

# Abdominal Perfusion and Preservation Protocol for NORS Teams in the UK

## Background

Following a meeting of representatives from all of the NORS abdominal centres on 9<sup>th</sup> October 2012, a national protocol for the use of preservation solutions was agreed. This protocol was reviewed on 17 September 2014.

Reviewed; 3<sup>rd</sup> September, 2021, after consultation with KAG, LAG and NORS Leads.  
*Changes; Addition of HTK for certain indications in organ retrieval (following the discontinuation of Soltran).*

Reviewed 20<sup>th</sup> January, 2023.

*Changes; Addition of HTK as a substitute for UW in organ retrieval. Removal of Soltran from protocol.*

The protocol covers the following:

1. Donor type: DBD or DCD;
2. Organ specific: Liver, pancreas and kidney retrieval;
3. In-situ portal flush of the liver;
4. Back table perfusion of liver, pancreas kidney;
5. Packing for static cold storage and transport;
6. Specific issues were also highlighted: use of streptokinase in DCD, pressurised aortic in-situ perfusion, minimum volumes of solution.
7. Where the document refers to University of Wisconsin (UW) solution, this should be read as "UW or equivalent". "Equivalent" means the fluid used must have the same chemical composition as University of Wisconsin fluid for cold storage solution.
8. *Where the document refers to 'HTK', this is taken to mean 'Custodiol HTK', which is the currently available HTK product from NSHBT suppliers.*

## In situ perfusion

1. The aim of in situ perfusion should be to ensure the effluent runs clear.
2. Teams should record the volume of fluid used per donor on the A form, including batch numbers, for all fluids used in perfusion/in contact with organs during transport.
3. The fluid which is used for the main aortic flush (UW or HTK) should also be used for the portal vein flush as appropriate.

DBD	Aorta (type/volume)	Portal vein (type/volume)
Liver and kidney, +/- pancreas	UW solution 50 – 70 ml/kg	Nil or 1 litre UW
	-----OR----- HTK solution as follows  150-200 ml Custodiol solution/kg body weight is necessary, equivalent to a perfusion quantity of cold Custodiol solution of 8-12 litres in patients weighing approximately 70-80 kg'.	-----OR----- Nil or 1 litre HTK
Kidney only	UW 50 – 70 ml/kg	N/A
	-----OR----- HTK solution as follows  70 ml/kg (5 – 6 litres in 70-80kg donor)	

The use of pressurisation of UW fluid was debated, with the recommendation that a pressure of max 200 mmHg be exerted, which has previously been shown to correspond to an intra-aortic pressure of around 40 mmHg.

HTK is recommended to be administered with a pressure of 100cm water (achieved by simply hanging the bags '100 cm above the liver'). It has a low viscosity, therefore, pressurisation with pressure bags may result in overly rapid administration with loss of cooling effect. The manufacturer only describes the use of bags hung 100cm above the donor and gives no guidance on pressure bags. If pressure bags are used, these should not exceed 100mm Hg.

DCD III	Aorta (type/volume)	Portal vein (type/volume)
<b>Liver and kidney, +/- pancreas</b>	UW solution alone (heparinised) 50 – 70 ml/kg -----OR----- 1 litre flush with heparinised low viscosity solution (HTK) followed by UW solution 50 - 70 ml/kg -----OR----- HTK solution (heparinised) as follows; 150-200 ml Custodiol solution/kg body weight is necessary, equivalent to a perfusion quantity of cold Custodiol solution of 8-12 litres in patients weighing approximately 70-80 kg'.	UW 1 litre or HTK 1 litre depending on fluid used for main aortic flush.
<b>Kidney only</b>	UW solution alone (heparinised) 50 – 70 ml/kg OR 1 litre flush with heparinised low viscosity solution (HTK) followed by UW solution 50 - 70 ml/kg OR HTK solution (heparinised) 70 ml/kg (5 – 6 litres in 70-80kg donor)	N/A

There was discussion around the merits of flushing the aorta and the organs in the context of DCD with 1 litre of low viscosity solution, such as HTK solution. It was noted that while there is currently no clear evidence for a benefit, teams who prefer this regimen can continue to do so.

Guidance for fluid pressurisation in DCD is the same as in DBD preservation.

## Back table perfusion

Back table perfusion may not be required if in situ examination demonstrates that the organs are well-perfused. However, portal perfusion of the liver must take place, either in situ or on the back table.

Back table perfusion should use the same fluid as that used for the main aortic flush.

<b>DBD or DCD III</b>	<b>HA (type/vol)</b>	<b>Portal (type/vol)</b>	<b>CBD (type/vol)</b>	<b>Pancreas (type/vol)</b>	<b>Kidney (type/vol)</b>
<b>Liver</b>	UW or HTK 200-500 ml	UW or HTK 1000 ml	UW or HTK 250 ml		
<b>Pancreas</b>				Nil unless indicated (UW or HTK)	
<b>Kidney</b>					UW or HTK 200-300 ml or until clear

### Packing for static cold storage and transport

<b>Packing</b>	<b>Liver (type/vol)</b>	<b>Kidney (type/vol)</b>	<b>Pancreas (type/vol)</b>
<b>DBD or DCD</b>	UW or HTK until submerged (approx 2 L)	UW or HTK (approx 250 ml)	UW or HTK (approx 500 ml)

## Other discussion points and specific issues:

1. The administration of streptokinase in an initial flush is not acceptable in the retrieval of liver or pancreas, as it must be delivered at normal body temperature, and concern was expressed about the delay in cold perfusion. The evidence base for its use in liver and pancreas retrievals is non-existent.
2. The group supported the administration of heparin in the aortic flush.
3. The use of pressurisation of UW fluid was debated, with the recommendation that a pressure of max 200 mmHg be exerted, which has previously been shown to correspond to an intra-aortic pressure of around 40 mmHg.

HTK is recommended to be administered with a pressure of 100cm water (achieved by simply hanging the bags '100 cm above the liver'). It has a low viscosity, therefore, pressurisation with pressure bags may result in overly rapid administration with loss of cooling effect. The manufacturer only describes the use of bags hung 100cm above the donor and gives no guidance on pressure bags. If pressure bags are used, these should not exceed 100mm Hg.

4. The addition of additives, such as benzyl penicillin, insulin and dexamethasone, to the preservation solution UW is not recommended any more. The addition of fresh glutathione is optional, although no clinical evidence is available for a benefit.
5. When UW solution is obtained from Bridge to Life (Belzer UW Solution) or from ORS (SPS-1) no filter is needed.
6. Auxiliary blood vessels retrieved for use as conduits should be stored in UW or HTK solution in pots to facilitate transport to the transplanting centres. If the vessels are to be stored more than 48 hours after the transplant, appropriate protocols must be in place according to HTA licensing requirements.
7. It was agreed that, in line with European practice, all organs should be stored in **THREE** bags.
8. All organs should be stored as follows:
  - a. Each organ is submerged in sufficient cold preservation solution in the first bag.
  - b. The second bag is filled with at least 250 ml cold saline (without any ice).
  - c. A small amount of fluid (sufficient to ensure there is no air in the bag) may be placed between the second and third bags.
  - d. Important: each bag is firmly tied after adequate de-airing.
  - e. The bagged organs are then placed in the transport box and covered with non-sterile melting ice.
9. The liver should be placed in a sterile bowl (if the liver is too large to fit in the bowl, the bowl should not be used) and submerged in preservation solution. The bowl with the liver is then packed as described above.
10. For all livers which are to be split, and in all paediatric donors, all perfusion must include in situ portal vein perfusion.
11. It was noted that following the initial in-situ flush first liver and then pancreas should be retrieved followed by immediate additional back table flush and packing. Ideally, another team member could retrieve the kidneys at the same time to reduce secondary warming

time, but only if the additional team member is competent to perform this task without supervision.

12. In the tables the 'generic' names for the preservation solution are used as according to tender processes brand names may vary.

## **Reference Base**

Manufacturers' Package Insert; Custodiol. Volume for 70-80kg donor is 8-12 litres.

<https://www.medicines.org.uk/emc/product/14445/pil>

UW package insert; minimum volume in adult is 2-4 litres

<https://bridgetolife.com/wp-content/uploads/2021/09/4107-us-belzer-uw-cs-multi-size-ifu-032321.pdf>

R. J. Lynch, J. Kubus, R. H. Chenault, S. J. Pelletier, D. A. Campbell and M. J. Englesbe. Comparison of Histidine-Tryptophan-Ketoglutarate and University of Wisconsin Preservation in Renal Transplantation. *American Journal of Transplantation* 2008; 8: 567–573.

J. de Boer, J. De Meester, J. M. A. Smits, A. F. Groenewoud, A. Bok, O. van der Velde, I. I. N. Doxiadis, G. G. Persijn. Eurotransplant randomized multicenter kidney graft preservation study comparing HTK with UW and Euro-Collins. *Transplant International* 1999; 12: 447-453.

J. M. O'Callaghan, S. R. Knight, R. D. Morgan and P. J. Morris. Preservation Solutions for Static Cold Storage of Kidney Allografts: A Systematic Review and Meta-Analysis. *American Journal of Transplantation* 2012; 12: 896–906.