols set out in SOP5413 – Liver and Intestinal Manual – Hub Operations

2.5.2. Named patient offers

2.5.3. Offers for named patients can be accepted only for the patient named in the offer. If a centre declines for a named individual, the centre should state whether they wish to decline for all individuals on their waiting list, in which case, the centre will not receive any further offers of that donor liver.

2.5.4. Combined DBD liver kidney offers

2.5.5. If the generated liver offering sequence for a DBD adult donor shows an elective recipient who requires combined liver kidney transplantation amongst the top three recipients, Hub Operations is required to delay offering one kidney for up to 60 minutes after elective offering commenced or until the combined liver kidney patient declines, whatever occurs first.

2.5.6. Combined DCD liver kidney offers

2.5.7. ODT Hub Operations will delay offering one kidney through the National Kidney Offering Scheme until the zonal and linked liver transplant centre(s) are offered and decline the combined liver/kidney offer. Transplant centres can accept the liver and decline the kidney when offered but not the converse.

2.5.8. For both DBD and DCD donors, the offer of the kidney is provisional and subject to there

not being patients in Tier A on the National Kidney Waiting List to whom both kidneys should be allocated by the National Kidney Offering Scheme. Once the combined liver/kidney is declined, kidneys will only be allocated by the kidney allocation scheme and the pancreas allocation scheme (see Appendix A for more details).

2.5.9. For both DBD and DCD donor, if a centre requests a kidney for a combined liver kidney recipient outside the agreement above, and the kidney has already been placed elsewhere, the relevant transplant centres must discuss between themselves to decide which recipient should take priority.

2.5.10. Only once all centres have declined for Group 1 patients, will Group 2 patients or hepatocyte requirements be considered. It is the responsibility of centres with Group 2 patients registered or with a hepatocyte programme to inform Hub Operations when declining an offer for a Group 1 patient that they wish to accept for a Group 2 patient or for their hepatocyte programme.

2.6. ***Use of blood group O livers***

2.6.1. Blood group O donor livers should be offered in the following priority order:

1) blood group O* patients
2) blood group B* or AB patients
3) blood group A patients

* Left lateral segments from O blood group donors must be offered for O and B blood group paediatric patients nationally before consideration is given to other blood group paediatric patients

2.6.2. Non-compliance will be followed up by NHSBT.

2.6.3. Super-urgent patients take priority in all blood groups.

2.6.4. These rules will be waived for fast track liver offers.

2.6.5. These rules will be waived for children under 2 years of age who require a liver transplant.

2.7. ***Maximum number of livers accepted at any time***

2.7.1. The maximum number of accepted liver offers per adult programme will be 3 at normal times and 2 during periods of crisis (e.g. during COVID). The maximum number includes both DBD and DCD offers, and an accepted offer is considered closed when the transplant is completed, or the liver is declined for another reason.

2.7.2. The three adult and paediatric liver transplant centres can consider paediatric offers in addition to their adult allocation but must be able to facilitate the totality of the accepted offers.

2.7.3. Centres which have reached the maximum number of accepted offers, will continue to receive further offers, but if they are to accept an offer beyond the maximum numbers, they will have to decline a previously accepted offer to ensure the numbers in 2.7.1 are met. In

such circumstance's centres could only opt to decline any offer until the arrival of the NORS team at the donor hospital.

2.7.4. Any centre who has requested a back-up be arranged due to local logistical issues should NOT accept any further offers until that initial case is resolved.

2.7.5. Transplant centres maintain the responsibility for adherence.

2.8. ***Domino livers***

2.8.1. The transplantation of domino livers is a developmental procedure and is therefore outside of the formal liver allocation process. Centres may use domino livers for patients outside the current selection criteria for liver transplantation (see section 3 Selection criteria in **POL195** – Liver Transplantation: Selection Criteria and Recipient Registration). Priority should be given to Group 1 patients over Group 2 patients. A non-directed domino donor liver who is registered with Hub Operations for offering will be offered according to the DCD donor offering sequence.

2.9. ***Liver splitting***

2.9.1. ***Donors after brain death*** who are less than 40 years of age, weigh more than 50kg and have stayed in ITU for less than 5 days meet the criteria for liver splitting. All such donors must be offered for splitting unless there are super-urgent, multivisceral, combined heart/liver or combined lung/liver patients waiting (see Figure 1).

It should be noted that the centre that accepts the left lobe of a split liver allograft for a paediatric or small adult patient is deemed the index centre and will have the right to decide which liver segments they would like to accept. Any changes made by the paediatric/small adult centre with regard to the extent of the split should be discussed with the centre accepting the contralateral lobe, with the centre accepting the left lobe having the final decision if consensus between centres cannot be reached as the left lobe recipient is the index case in such situations

2.9.1.1. Hub Operations will offer the left lateral segment to UK centres with a paediatric or small adult patient registered in accordance with the liver allocation sequence (see section 6 The liver allocation sequence). If there is a suitable paediatric patient for the left lateral segment splitting must proceed and must not be stopped because an adult patient requires a whole liver.

2.9.1.2. If the accepting left lobe centre decide their recipient needs more than a left lateral, then they have the right to dictate this and the centre accepting the right lobe need to be informed. This may mean that the right lobe will not be useable for the nominated right lobe recipient. The left lobe recipient has primacy and therefore this is acceptable.

2.9.1.3. Each centre will maintain a list of surgeons deemed capable of splitting a liver. The outcomes of imported and exported liver will be monitored frequently.

2.9.1.4. The paediatric centre receiving the left lateral segment may choose where the liver is split; either by transporting the liver to the paediatric centre to be split there, or by sending a splitting team to the retrieval centre. Prior to splitting a liver in a non-paediatric centre, a designated splitting surgeon must liaise with the relevant surgeons from the paediatric centre who will receive the left liver for the paediatric case and the implanting paediatric transplant centre has the right to over-rule.

2.9.1.5. Left lateral segments from O blood group donors must be offered for O and B blood group paediatric patients nationally before consideration is given to other blood group paediatric patients.

2.9.1.6. If a left lateral segment that has been accepted for a paediatric recipient is later declined after retrieval has commenced or the organ is deemed not suitable for splitting, then the whole liver allograft will be offered to the adult recipient who had previously accepted the extended right lobe or full right lobe. If the whole graft is declined by the adult recipient who had previously accepted the extended right lobe or full right lobe, then the whole liver allograft will continue to be offered to the next individual in the offering sequence, or via fast-track if a fast-track trigger point is reached. The reasons for not ultimately splitting donors eligible to be split will be recorded by Hub Operations and reported to the LAG on a regular basis.

2.9.1.7. Any **lobes** (right lobe/left lobe) will be offered in accordance with the liver offering sequence, this is, on a centre basis for paediatric and small adult recipients (except hepatoblastoma cases, who are offered individually) and on a named individual basis for elective adult and large paediatric recipients.

2.9.1.8. If the centre accepting the left lobe changes which left liver segments are required leading to the right lobe being unsuitable for the original patient for whom the right side had been accepted, the right lobe should be offered to the next individual in the offering sequence, or via the fast-track sequence if a fast track trigger point is reached.

2.9.1.9. If a liver is initially offered as a whole graft and the accepting centre anticipate the liver will be split regardless of whether the donor meets split criteria, then the initially accepting centre should inform ODT Hub

Operations when accepting the liver which segments not required (e.g. right lobe) needs to be offered nationally through either the national liver transplant offering scheme (if donor meets split liver criteria) or through the Fast Track scheme if either a fast track trigger points has been reached or the donor does not meet split liver criteria. This applies to all offering tiers.

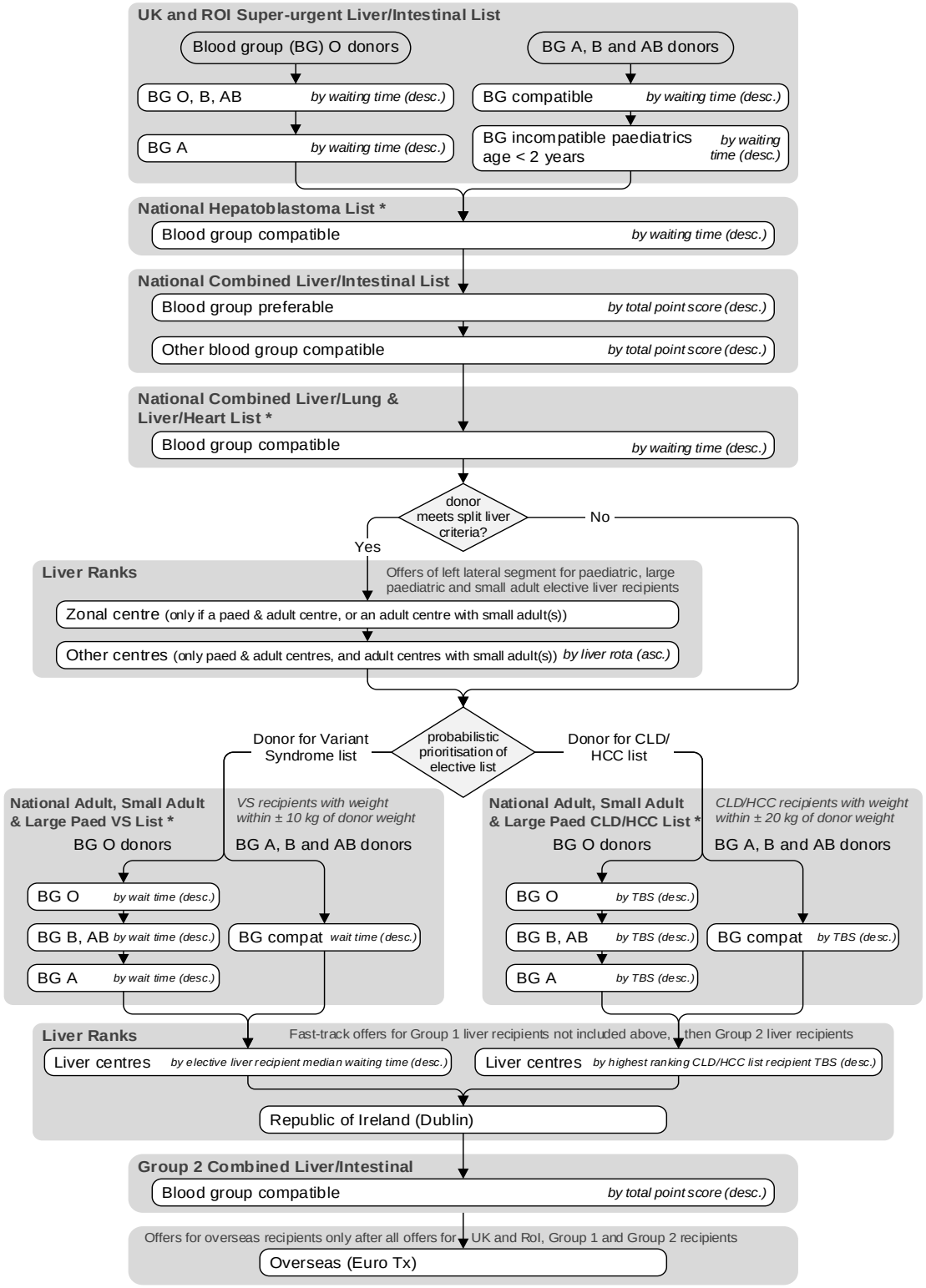
2.10. *Donor zones*

2.10.1. In the past, most of the offering of DBD donors was done according to each UK centre's donor zone. In the new National Liver Offering Scheme, the use of donor zones is limited to the offering of DBD paediatric donors to paediatric and small adult centres and left lobes to paediatric and small adult centres. The size of the donor zone and which hospitals are included in it, is dictated by that centre's percentage share of all new registrations onto the National Elective Liver Transplant List. The offering of DCD donors (both adult and paediatric) is also done using donor zones.

2.10.2. For the purposes of the calculation, a registration is any adult patient aged 17 years or older at the time of registration who is registered for a Group 1 elective liver transplant during a previous specified one-year period.

2.10.3. Also, for the purposes of the calculation, the number of donors in a hospital is averaged over a previous specified three-year period. Only livers from DBDs which result in a transplant are considered and DBDs used for super-urgent transplantation are excluded. If a donor liver is split and transplanted into two elective patients, this is counted as one donor liver. If a donor liver is split and part transplanted into a super-urgent patient and part into an elective patient, then this too is counted as one donor liver. Paediatric donors who donated whole livers to adult patients are included so too are adult donors whose livers are transplanted into paediatric patients only.

Figure 1: Offering sequence for a DBD adult liver and intestinal donor



* requirement to split if donor meets split liver criteria

3. Super-urgent liver scheme

3.1. *Super-urgent diagnosis*

Criteria for selection to the super-urgent transplant list are described elsewhere (see **POL195** – Liver Transplantation: Selection Criteria and Recipient Registration, section *3.4 Selection criteria for adult and paediatric super-urgent transplantation).*

3.2. *Super-urgent liver scheme ranking*

3.2.1. The sequence of offers for patients registered as super-urgent will be strictly in relation to blood group and the time of registration; the blood group compatible patient having been registered the longest at any one time taking priority, and thereafter in reverse-chronological order by time of registration. The rules for the use of blood group O donor livers will apply. NHSBT will maintain a list of super-urgent registrants.

3.2.2. Offers for paediatric patients under 2 years of age may be accepted for incompatible blood groups.

3.3. *Exceptions*

3.3.1. When a super-urgent patient is registered at NHSBT after a liver has been offered to and accepted by a centre for a non-super-urgent patient but is not yet implanted, the registering centre of the super-urgent patient has the responsibility of approaching any centres who have accepted a liver with a view to requesting they relinquish their offer. Hub Operations can provide information on which centres have accepted which livers from which donors to aid this process. Where a recipient has been notified of an offer then this should not be withdrawn unless the two surgeons have agreed.

3.3.2. In such cases it will not be possible for NHSBT to organise peer review prior to advising the transplanting centre of the newly registered super-urgent patient. If the patient does not receive the previously accepted liver, peer review will be carried out in the normal way.

3.3.3. When a liver has been accepted for a super-urgent patient and the transplant does not proceed, the liver will be offered through the fast track offer scheme.

3.3.4. If a centre wishes to accept an organ out of sequence (e.g. if a centre has two or more super-urgent patients appearing in the sequence non-consecutively and wishes to accept for a patient who is not at the top), the surgeon making this request must discuss with surgeons at the centres prioritised above them and inform Hub Operations of the outcome. Hub Operations will neither monitor nor organise any pay back of offers in such circumstances.

4. Adult donor organ offering

4.1. *Offering – Adult donor organs*

4.1.1. All livers donated in the Republic of Ireland will be used in that country for any patient on the transplant list, whether super-urgent or elective. Livers from the Republic of Ireland which cannot be used in that country will be offered to patients in the UK through Hub Operations.

4.2. *Liver and composite liver and small intestine (Figure 1)*

4.2.1. All livers or composite livers and small intestines donated in the UK, and those livers declared surplus in the Republic of Ireland, will be offered by Hub Operations in the following priority order for Group 1 patients at:

4.2.1.1. Super-urgent patients in the UK or Republic of Ireland (see section 3).

4.2.1.2. Patients with Hepatoblastoma

4.2.1.3. Prioritised paediatric patients (currently included in hepatoblastoma tier)

4.2.1.4. Acute on Chronic Liver Failure patients (currently included in hepatoblastoma tier)

4.2.1.5. Patients within designated centres in the UK for combined liver/small intestine transplants (where the donor meets the criteria for bowel retrieval and where the *intestinal* donor definition is used to calculate the Total Point Score; see POL193).

4.2.1.6. Patients who require combined lung/liver or heart/liver grafts in the UK.

4.2.1.7. Designated centres in the UK for paediatric or small adult liver patients, prioritised by the liver allocation sequence (see section 6) if the donor meets split liver criteria (see section 2.9 Liver splitting).

4.2.1.8. Elective adult and large paediatric patients who require a liver only or a combined liver/kidney graft. When reaching this tier, the offering process will offer most donors to patients with chronic liver disease (CLD), hepatocellular carcinoma (HCC) or a variant syndrome in the context of CLD (diuretic resistant ascites [DRA] and/or chronic hepatic encephalopathy [CHE]). A small proportion of donors will be offered to patients with a variant syndrome (VS; see section 4.3).

4.2.1.9. Fast-track offers to UK centres for Group 1 patients.

4.2.1.10. Group 1 patients in the Republic of Ireland.

Offers will then be made to centres in the following priority order for Group 2 patients at:

4.2.1.11. Any centre in the UK or Republic of Ireland for patients requiring an emergency re-transplant.

4.2.1.12. Any other patient in the UK or Republic of Ireland.

4.2.1.13. Patients within designated centres in the UK for combined liver and small intestine

or intestinal only transplant (where the donor meets the criteria for bowel retrieval and where the *intestinal* donor definition is used to calculate the Total Point Score; see POL193).

4.2.1.14. Thereafter, Hub Operations will offer any organs which remain surplus, to organ exchange organisations in Europe and elsewhere. As is practice across Europe, this will be on a first response basis. Group 1 recipients will always be prioritised above Group 2 recipients.

Organs from deceased donors in Gibraltar will be facilitated using the same donor characterisation process as a UK donor and all information can be viewed on EOS. Due to the logistical issues encountered with a flight time of 3 hours, these organs will be offered simultaneously to every centre who has registered to receive fast track offers. At the end of 45 minutes' organs will be allocated using previously agreed policy.

4.3. *Offering – the Transplant Benefit Score and proportional offering by waiting time*

4.3.1. Elective liver patients who require a liver only or a combined liver kidney graft and with CLD, an HCC or DRA/CHE, will be prioritised for offering according to their Transplant Benefit Score (TBS). A patient's TBS integrates both their expected survival without a transplant (need for a transplant) and their expected survival following transplantation with the graft on offer (utility from that transplant). The TBS is calculated, for each eligible patient and given the donor on offer, using 16 recipient and 6 donor characteristics (see Table 1).

Table 1:

Recipient characteristics	
Age	Inpatient status
Disease group	Year of registration
Serum creatinine	Previous abdominal surgery
Serum bilirubin	Presence of ascites
INR	Presence of hepatitis C*
Serum sodium	Maximum AFP level*
Albumin	Maximum tumour size*
Renal support	Number of tumours*
Donor characteristics	
Age	Diabetes
Cause of death	Donor-recipient blood group compatibility
Donor type (DBD or DCD)**	Donor within split criteria
* patients with an HCC only	
** donor type is currently a 'mute' characteristic as only DBD donors are offered via TBS	

4.3.2. A patient's TBS is the difference between the patient's expected utility from the transplant and the patient's predicted need. The patient with the greatest difference between these two quantities will score the highest TBS.

4.3.3. Only patients with a weight within ±20kg of the donor weight are included in a TBS-based offering sequence.

4.3.4. Elective liver patients who are registered with a VS will be prioritised for offering according to their waiting time. Only patients with a weight within ±10kg of the donor weight are included in an offering sequence to variant syndromes.

4.3.5. Waiting time for elective combined liver and kidney patients registered with a VS will be calculated from the earliest of liver registration, kidney registration or dialysis start date as appropriate. Waiting time for elective combined liver and kidney patients registered with either CLD or HCC and not VS will be calculated from the date of liver registration only.

4.3.6. When Hub Operations generates a liver offering sequence for a given donor, the algorithm will automatically decide whether to offer to the CLD/HCC list or the VS list. The decision is based on a probabilistic rule which randomly selects one of these two lists, with a 90% probability of selecting the CLD/HCC list and a 10% probability of selecting the VS list. Therefore, a small proportion of liver donors are reserved for VS patients and this is what is referred to as proportional offering.

4.3.7. The probability values for selecting either CLD/HCC or VS patients are based on the proportion of variant syndrome registrations to the Elective Liver Transplant List over the course of a year and these values will be reviewed on a regular basis.

4.3.8. Any recipients in a prioritisation sequence who are tied with equal waiting time will be further ordered by ascending registration ID, as the final tiebreaker. Patients' TBS will be calculated to five decimal places. In the unlikely situation where any recipients in a prioritisation sequence are tied with equal TBS, they will be further ordered by ascending registration ID, as the final tiebreaker.

4.4. *Allocation within centres*

4.4.1. For offers made to centres, rather than to named individuals, the centre may select the most appropriate recipient within their waiting list. Centre offers include offers of a left lateral segment, offers from DBD paediatric donors to paediatric or small adult recipients, offers from DCD donors or fast track offers.

4.4.2. Most centres allocate the liver graft to the patient with the greatest need, but a number of additional factors will also need to be considered to obtain optimal outcomes. Donor factors that are relevant include age, size, liver function, damage to graft, virology status, history of malignancy, history of diabetes and other relevant donor history, type of donor (DCD or DBD), whole or segmental graft, and BMI; recipient factors include severity of liver disease, aetiology of liver disease, age, size, renal replacement therapy and hospital status (out-/in-

patient, HDU) and projected cold ischaemia time.

4.4.3. Discussions are necessary with all patients concerning the varying risk associated with some donors and appropriate consent must be obtained (see **POL191**).

5. Paediatric donor organ offering (Figure 2)

5.1. *Offering - Paediatric donor organs – Liver and composite liver and small intestine*

5.1.1. All paediatric donor livers or composite livers and small intestines donated in the UK, and those surplus in the Republic of Ireland, will be offered in the following priority order for Group 1 patients at:

5.1.1.1. Any centre in the UK or Republic of Ireland for super-urgent patients.

5.1.1.2. Patients with hepatoblastoma.

5.1.1.3. Prioritised patients (currently included in hepatoblastoma tier)

5.1.1.4. Patients within designated centres in the UK for combined liver and small intestine transplant (where the donor meets the criteria for bowel retrieval and where the *intestinal* donor definition is used to calculate the Total Point Score; see POL193).

5.1.1.5. The designated zonal centre for paediatric or small adult liver patients.

5.1.1.6. Designated centres in the UK for paediatric or small adult liver patients, prioritised by the liver allocation sequence (see section 6).

5.1.1.7. Elective adult and large paediatric named patients who require a liver only or a combined liver/kidney graft; via probabilistic prioritisation of either the CLD/HCC or VS lists.

5.1.1.8. Fast-track offers to UK centres for Group 1 patients.

5.1.1.9. Group 1 patients in the Republic of Ireland.

Offers will then be made to centres in the following priority order for Group 2 patients at:

5.1.1.10. Any centre in the UK or Republic of Ireland for patients requiring an emergency re-transplant.

5.1.1.11. Any other patient in the UK or Republic of Ireland.

5.1.1.12. Patients within designated centres in the UK for combined liver and small intestine or intestinal only transplant (where the donor meets the criteria for bowel retrieval and where the *intestinal* donor definition is used to calculate the Total Point Score; see POL193).

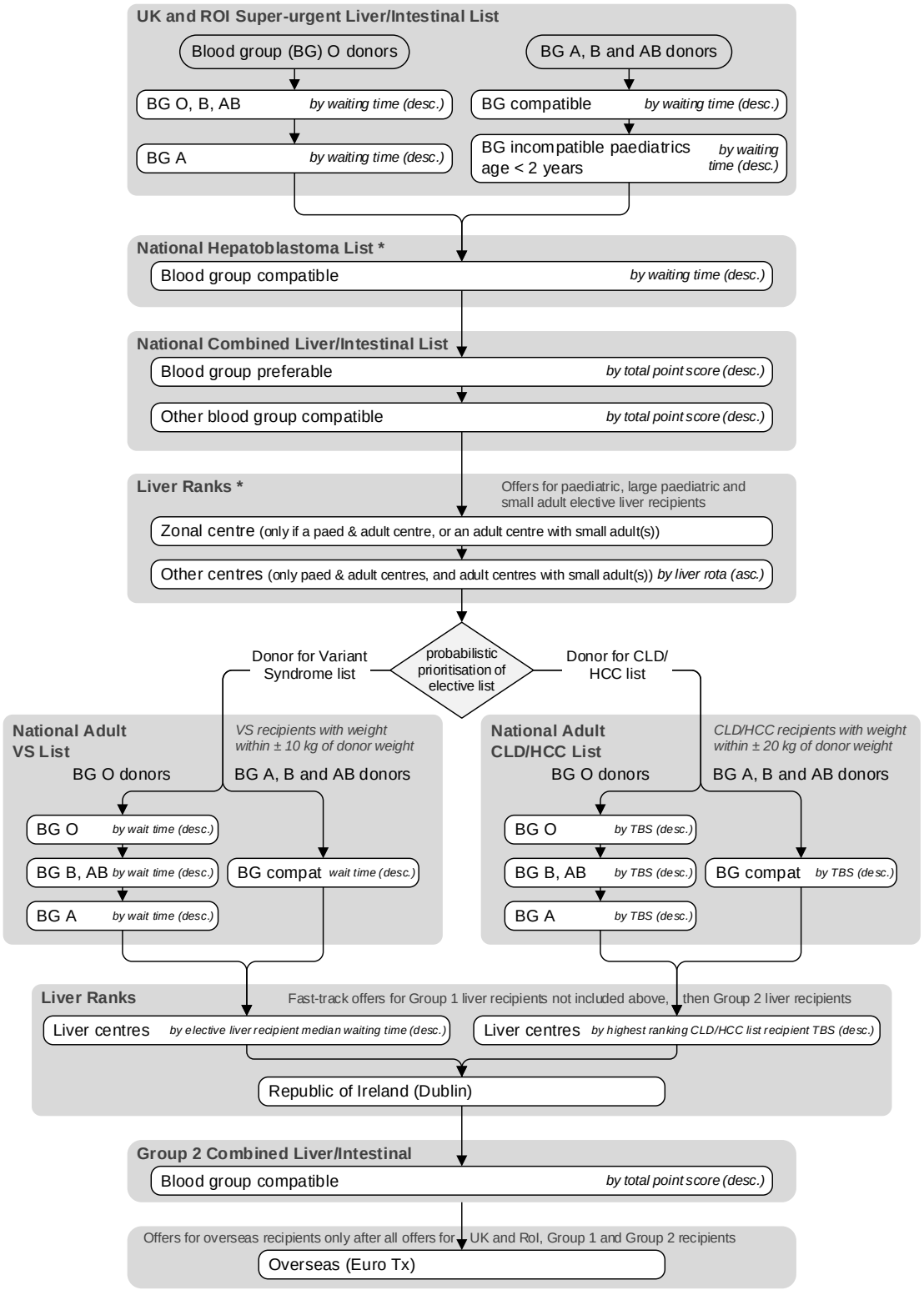
Thereafter, Hub Operations will offer any organs which remain surplus to organ exchange organisations in Europe and elsewhere as follows. As is practice across Europe, this will be on a first response basis. Group 1 recipients will always be prioritised above Group 2 recipients:

5.1.1.13. Organ exchange organisations in EC and other Group 1 countries for emergency patients.

5.1.1.14. Organ exchange organisations in EC and other Group 1 countries.

5.1.1.15. Organ exchange organisations in Group 2 countries.

Figure 2: Offering sequence for a DBD paediatric liver and intestinal donor



* requirement to split if donor meets split liver criteria

6. The liver allocation sequence

6.1. A small number of donor organ offers will be in accordance with the liver allocation sequence (or liver rota). The sequence comprises designated centres, headed by the zonal centre. Cases where offers will be made by the liver rota are offers of a left lateral segment for paediatric/small adult elective liver patients, offers of a DBD paediatric donor to paediatric/small adult liver patients, and all DCD offers (both adult and paediatric donors).

6.2. The liver allocation sequence will be used to advise designated centres of the availability of a donor organ, regardless of whether a patient of the appropriate blood group is registered from their centre on the UK Transplant Registry at the time.

6.3. The liver allocation sequence will be sequenced according to each centre's transplant activity, based on a rolling 4-week period (not including the most immediate week to allow for transplants to be recorded on the UK Transplant Registry). The centre with the least number of transplants during this period will appear at the top of the sequence, down to the centre with the most number of transplants during this period.

6.4. NHSBT will maintain the liver allocation sequence for each centre which will be calculated as follows:

6.4.1. The 4-week period does not include the past week most immediate to the liver to be allocated. Instead, a 1-week window is used to allow Hub Operations to record liver transplants on the UK Transplant Registry. For example, if a liver allocation sequence is produced on Saturday 20 May, the 4-week period used to determine a centre's transplant activity will be to Saturday 15 April to Saturday 13 May.

6.4.2. Livers transplanted from DBD, DCD and domino donors are included in the calculation. Livers offered and transplanted from donors from European organ exchange organisations are included in the calculation.

6.4.3. Live liver transplants are not included in the calculation.

6.4.4. Centres with an identical activity count on the liver allocation sequence will be ranked in reverse-chronological order according to the date on which a transplant took place.

7. Fast track liver offer scheme

7.1. ***UK and Republic of Ireland***

7.1.1. Liver centres in the UK and Republic of Ireland are required to notify Hub Operations of all livers that have either been declined for any reason or not accepted by any centre at or after cross clamp. These livers will be offered to all centres, simultaneously, by the fast track offer scheme.

7.1.2. Donor livers declined by seven named adult or large paediatric patients because of donor or organ-specific reasons will be offered to all centres, simultaneously, via fast track.

7.1.3. When a liver has been accepted for a super-urgent patient and the transplant does not

proceed at or after cross clamp the liver will be offered through the fast track offer scheme.

7.1.4. Livers accepted but declined prior to cross clamp for any patient (including super-urgent) will continue to be offered through the national liver transplant offering scheme until either the liver is accepted or a fast-track trigger is met.

7.1.5. Livers offered on the fast track offer scheme may be accepted for any blood group compatible or identical patient within the centre: the usual blood group O priority will be waived. The accepting patient must be registered on the liver waiting list.

7.1.6. The scheme will operate as follows:

7.1.6.1. If a centre does not respond at all during the allocated time to a fast track offer, ODT Hub Operations will assume that the offer has been declined.

7.1.6.2. If a liver is accepted by more than one centre it will be allocated to the centre placed highest in the offering sequence at the time of the offer. Centres not responding at all will be deemed to have declined the offer. Centres accepting for a super-urgent or hepatoblastoma patient will be given priority over centres accepting for an elective patient.

The offering sequence at fast track will be determined by TBS scores when the liver offering sequence for elective liver recipients is based on the TBS or by median waiting time when the liver offering sequence is based on proportional offering to VS patients (see section 4.3 Offering – the Transplant Benefit Score and proportional offering). The centre with the highest-ranking TBS patient will appear first in the fast track sequence, followed by the centre appearing next in the TBS sequence and so on. If the fast track sequence is based on proportional offering to VS patients, a centre's median waiting time will be calculated from the totality of the centre's elective, blood group compatible patients. Centres will appear in the fast track sequence by decreasing median waiting time.

There might be cases where not all centres appear in the fast track sequence. If two non-appearing centres wish to accept for Group 1 recipients, Hub Operations will facilitate a discussion between the centres.

7.1.6.3. Centres accepting for Group 2 patients or a hepatocyte programme must wait until the 45 minutes and follow up have elapsed to ensure that no centre is accepting for a Group 1 patient. Centres accepting for a Group 2 patient or a hepatocyte programme must formally first decline for all their Group 1 patients.

7.2. *Fast track liver offers from Europe*

7.2.1. Designated liver centres may register with Hub Operations to receive offers of livers which

are available from other centres in Europe. The scheme will come into play for all offers of whole livers and liver lobes from European organ exchange organisations. The scheme will operate as follows:

7.2.2. Hub Operations will accept all offers from other centres in Europe. Offers of livers meeting the fast track offer scheme criteria will be made only to centres registered in the scheme.

7.2.3. Offers will be made by Hub Operations by simultaneous transmission of donor information. Telephone offers will not be made.

7.2.4. If a liver is accepted by more than one centre it will be allocated to the centre placed highest on the liver centre rota at the time of offer. Centres not responding will be deemed to have declined the offer. Centres accepting for a super-urgent or hepatoblastoma patient will be given priority over centres accepting for an elective patient.

7.2.5. Centres accepting for Group 2 patients or a hepatocyte programme must wait until the 45 minutes and follow up time have elapsed to ensure that no centre is accepting for a Group 1 patient. Centres accepting for a Group 2 patient or a hepatocyte programme must formally first decline for all their Group 1 patients.

7.2.6. Within 45 minutes of receiving the referral, Hub Operations will advise the offering European organ exchange organisation of the outcome.

8. Blood-borne Positive Donor Virology Scheme

8.1. *Positive donor virology scheme offering criteria for deceased donor livers*

8.1.1. The positive donor virology scheme is initiated when NHSBT is notified that a donor has an initial positive result for any of the markers listed below:

- Hepatitis B surface antigen (**not Hepatitis B** core antibody positive alone, with negative HBsAG)
- Hepatitis C antibody
- HIV 1 and 2 antibody
- HTLV 1 and 2 antibody

8.2. *Offering via the positive donor virology scheme*

8.1.2. Offers of livers meeting the positive donor virology scheme criteria will be made to all centres simultaneously that have confirmed they wish to be included in the scheme.

8.1.3. Offers will be made by Hub Operations by simultaneous text message to pager/mobile phone transmission of donor information.

8.1.4. Centres must respond by telephone to a positive donor virology offer to Hub Operations within 45 minutes of the offer if they wish to accept. Hub Operations will not follow-up those centres that do not respond within this time. Centres not responding will be deemed to have declined the offer.

8.1.5. Livers will be allocated to the highest accepting centre in the offering sequence that has

expressed an interest in the offer.

APPENDIX A

Combined liver and kidney patient offering

Changes in the logistics around donor characterisation and organ allocation has resulted in patients awaiting a combined liver and kidney transplant becoming disadvantaged with significantly longer waiting times. To provide more equitable access to deceased donor organs by all listed transplant candidates, a revised protocol has been agreed where Hub Operations will delay offering one kidney from either a DBD donor for up to 60 minutes or, for a DCD donor, both the zonal and linked centre(s) have declined to allow elective recipients who require combined liver kidney transplantation to accept one kidney to accompany the liver.

DBD donors

If the generated liver offering sequence for a DBD adult donor shows an elective recipient who requires combined liver kidney transplantation amongst the top three recipients, Hub Operations will delay offering one kidney for up to 60 minutes after elective offering commenced or until the combined liver kidney patient declines, whatever occurs first.

DCD donors

ODT Hub Operations will delay offering one kidney through the Kidney Offering Scheme until both the zonal and linked centre(s) have declined the combined liver kidney offer. The zonal and linked transplant centres are entitled to accept the liver and decline the kidney offer if they have no suitable recipients but not the converse.

The offer of the kidney from both DBD and DCD donors is provisional and subject to there not being patients in Tier A on the National Kidney Waiting List to whom both kidneys should be allocated by the national kidney offering scheme.

If a kidney has been accepted for a recipient with intestinal failure, then the remaining kidney will not be held for the liver offering but will be offered according to Hub Operations procedure.

If the kidney is accepted with the liver, Hub Operations will offer the remaining kidney according to the agreed national allocation procedure.

If the kidney is not accepted with the liver by either the patient appearing amongst the three top ranking recipients or 60 minutes have elapsed since the offer was made (for DBD) or the zonal and linked centre have both declined (for DCD), Hub Operations will offer both kidneys according to the agreed national allocation procedure.

If a centre requests a kidney for a combined liver kidney recipient outside the agreement above, the centre may request that the kidney is accepted with the liver at any point during offering process, but the availability of the kidney will depend on whether it had been allocated for kidney or simultaneous pancreas and kidney recipients.

If a liver centre wishes to request that a renal centre relinquish a kidney offer, then this can be agreed only if the renal centre agrees that this is clinically appropriate. Hub Operations will provide contact information to enable the relevant clinicians to discuss and agree the appropriate option.