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## Introduction

There are very few countries where organ donation is not covered by the provisions of law or is expressly prohibited. However, healthcare infrastructure or cultural and religious traditions have prevented widespread adoption of the practice in many societies. Substantial differences exist in donation rates even amongst countries of similar socio-economic status, sharing a similar cultural and religious heritage and similar legislative framework. Such differences testify to the important role of logistics in the success of organ transplantation.

Organ transplantation involves two surgical procedures: the retrieval of an organ from a donor and implantation of the organ to a recipient.

This chapter specifically deals with logistical issues surrounding organ retrieval. The details of the surgical procedures required to retrieve organs are covered in subsequent chapters of the book. The logistical issues discussed refer to organ retrieval from deceased donors only.

## Diagnosis of death – DBD and DCD donation

It is acknowledged worldwide that the irreversible loss of the capacity for consciousness combined with the irreversible loss of the capacity to breathe equates to death. Irreversible loss of brainstem functions produces

this state. Therefore demonstration that the functions of the brainstem have irreversibly ceased allows diagnosis of death.

On the background of this principle, different legal definitions of death have evolved in different countries.

### Donation after brain death (DBD)

In the UK demonstration of the absence of all the functions of the brainstem by clinical tests is adequate for the diagnosis of brainstem death (BSD) to be made, providing that severe metabolic disturbance and potential effect of drugs and hypothermia have been excluded and a cause has been established. Other countries require additional criteria such as demonstration of lack of electrical activity in EEG or demonstration of the absence of blood flow to the brain by imaging. Criteria used to diagnose BSD in children are the same as those in adults, but it should be noted that the diagnosis of BSD in infants under the age of 2 months is not appropriate or possible.

In order to test for BSD, the patient must be in an unresponsive coma, having sustained 'irreversible' brain damage of known aetiology.

Potential reversible circulatory metabolic and endocrine disturbances must have been ruled out as the cause of continuation of unconsciousness:

- Drugs: sedative, muscle relaxants
- Hypothermia <35°C
- Circulatory, metabolic, endocrine disturbance

In DBD donors, circulation and the oxygenation of peripheral tissues are maintained after death. This allows better preservation of function in the organs to be retrieved and transplanted. The range of organs suitable for transplantation is greater in DBD donation and in general the outcome of transplantation using DBD donor organs is better.

### BSD testing:

- Absence of pupillary response to light (occulomotor III cranial nerve)
- Absence of corneal reflexes (trigeminal V cranial nerve)
- Absence of caloric responses
- No motor response in the distribution of the cranial nerves (trigeminal V sensory supply to upper face and facial VII cranial nerves)
- No cough or gag reflex (glossopharyngeal IX and vagus X cranial nerves)
- Testing for apnoea

### Death following cessation of cardiorespiratory function – DCD donation

Death can also be diagnosed by an appropriately qualified individual, by confirming irreversible cessation of cardiac, respiratory and neurological activity. In practice the irreversibility of the loss of neurological function is inferred from the length of time that breathing and circulation has been absent.

The cessation of cardiac activity can be determined by the absence of pulses and heart sounds. In the hospital setting, demonstration of asystole on ECG or the absence of blood flow in direct arterial pressure monitoring may also supplement the diagnosis. After 5 minutes of continued absence of circulation and absence of breathing, the absence of pupillary or corneal reflex is tested to confirm cessation of neurological function also. This category of deceased organ donation (previously also referred to as non-heart beating donors – NHBD) is called donation after cardiac death or donation after circulatory death (DCD).

Organ donors in this category are patients who have often sustained catastrophic irrecoverable brain injury and in whom further treatment has been considered futile.

Any decision about futility of further treatment and whether or not active treatment should be withdrawn must be made only in the interest of the patient and with no regard to any consideration of potential organ donation.

When the doctors caring for the patient have made the decision that further treatment is futile, the timing of the withdrawal of treatment can be coordinated, to allow for organ retrieval to take place after circulatory death is diagnosed.

In the early days of organ transplantation, prior to the establishment of criteria to diagnose BSD, this type of donation was the only means to provide organs for transplantation from deceased donors. In the last 10 years there has been a revival of the concept and the practice of DCD. DCD donors provide a variable but increasing proportion of the deceased donor organs transplanted. Specific considerations about retrieval of organs from DCD donors and transplantation of such organs are dealt with in the relevant chapters of this book.

It should be noted that the practice of donation after circulatory death is expressly forbidden by law in certain countries, notably in Germany.

### Evolution of organ donation and the legal framework governing organ donation

Historically, even after donation after brain death became accepted practice, the responsibility for retrieving organs from deceased donors rested with the surgical teams of individual transplant units. The multiorgan retrieval procedure involved separate teams from kidney, liver, pancreas and cardiothoracic transplant units to travel to and assemble at the donor hospital.

As organ transplantation became established practice and activity levels increased, it became evident that better coordination of organ retrieval from multiorgan donors and regulation of the allocation of organs for transplantation were required. The differences in statute and social-cultural norms in different countries naturally resulted in varying forms of regulation of organ donation. Broadly speaking the laws dealing with authority for organ retrieval can be divided into two categories:

**Table 1.1** Donor legislation in various countries.

Presumed consent (opt out)		Informed consent (opt in)	
Argentina	Italy	Australia	Lithuania
Austria	Latvia	Brazil	Netherlands
Belgium	Luxembourg	Canada	New Zealand
Bulgaria	Norway	Chile	Romania
Costa Rica	Panama	Denmark	Switzerland
Croatia	Poland	Germany	UK
Czech Republic	Portugal	Ireland	USA
Estonia	Singapore	Japan	Venezuela
Finland	Slovak Republic		
France	Slovenia		
Greece	Spain		
Hungary	Sweden		
Israel			

**1 opting out systems** where it is assumed that the deceased had no objection to donation unless such objection had been expressly registered prior to death, and

**2 opting in systems** where prior consent is not assumed and some indication or evidence is required that donation was the wish of the deceased or donation requires consent from relatives.

The legal requirements for donation vary across the globe (Table 1.1) [1,2]. In some countries, an opt-in law, which requires informed consent from the relatives prior to proceeding to donation, is in place. Most European countries have adopted the opt-out or presumed consent law, whereby organs are removed from every identified donor unless they have expressed their wishes against donation ('hard form' opt out) or after inquiring from the relatives whether they were aware of such wishes ('soft form' opt out).

There is some evidence that the introduction of a decentralized organ procurement system has led to an increase in the number of organ donors [3,4]. It is yet unclear whether replacing an 'informed consent' with 'presumed consent' legislation has a similar effect on organ donation rates, but some studies [5,6] suggest that a significant increase was noted in countries where the change in legislation was adopted.

## Organ retrieval teams and organ transplantation units

Many countries worldwide have gradually moved to a varying degree of separation of the multiorgan retrieval process from the process of organ transplantation. Whilst the details of organ retrieval services vary around the world, there is broad agreement about the principles and standards that apply to successful retrieval of organs from deceased donors.

The key to successful organ retrieval is cooperation between the three essential components, namely donor coordinators, the organ retrieval team and the transplant units.

### Donor coordinators

Donor coordinators may be affiliated to transplant centres or be part of an independent organization. Transplant coordinators who remain affiliated to transplant units and serve a dual role as donor and recipient coordinators may fulfill each role equally effectively and this model may arguably have some benefits. However, in terms of one of the most important outcome measures, namely maximizing the potential from deceased donation, international experience and the balance of evidence suggests that dedicated donor coordinators based in potential donor hospitals is a superior model [7].

A wide network of donor coordinators based in local hospitals is the key component of a successful organ donation programme.

In some of the countries with the highest deceased donation rates such as Spain, Portugal and Italy, there are donor coordinators based in every hospital in the country. They play an important role in raising and maintaining the awareness of donation and provide education and support to staff of potential donor hospitals. In the case of DBD donation, donor coordinators will often help approach the donor family, take part in the process of consent or authorization for donation, provide help with donor management in the critical care unit and support the donor family during the process of donation. When required, donor coordinators will also liaise with legal authorities to facilitate donation and ensure that potentially surmountable legal obstacles do not prevent donation



**Figure 1.1** The equipment required by a single multiorgan abdominal retrieval team.

of organs. Donor coordinators will then inform organ retrieval teams and coordinate the retrieval process.

The responsibility for transporting teams to donor hospitals and organs to their destinations may rest with the donor coordinator, or the transplant units themselves, or be shared. The increased regionalization of the donation services, together with a standardized approach to the travel arrangements, is expected to improve the quality and safety of the travel services for the donor team [8,9].

Donor coordinators also share the responsibility for appropriate documentation of donor details and the submission of information to the National Transplant Database as well as individual transplant units.

The paperwork that is currently completed throughout the donor process in the UK includes:

- Authorization for Solid Organ and Tissue Donation
- Patient Assessment Form
- GP Fax – will be sent retrospectively if donation out-with GP surgery hours
- EOS form (Core Donor Data Form)
- Donor Management Audit paperwork
- If the heart is being used for valves – separate documentation pertaining to Tissue Services will be completed (this also applies to islets)
- UK Transplant Registry – Proceeding and Non-Proceeding Donors after Cardiac Death Information
- UK Transplant Registry – Organ Retrieval Information for attending Specialist Nurse – Organ Donation
- End of process documentation for the donor patient hospital notes

#### Donor coordinator roles:

- Promote and facilitate the entire donation process
- Provide support and appropriate information to families regarding organ and tissue donation.
- Ensure that donation proceeds in line with national legislation, policies and procedures.
- Obtain all relevant information enabling transplant centres to assess the suitability of potential donors.
- Assist in the optimization of organs for transplant through appropriate donor management.
- Maximize the placement of organs for transplant
- Train donation services team members
- Collect data for the organ donation related audits
- Facilitate and support education of healthcare professionals and the general public

#### Organ retrieval teams

The organ retrieval teams vary in their size, composition and funding. Most teams will be formed of staff of transplant centres, who should be available 24 hours a day without other commitments in their own centres during the time on-call for retrieval. Cardiothoracic organ retrievals are almost always performed by teams from cardiothoracic transplant centres (lead surgeon +/- assistant, scrub nurse and perfusionist). For retrieval of all other organs, ideally a single abdominal organ retrieval team should be available. The team should include a lead surgeon, assistant surgeon, scrub nurse and operating theatre practitioner.

Organ retrieval often happens in small hospitals unaccustomed to the surgical procedure and where some of the specialist equipment required may not be available. The presence of a single retrieval team, rather than individual organ teams (e.g. a liver team, a kidney team, a pancreas team) streamlines the process and ensures a uniform approach to the abdominal retrieval, which is an important factor, particularly when operating in different environments.

Ideally the retrieval team should be self-sufficient and not require any support from the donor hospital other than an operating theatre and a local member of staff. In practice, for DBD donors, most retrieval teams also require a donor hospital anesthetist to be present during the retrieval procedure. There is some evidence that the inclusion of a dedicated transplant anesthetist in the retrieval team allows a greater degree of flexibility at the local hospital (as the team will only require access to an operating theatre) and improves the quality of the organ donor management preretrieval.

All retrieval teams should be self-sufficient. Ideally a dedicated transplant anesthetist should be part of the retrieval team to facilitate organ donation management.

There should be policies in place for training and certification for the members of the retrieval team and for effective audit of the teams' activity and outcomes.

The key responsibility, by far the most important responsibility and an absolute imperative for the lead surgeon of the retrieval team is correct identification of the potential donor in the operating theatre prior to the retrieval operation. The lead surgeon assisted by the donor coordinator must also check that diagnosis of death has been made appropriately and documented correctly, and the consent or authorization for donation has been obtained and documented. Preoperative checks (see Figure 4.1) should also ensure that all other necessary information about the donor (e.g. blood group, virology status, relevant medical history, results of other blood tests) is available. If there are both cardiothoracic and abdominal teams present, a brief discussion about the conduct of the surgical procedure and the sequence of events should take place between the teams before the operation.

The surgeons of the retrieval team should document any unexpected finding or abnormality, should document donor instability or suboptimal organ perfusion

and should provide a brief description of the surgical procedure for the hospital records of the donor.

The retrieval team jointly with the donor coordinator are also responsible for documentation of the timing of the key events (such as withdrawal of support, time of asystole, time of declaration of death and the start of perfusion for DCD donors or the time of cross-clamp, start of cold perfusion, time of placement of organs in ice for DBD donors) and the correct labeling of all organs and accompanying blood and tissue samples.

#### Key checks to be performed by the lead surgeon:

- Identity of the donor
- Brainstem death tests performed and documented appropriately
- Consent for organ donation
- Blood group
- Virology status, medical history and other blood tests

#### Responsibilities of the retrieval team:

- Documentation of key retrieval events
- Completion of appropriate documentation
- Completion of procedure summary in medical notes
- Correct labeling of the organs and blood and tissue samples

### Transplant units

The recipient centre where the implantation of organs takes place must have a point of contact available at all times. A senior transplant surgeon should be available to discuss donor details and the retrieval operation with the donor coordinator and the retrieval team.

Transplant centres should maintain a record of all offers of deceased donor organs accepted or rejected. The transplant centres have the ultimate responsibility for the suitability of the organs to be transplanted. This requires checking of donor and recipient blood group, donor virology status, other blood tests and medical history, the critical times during the retrieval procedure and physical inspection of the organ to be transplanted when it arrives in the recipient centre. Any damage or abnormality such as a suspected tumour noted by the transplanting surgeons must be reported to the National Transplant Organization without delay, since this may have implications for potential recipients of other organs from the same donor.

## Post Operative Theatre Checklist for SN-OD (optional)

		Yes	No	
Has the operation / procedure summary been completed by lead surgeon in medical records?		<input type="checkbox"/>	<input type="checkbox"/>	
		Yes	No	
Organ specific forms completed?		<input type="checkbox"/>	<input type="checkbox"/>	
Organ specific forms with organ?		<input type="checkbox"/>	<input type="checkbox"/>	
Blood group form with organ?		<input type="checkbox"/>	<input type="checkbox"/>	
Organs packed?		<input type="checkbox"/>	<input type="checkbox"/>	
Have the specimens been labelled correctly (including patient's name)?		<input type="checkbox"/>	<input type="checkbox"/>	
Proceeding/non-proceeding DCD form with organ?		<input type="checkbox"/>	<input type="checkbox"/>	
		Yes	No	N/A
Have security tag numbers been documented?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Left kidney tag # _____		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Right kidney tag # _____		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pancreas tag # _____		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heart for valves # _____		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Corneas tag # _____		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Yes	No	N/A
Has transport been arranged?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tissue donation paperwork / bloods		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Yes	No	
<b>Last offices</b>	Family keepsakes	<input type="checkbox"/>	<input type="checkbox"/>	
	Family requests	<input type="checkbox"/>	<input type="checkbox"/>	
Details: _____				
_____				
		Yes	No	
Local policies available:		<input type="checkbox"/>	<input type="checkbox"/>	
<b>Name:</b>				
<b>Signature:</b>				

**Figure 1.2** Postoperative checklist to ensure appropriate documentation is completed following organ retrieval procedures. (SN-OD, Specialist Nurse for Organ Donation.)



Donor surgeons and coordinators should be able to discuss any donor-related issues with the recipient centres at all times.

The transplant centres have the responsibility to organize the transport for the organs that they have accepted. They should liaise with the donor coordinators to establish the optimal time for the dispatch of organs, without undue delays that could increase the length of the cold ischemic time.

## **Patient selection for transplantation and allocation of deceased donor organs for transplantation**

### **Patient selection**

Refinement of surgical techniques and immunosuppressive therapy as well as improvements in the detection and management of comorbidity and complications of organ transplantation have resulted in widening of the indications for transplantation. Organ transplantation therefore has become a victim of its own success, with a worsening shortfall in the availability of organs for transplantation compared with the number of patients registered for transplantation.

Policies used for the selection of patients for transplantation vary depending on the type of organ transplant under consideration and the local circumstances, primarily pertaining to the degree of donor organ shortage. It is beyond the scope of this chapter to examine patient selection policies and the evidence base for such policies in detail. It is sufficient to mention here that each organ transplantation organization needs to consider the appropriate balance between the conflicting requirements of utility and duty of care to individual patients and reach an agreement on uniformly applied criteria for patient selection. An example of the dilemmas faced with patient selection would be eligibility for liver transplantation for hepatocellular carcinoma (HCC). Offering transplantation to patients with advanced HCC, however small the cure rate may be, may still be the best treatment option for the patients with the cancer. However, restricting transplantation to those whose cancers are not advanced beyond certain limits (such as the Milan criteria) may represent a better balance between utility and benefit.

### **Allocation of deceased donor organs for transplantation**

Allocation of deceased donor organs to potential recipients is an even greater challenge than determining the suitability of patients for transplantation. All methods of allocation attempt to strike an appropriate balance between the conflicting demands of utility, duty of care to individual patients, justice and benefit.

In general, models of allocation of deceased donor organs for kidney transplantation take account of factors associated with improved outcome, such as HLA matching, in addition to elements of fairness or justice, such as waiting time. The need or desire to give priority to certain groups such as children or other disadvantaged recipients on the waiting list, such as those with anti-HLA sensitization or certain blood groups, are also considered in kidney allocation models. In most countries complex allocation formulas based on the considerations mentioned above are used to allocate deceased donor kidneys to individual patients on national or regional waiting lists. Clearly other criteria such as social status, ability to pay, gender and ethnic origin have no role in allocation decisions.

The difficulties are compounded further for transplantation of other solid organs such as heart, lung or liver, where the potential recipients often have a short life expectancy on the waiting list; hence the conflict between utility and benefit comes into sharper focus.

Again, a detailed discussion about the pros and cons of different allocation policies is beyond the scope of this chapter, but it seems important to remember that deceased donor organs are scarce and extremely valuable resources. Therefore rules governing the selection of patients for transplantation and allocation of the organs must be carefully considered, must be transparent and must command the support of the public as well as the healthcare professionals.

We must also remember that patient selection and organ allocation are only two aspects of a range of logistical challenges, all of which play an important role in the success of the endeavor of organ transplantation. A thorough understanding of these challenges and continuous efforts to address them is the duty of every transplant professional.

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