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Organ donation in the United Kingdom

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Abstract

The need of organ transplants is increasing worldwide. We observe the increased numbers on the waiting list as a result of the on-going lack of available organs. In 2014 in the EU (European Union) plus Norway, Turkey and Iceland 86.000 people were on the waiting list. Every day 16 people died while waiting for a transplant [1]. Donation rate (per million population) in 2013 in the UK was 21 while in Spain was 35, Croatia 34, Malta 35, Belgium 29, Portugal 28 and France 26. Over a period of 10 years (from 2004-2013) the organs transplant from deceased and leaving donors in EU shown 18% increase in deceased donation, 86% increase in leaving donation and 33% total increase in donation [2]. *Anestezjologia i Ratownictwo 2017; 11: 166-175.*

Keywords: organ donation, transplant, tissue donation, brain stem death

Introduction

In the UK there are couple of ways to donate:

DBD – donation occurs after confirmation of brain steam death, patient has been taken to theatre on the ventilator, aorta has been cross clamped and asystole occurs. DBD donors can donate: heart, lungs, liver (hepatocytes), kidneys, pancreas and small bowels.

DCD – donation after circulatory death is when death is inevitable and the treatment is to be withdrawn. Treatment is withdrawn in anaesthetic room and when the death is confirmed by the doctor, the donor is immediately transferred to theatre for rapid laparotomy. Can donate: lungs, liver, kidneys, pancreas and heart [3].

Living donor- removal of the part of the organ or tissue from healthy, leaving person and placed in recipient body. Can donate liver, kidneys, tissues, bone and amniotic membrane [4,5].

Tissues donation is the donation of the tissue to improve quality or even save recipient's life. What can be donated: corneas, tendons achilles, patellas, semitendinosus, meniscus, heart tissues (valves, pericardium), blood vessels (femoral, thoracic, abdominal) skin, bones (knees, femur, femoral head) Tissue donation in the UK is regulated by *Standards for the retrieval of human ocular tissue used in transplantation, research and training. October 2008* and *Human tissue ACT 2008* [6].

Organ donation and transplantation in the UK during 2015 shows that total number of deceased donors increased. There were 187 more deceased donor transplants in 2015-2016 than the previous year which is 6%. Over 10 years period deceased donors after brain death has increased in the 3 to 4 year and reached the highest number in 2015-2016 (785). The number of DCD donors has increased year to year except 2014/2015, reaching the highest number in 2015/16-579 what gave 42% of deceased donors [7,8]. During the last 7 years the number of living donors has ranged from 1046 to 1148. Compared with last year there was a 2% fall to 1075 living donors this year. The latest statistic shows that 44% of all organ donors are living donors at the same time living donors is 25% of total transplant activity [9].

Organ donation should be considered as a part of end of life care. The aim is recognise the possible organ donors as early as possible. The criteria should

be based of namely:
- for the patients who had suffered from catastrophic brain injury:
- with absence of one or more cranial reflexes and
- GCS score is 4 or less and it's not explained by sedation unless there is clear reason for a low GCS in other case brain steam death testing should be performed.
- withdrawn of the treatment which will result with circulatory death [10].

Brain death is defined as the irreversible loss of all functions of the brain, including the brainstem. The three essential findings in brain death are coma, absence of brainstem reflexes, and apnoea. An evaluation for brain death should be considered in patients who have suffered a massive, irreversible brain injury of identifiable cause. A patient determined to be brain dead is legally and clinically dead [11].

Brain stem death is diagnosed in three stages:
1. It must be established that the patient has suffered an event of known aetiology resulting in irreversible brain damage with apnoeic coma, i.e. the patient is deeply unconscious, mechanically ventilated with no spontaneous respiratory movement.
2. Reversible causes of coma must be excluded.
3. A set of bedside clinical tests of brain stem function are undertaken to confirm the diagnosis of brain stem death. Before starting brain stem testing it has to be established that patient has suffered from irreversible brain damage resulting in coma and apnoeic state, excluded reversible cause of coma (drugs, hypothermia, electrolyses disturbances, brain stem encephalitis, GB syndrome) [12].

Formal testing can take place once clinicians are satisfied that the patient has satisfied the essential preconditions and that there are no significant reversible contributions to the comatose and apnoeic state. These tests are designed to be easy to perform with unequivocal results. They require no special equipment and can be performed at the bedside [11,13].

Who can be a donor?

Any patient who has suffered major and irreversible neurological damage leading to brain stem death or alternatively whose condition is such that continuing critical care is considered futile and withdrawal of treatment is being considered as an organ donor. Any patient HIV negative and not known or suspected to have CJD should be considered as an organ donor. There are no absolute age restrictions although solid organs are rarely retrieved from donors over 80 years of age. The criteria for tissue donation with respect to both age and medical suitability vary depending on the tissue to be donated. Absolute contraindications for tissue donation include patients who have ever tested positive for HIV, hepatitis B, hepatitis C, human T cell lymphotrophic virus (HTLV) or syphilis or have high risk behavioural factors for contracting these infections. Any patient that suffered from or has evidence of CJD or a family history of CJD cannot be a donor. A patient that has had a progressive neurological disease of unknown pathophysiology, e.g. multiple sclerosis, Alzheimer's Disease, Parkinson's Disease, motor neurone disease, those who suffered from leukaemia, lymphoma or myeloma or had a previous transplant requiring immunosuppressive treatment is also restricted from donation [12].

Table I. Brainstem reflex test [14]

No pupillary response	No pupillary response to light recognising when pupils do not respond either directly or consensually to sharp changes in the intensity of light.
Absent corneal reflex	There is no response to direct stimulation of the cornea once applying gentle pressure to the cornea with either cotton wool or the tip of a gauze swab.
Absent vestibulo-ocular (caloric) reflex	The head should be flexed at 30°. If cervical spine instability is suspected, then the bed may be tilted with head up at 30°. No eye movements are seen following slow injection of at least 50 ml ice cold water over one minute into each external auditory meatus in turn.
No motor response to central stimulation	No motor response within the cranial nerve or somatic distribution in response to supraorbital pressure.
Absent gag and cough reflex	No contraction of the soft palate when the uvula is stimulated with a throat spatula or no response to bronchial stimulation by a catheter passed at least as far as the
Absence of respiratory movement during the apnoea test	No respiratory movements seen when the patient is disconnected from the ventilator when the arterial carbon dioxide partial pressure is above the threshold for respiratory stimulation (i.e. greater than > 6.65 kPa (50 mmHg))

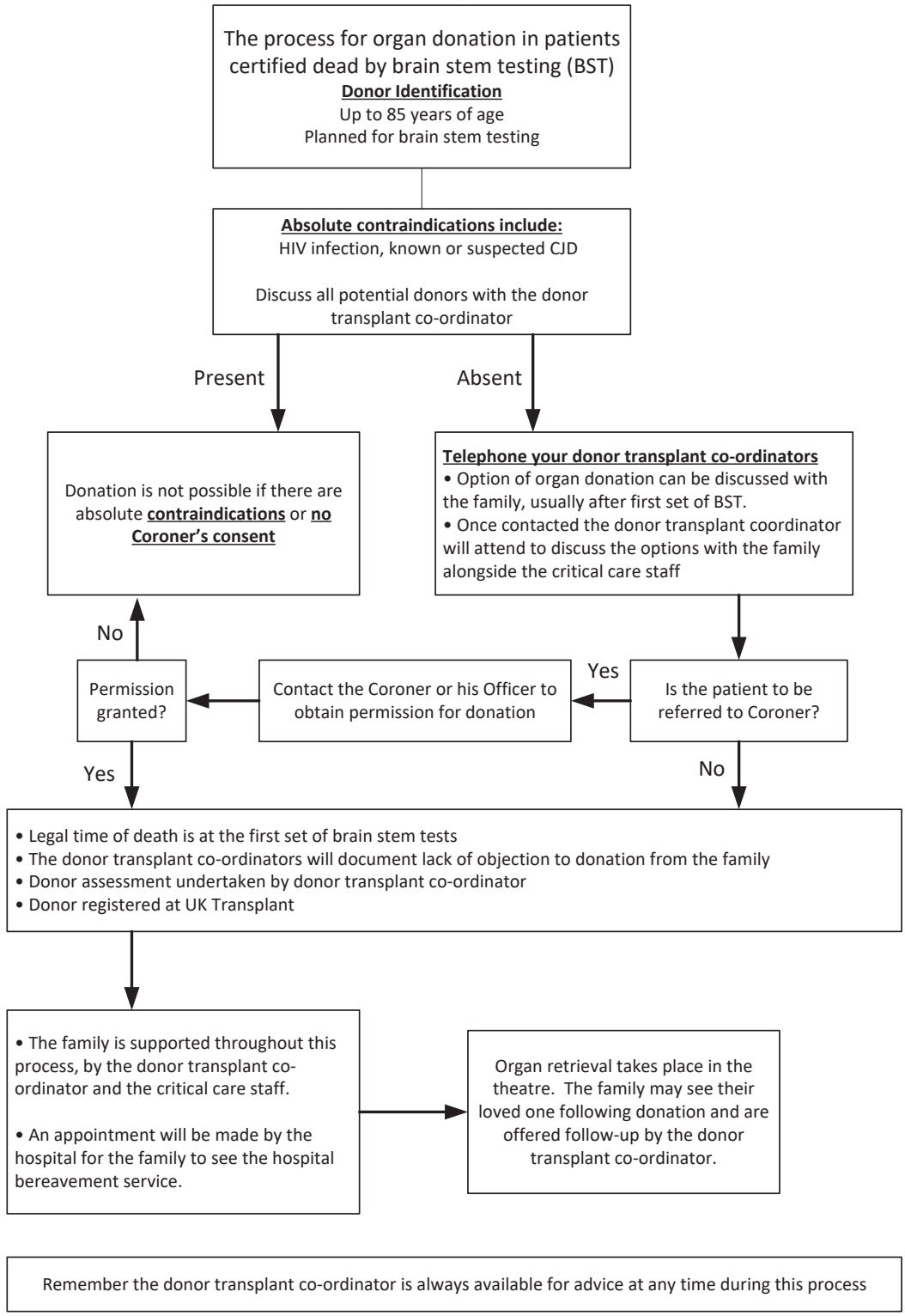

Table II. Process for organ donation in patients diagnosed with brain stem death [12]

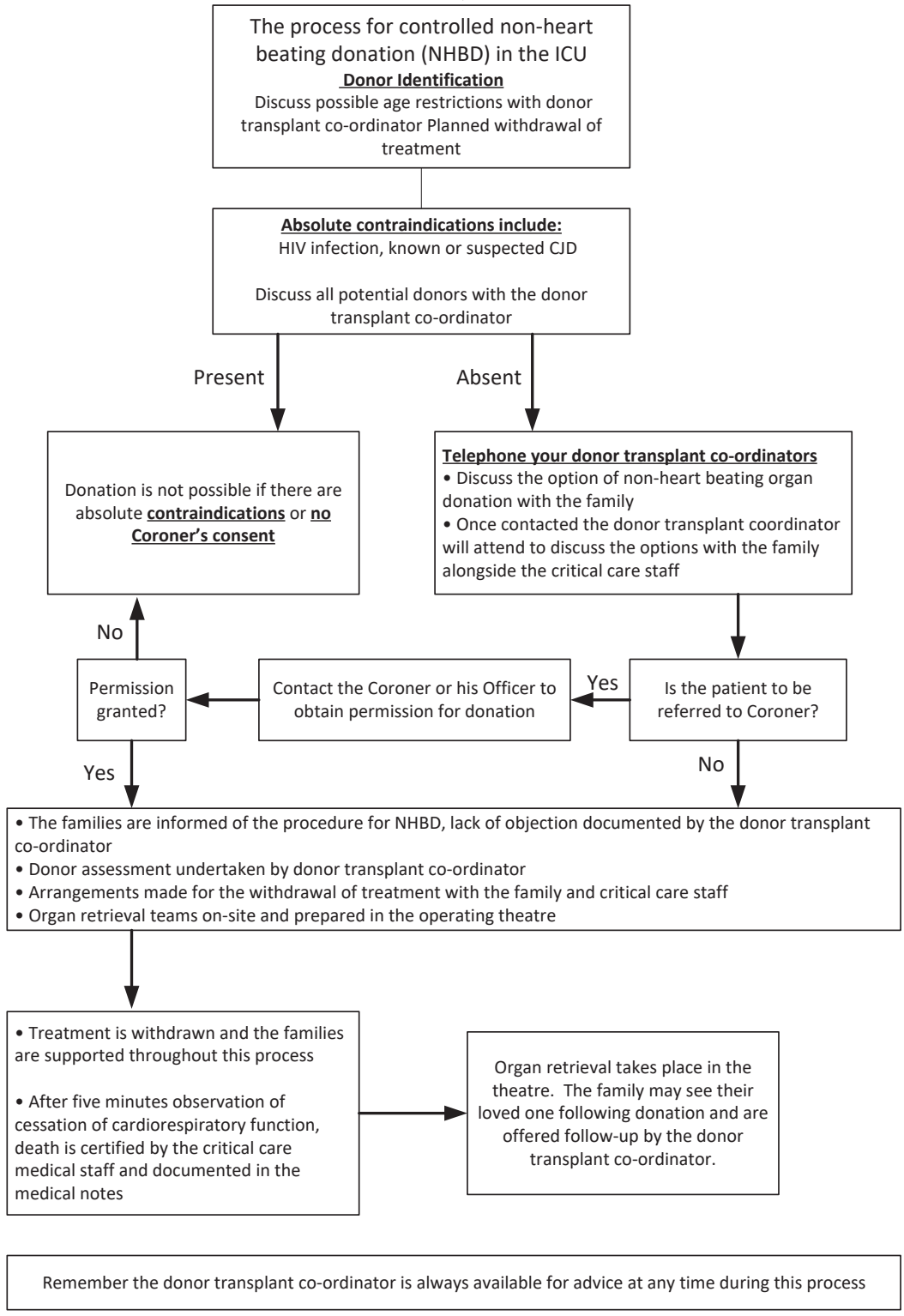

Table III. The process for controlled non-heart beating donation [12]

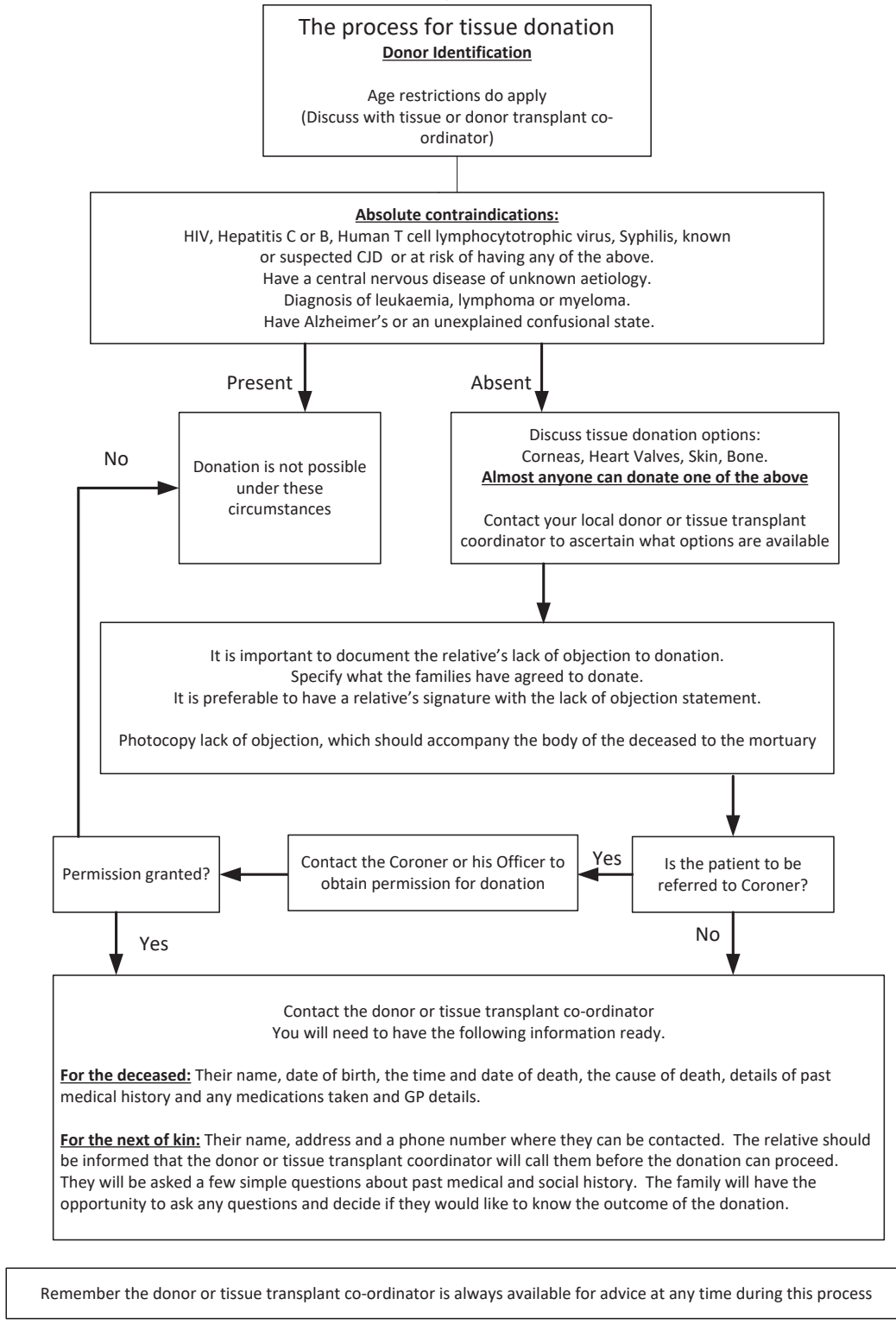

Table IV. The process for tissue donation [12]

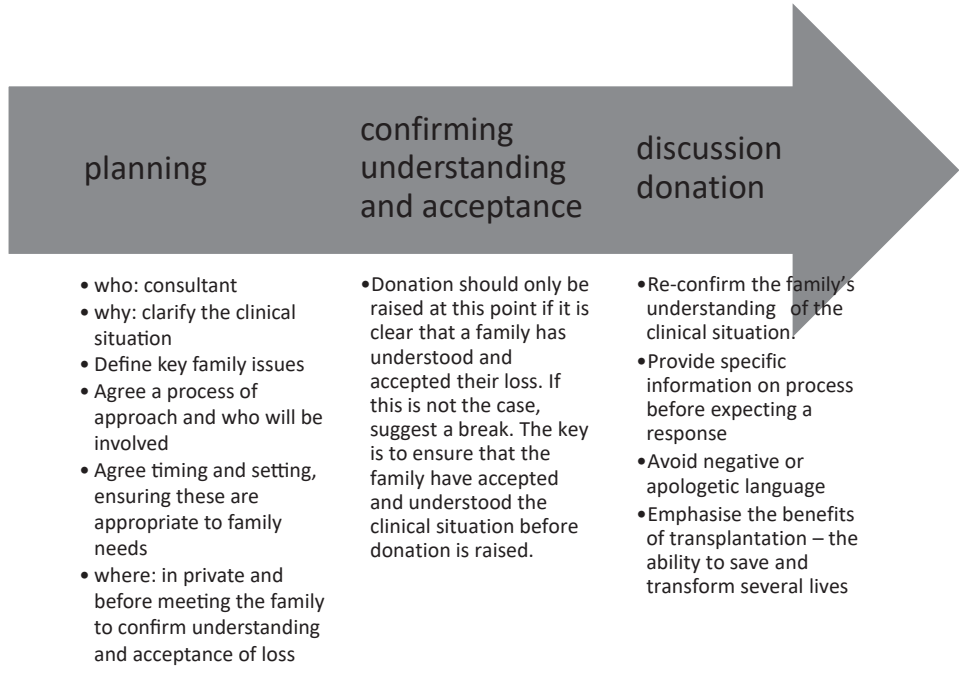

Figure 1. Approaching the families of potentials organ donors [15]

In circumstances when the patient has the capacity, she/he is able to provide the consent for the organ donation. If the patient lacks of the capacity decision making is based on the patient's best interest which consider patient's believe, feelings, opinion and wishes which the patient has previously shared with the family as well as- the family's wishes. Check the statement on NHS Organ Donor register to establish if the patient registered and recorded the consent. Explore with the family/closed to the patient what was the patient's view for an organ donation [10,11].

Approaching the family of potential donor

A multidisciplinary team (MDT) should be responsible for planning the approach and discussing organ donation with those close to the patient. The MDT should include the medical and nursing staff involved in the care of the patient, the specialist nurse for organ donation (SNOD) and local faith representative where relevant [10]. Prior to initiating a family approach the consultant, SNOD (Specialist Nurse for Organ Donation) and bedside nurse/nurse in charge should meet in private to discuss and outline how the request process should proceed. This is a key stage in the process, allowing time for clinical issues to be clarified, the patient's donation potential to be assessed and the implications of organ retrieval to be understood. Time to find out evidence of prior consent/self-authorisation such as registration on the Organ Donor Register should be determined. It also provides opportunity for next-of-kin and key family members to be identified and specific family issues to be understood.

SN-ODs receive detailed training in communication and family support, and are thereby able to recognise and avoid factors that inadvertently and unnecessarily lead to a family refusal. Involving the specialist nurse early in the process gives time for a relationship between the family and SN-OD to develop and for these factors to be addressed. Any request for donation is less likely to succeed if the family have been unable to listen to, understand and assimilate over a period of time the fact that their loved one has died (brainstem death) or that death is inevitable because it will follow the withdrawal or limitation of life-sustaining treatments. Put another way, a family that has yet to understand and accept their loss are unlikely to countenance any discussion of post mortem procedures such as organ retrieval. In short, donation should not

be discussed until the family has accepted the reality of the clinical situation [11].

Clinical management of organ donors

Caring for a brain dead potential organ donor is therefore major challenge for nurses and physicians. The pathophysiological changes following brain death entail a high incidence of complications including hemodynamic instability, endocrine and metabolic disturbances that jeopardize potentially transplantable organs. The knowledge of the complex physiologic changes is crucial to the development of effective donor management strategies. The widespread physiological changes that follow brain death entail a high incidence of complications jeopardizing potentially transplantable vital organs. Adverse events include cardiovascular changes, endocrine and metabolic disturbances, and disruption of internal homeostasis such as blood coagulation and hydro-electrolytic balance brain death also upregulates the release of proinflammatory molecules. Strategies for the management of organ donors exist and consist of the normalisation of donor physiology. It should reflect optimum ICU care so should be continued beyond the observation of brain death, continued invasive monitoring, adherence to infection control procedures, aggressive treatment of arrhythmias and electrolyte imbalance, hygiene needs, regular patient repositioning, and the presence of nursing staff [16-18].

Recommendations for treatment and points of debate

- **Cardiovascular system**

The goals of management for the donor's hemodynamic status are to achieve normovolemia by volume expansion, maintenance of blood pressure, and optimization of cardiac output so as to reach perfusion pressure and blood flow gradients that promote organ function with the least support of vasoactive drugs. These compounds often represent a vasoconstrictive load potentially inducing organ ischemia. Standard targets for donor's management:

1. Mean arterial blood pressure 60-70 mmHg
2. Urine output 0.5-3 mL/kg/h
3. Central venous pressure 8-12 mmHg,
4. Heart rate 60-120 b/min, Hb >10 g/dL)
5. Left ventricle ejection fraction at least 45%
6. Maintain central venous oxygen saturation ($ScvO_2$) >70%
7. Monitor for and aggressively treat diabetes insipidus and hyperglycemia
8. Consider antibiotics for possible or documented infections

In addition, donors need to be considered for volume expansion therapy (crystalloids and/or colloids), the use of vasopressor drugs at the lowest possible dosage (dopamine, noradrenaline), and inotropic support (dobutamine) if cardiac failure occurs. Although not always evident, brain death is associated with a massive increase in catecholamine levels (the sympathetic/autonomic storm) sometimes resulting in increased heart rate.

Regardless of whether the systemic arterial pressure is low or high, the donor is usually hypovolemic. Brain death-induced physiologic changes lead to an increase in capillary permeability and create a functional intravascular hypovolemia because of increased fluid loss (i.e., mannitol, other diuretic therapy, or diabetes insipidus). This hypovolemic state is difficult to assess without monitoring central venous or pulmonary artery occlusion pressures. Central venous pressure (CVP) monitoring is should be mandatory [19-21].

- **Endocrine system**

Endocrine abnormalities occur frequently with severe brain injury and brain death. The most frequent and almost immediate manifestation is diabetes insipidus due to loss of antidiuretic hormone incretion secondary to supraventricular and paraventricular hypothalamic nuclei ischemia. The kidneys are unable to concentrate urine and excrete large amounts (4 mL/kg/h) of dilute urine (specific gravity: 145 mEq/mL, which is common and sometimes severe and progressively worsening) associated with rising serum osmolality and hypovolemia. Debate continues over the value of T3 replacement. Practical difficulties identifying the subgroup of patients with decreased free T3 have led to most transplant units empirically commencing T3 infusions in all potential organ donors. Early studies showed that Liothyronine (T3) as part of a package of measures was associated with increased numbers of organs retrieved and improved organ function post-transplantation. High dose methylprednisolone 15 $mg \cdot kg^{-1}$ is commonly given as part of the hormone package to diminish the inflammatory response [22-24].

- **Respiratory system**

More than 30% of the lungs theoretically suitable for donation are not actually harvested because following brain death, they often develop severe hypoxemia and an abnormal chest X-ray reveals them to be unsuitable. The association between the brain death process and subsequent pulmonary dysfunction is well recognized. Severe brain injury resulting in brainstem death is characterized by the release of proinflammatory mediators in the systemic circulation. If the lungs are to be transplanted, the FiO_2 should be kept at or below 0.4 to minimise the risks of oxygen toxicity. A modest level of positive end expiratory pressure (PEEP) < 5 cm will prevent alveolar collapse. Strict asepsis should be continued during physiotherapy and tracheal toilet. Physiotherapy should include regular two-three hourly side-to-side turning. The transplant team may request an up to date chest x-ray.

Suitable goals for respiratory support are:

- Maintenance of normocapnia ($PaCO_2$ ~ 5.0-5.5 kPa)
- Ventilation with the lowest FiO_2 to maintain PaO_2 of >10.0 kPa
- PEEP > 5 cm H_2O may reduce cardiac output and is rarely required
- High inspiratory pressures should be avoided [25-27].

Renal support

Hypotension is associated with acute tubular necrosis and failure of transplanted kidneys. Although low dose dopamine is now unfashionable in the general critical care setting, there is some evidence that donor pre-conditioning with dopamine improves initial graft function after kidney transplantation.

Nursing and psychological care

Nursing staff working in critical care areas play a key role in caring for potential organ donors and their families. The complex care required by these patients and families has been described as emotionally demanding and stressful. The donor's family, friends and carers will require considerable psychological and pastoral support. The circumstances of the donor's death may engender feelings of remorse, guilt or even anger. Nurses may have difficulty caring for a patient in whom death has been declared when previously care was directed at saving life. Explaining futility of care to families and friends is difficult. The attitudes and actions of nursing staff will significantly affect the family. Effective documentation and communication between medical and nursing staff is vital to ensure the families of organ donors are supported and kept well informed of the progress of events [28,29].

Controlled Non Heart Beating Organ Donation

Initially considered as marginal donors, improved techniques of organ preservation and assessment of function before transplantation have resulted in outcomes (in the case of kidney transplants) to rival those achieved after transplantation of kidneys from heart beating donors. An international meeting on non-heart-beating donation held in Maastricht in 1995 identified four categories of potential non-heart--beating organ donors, to which a fifth one which has recently been added [30]. These may be described as either uncontrolled (Categories I/II and V) or controlled (Categories III/IV) donors [31] (table V).

Table V. The modified Maastricht classification of non-heart-beating donors [30]

Category I.	Dead on arrival
Category II.	Unsuccessful resuscitation
Category III.	Awaiting cardiac arrest
Category IV.	Cardiac arrest in a brainstem dead donor
Category V.	Unexpected cardiac arrest in a critically ill patient

Controlled non-heart-beating donation in the critical care unit involves mainly Category III patients, and may increasingly be appropriate for Category IV patients. Both allow organ retrieval to be planned, warm ischaemic time to be minimized and organ outcomes optimized. Category III patients will usually be in a critical care unit, but occasionally in the accident and emergency department, and usually represent patients in whom it has been decided that further active treatment is futile [31].

A decision to withdraw or limit active treatment in critical care is common in UK practice where such decisions are made in 12% of all ICU admissions. The decision to withdraw treatment should be made in accordance with current guidelines from the ICS, BMA and the GMC. There must be consensus among the critical care consultant, the patient's relatives, the

referring consultant and nursing staff that the decision is made in the patient's best interest. However the ultimate responsibility for the decision and its timing rests with the responsible critical care consultant.

Once a decision to withdraw treatment has been reached the current level of support should continue until the time to withdraw treatment is agreed with the relatives. It is inappropriate to escalate current treatment, add new therapies (e.g. inotropes, heparin, hormone replacement) or to undertake invasive interventions (e.g. vascular cannulation before death for cold perfusion) to improve organ viability. However with the agreement of the relatives it is reasonable for blood samples to be taken from an indwelling line for tissue typing and serology purposes. The appropriate time to withdraw treatment is influenced by many factors but the wishes and needs of the patients' relatives are the main determinants. Although the donor transplant co-ordinator may be present during withdrawal of treatment if the family find it helpful, it is inappropriate for the retrieval team to meet the family except at the family's request. Communication with the family should remain the responsibility of the critical care team and/or the donor transplant co-ordinator/SNOD. Withdrawal of active treatment should proceed in accordance with the usual practice of the critical care unit. This may include stopping artificial ventilation, supplemental oxygen, inotropes, extubating the patient, and commencing the infusion of opioids or sedatives to ensure that the patient is pain free and not distressed. Withdrawal of active treatment should not vary from local practice because organ donation is being considered. Withdrawal of active treatment should usually take place within the critical care unit. In exceptional circumstances treatment may be withdrawn within the theatre complex (e.g. an anaesthetic room, recovery area). This should be undertaken only as a way of meeting the patient's and relatives' wish to donate organs and not simply as a means of reducing warm ischaemic time. The same level of critical care nursing skill and expertise in the care of the dying patient should continue to be provided if treatment is withdrawn outside the critical care unit [12,27,29,32,33].

As an experienced critical care practitioner I can state that looking after the potential donor on the ITU requires a multidisciplinary team effort. It's not only about care for the patient but also family and others closed to them. Usually the circumstances are very motive and family require lots of reassurance and psychological support. The bedside nurse is usually the one who coordinates the whole process. It's nurse's responsibility to recognise the family's needs and facilitate as much as we can. Some of the families are more difficult than the others one but the whole effort is rewarded in two simple words 'thank you'. You can't be more proud of yourself when you get the message that we found recipients and saved some someone's life. Because there is nothing more precious and beautiful then human life so enjoy every single minute of your life because you don't know how long does it last for.

Conflict of interest
None

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