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Guest editorial

Transplantation using lung lobes from living donors

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Introduction

At present, in the UK, live lobe donation of the lung is generally considered in the context of patients with cystic fibrosis (CF) which is a life-threatening, inherited disease.¹ However, if this technique is successfully developed it may be applicable to other patients with end stage lung disease. Cystic fibrosis is a disease where the major morbidity and mortality is due to pulmonary infection and respiratory failure.² In 1938 70% of patients born with CF died within one year of birth, but now the average survival has improved to 32 years.¹ The improved survival has been due to improved medical care, but also, and in very large measure, to the devotion of the families who have carried out time-consuming daily treatments such as chest physiotherapy, nebuliser treatment, high calorie diets etc. To these patients and their families lung transplantation brought new hope.³ The first successful transplant for CF was performed in the UK in 1985 and we now have patients alive and well more than ten years after transplantation. However, sadly, nearly 50% of patients with CF die on the transplant waiting list because of a shortage of donor organs from brain stem dead donors. This is a tragedy for the individual patient, the families and those who care for them. Is there a way forward?

Can the number of organs available for transplantation be increased?

Education of the public so that a relative of a brain dead individual will give permission for the organs to be used has been carried out for many years but only with a small increase in the number of available organs. "Required request" where doctors would be required, by law, to ask relatives of brain dead patients to consider transplantation and "assume consent" where consent to donation is assumed unless there is evidence to the contrary, do not have the support of our politicians. Personally, the author cannot see why "required request" is not brought in. Doctors are required to notify cases of tuberculosis, and to notify patients who die of mesothelioma. Why can they not be required to request relatives to consider organ donation? As long as this request is made sensitively and without coercion there might be a slight increase in the number of available organs. Transplantation from animals is

still some way off. There is a theoretical risk of transmission of infection and some people find animal organ transplantation offensive. Human to human transplantation provides a great challenge to prevent organ rejection, particularly when dealing with the lung, and this would be of a different order if one was transplanting between species. Family members have donated one kidney to save a loved one who is dying of renal failure for many years. Transplant results may be better than those from brain stem dead donors as the tissues are from genetically related individuals, for example a parent, cousin, sister, brother, uncle, aunt, nephew or niece. It is against this background and being faced with dying twenty to thirty-year-olds that clinicians have considered the use of living lung lobe donors for patients with end stage cystic fibrosis.

Living lobe donation for patients with CF

The first successful transplant using lobes from living donors was carried out by Professor Starnes in the USA.^{4,5} In 1996 he reported a 75% one-year survival rate for 20 CF patients who had had lung transplants from living lobe donors. This is a similar rate to that for conventional transplantation. There were no reports of mortality in the donors. The major advantage of a living lobe transplantation for patients with CF is that the patient gets a transplant instead of a 50% chance of dying on the waiting list. It is likely that about 25% of patients with CF have family members who are willing and able to donate organs. Humans have five lung lobes and the patient receives one lower lobe from each of two donors. The donor is left with four lung lobes. The recipient has both his/her diseased lungs removed and receives two new lung lobes, one from each of two donors. However, the lung function of these recipients at two years is comparable with those receiving conventional transplantation from a brain stem dead donor with five lobes. The tissue transplanted from a living donor is deprived of its blood supply for a shorter period of time than when a brain stem dead donor is used. In the latter situation there is always delay, sometime of three to four hours, while the tissue is being transported from the donor hospital to the recipient. The use of lobes from a living donor also has the advantage that the operation can be done electively during the day, not

in the middle of the night as an emergency, as so often happens with transplants from brain stem dead donors. Patients who receive genetically related transplants also appear to have fewer problems with obliterative bronchiolitis. This is a condition which causes a lot of morbidity in patients receiving conventional lung transplantation and it is thought to be a form of chronic rejection of the transplanted tissue.

How should a living lung lobe transplant be arranged?

The laws on transplantation differ from country to country and must be obeyed. In the UK the Human Organ Transplant Act 1989 allows someone to donate all or part of an organ to a close blood relative—a live organ donation. People who are not close relatives, for example, friends, spouses, Godparents etc, may also donate but this needs the prior approval of the Unrelated Live Transplant Regulatory Authority (ULTRA).

Initially surgeons found this a difficult operation to contemplate. Surgeons usually operate on sick patients with the hope of making them better. In this situation they are being asked to operate on two fit people, leaving them with four, instead of five, lung lobes, in the hope of saving the life of a critically ill third person. However, after much thought and consideration, including discussion with the ethics committee, the team at Royal Brompton and Harefield Hospitals thought they no longer had a right to refuse. There was also considerable pressure brought by the relatives of sick CF patients for this procedure to be made available. The first living lobe transplant for CF in the UK was performed by Professor Magdi Yacoub in July 1995, at Harefield.

It is essential that potential donors are of the correct blood group and this excludes some family members. These relatives may be distressed because they cannot help to save a loved one's life, but their motivation can be tactfully diverted to supporting the patient and those who are going to make a donation. Donors must have extensive counselling to make sure they understand the risks, both in terms of morbidity and mortality. The risks are small but should be spelt out in detail and written information given to the donor. The results of previous surgery for living lobe donation should be discussed. All donors will experience some post-operative pain and will have a chest tube in situ for at least a few days after the operation. The chest tube is usually only in place for one to three days but the occasional donor may have a chest tube for as long as three weeks. There is also a risk, again small, of postoperative infections and other, rare, postoperative complications. As this is a new procedure it is impossible to give exact estimates as to risk. Nobody who has donated a lung lobe in the USA or UK has died. In the UK no donor has experienced major or life-threatening complications. We know, however, that all general anaesthetics and surgery have some risk and removal of a lung lobe for cancer has a mortality rate of about

one per cent. If donation of living lung lobes becomes widespread then eventually a donor will die. A donor with four lung lobes instead of five lung lobes will have less exercise tolerance for competitive sports, but will be able to live a normal life in all other respects. If, however, he/she later develops severe chest infection or lung cancer he/she will have less lung tissue in reserve.

Potential donors should understand that they can change their minds at any time during the assessment process and that the reason for them being considered not suitable as a donor, ie medical, psychological, or change of mind, would not be given to the other members of the family or potential recipient. The reason why the individual wishes to donate must be explored. No money, or other reward, must be involved. The reason given is usually to see a loved one survive, or at least have a better quality of life for a period—surely an admirable motive. All potential donors are assessed by an independent medical assessor who is not responsible for the donor and is not part of the transplant team. They are also seen by a psychiatrist, who interviews them and also, if appropriate, their spouse. It is the job of these independent colleagues to make sure the potential donor has fully understood the risks and to explore again the person's motivation. It is important that potential donors realise they can make this generous gift only once, and that the patient may still die. This is particularly important when there is more than one affected child in the family. It must be emphasised that a parent can only do this once. Potential donors should understand there is 20–30% mortality in lung transplant patients in the first year, although approximately 70% of patients receiving conventional transplantation do well, with greatly increased quality of life and a chance of survival for ten years or longer.

What are the ethical dilemmas?

Young people are dying because of the shortage of donor organs. Do the physicians have the right to say no to those who love them and wish to donate an organ to help save their lives? We think not. Not all patients have family members who are fit enough and willing to donate organs, but if 25% of patients could be treated in this way there would be more brain stem dead donors for other patients on the waiting list. It is essential that no pressure is put on a family member either by the patient, another family member or members of staff. When preparing a patient for routine transplantation we inform the patient that this option is available without pushing the issue. The family members then come to us and ask to discuss it and we take the matter further. We are always extremely cautious if one family member volunteers another, as sometimes happens! If a spouse is not happy, then we would not be happy to accept that potential donor. We think it is important that the family are in agreement in matters as important as this. Some patients do not want their loved ones to take this risk for them and this decision must, of course, be

respected. However, some patients will find this option acceptable but would not want to consider the question of receiving an animal organ, should this one day become available.

What is the risk to the donor? Doctors are trained to cause patients no harm and indeed many of our team were initially reluctant to become involved. However, have doctors the right to "play God" and prevent, say, two parents attempting to save their child's life? If the risk is minimal and the donors are fully informed this is, in my judgment, acceptable. As it is a new procedure the exact risks of mortality are not known but they are probably less than one per cent, and when the surgical team has become more experienced the risks may be similar to those involved in donation of a kidney from a living donor.

In performing living lobe transplantation the surgeons are respecting the autonomy of the potential donors to risk their lives to try and save the life of another. It is essential that the autonomy of the medical team is also respected and if they consider a potential donor to be at significant risk as a result of the medical tests then they must have the right to say no to a particular donor. The medical team must uphold the principle of minimal risk.

Potential donors may receive some benefits which were initially unexpected. When we assessed our first 20 potential donors, three of them who were asymptomatic were found, as a result of the intensive medical tests, to have serious medical conditions requiring urgent treatment. One potential donor needed immediate cardiac surgery for blocked blood vessels to his heart. He has now made an excellent recovery and the son he was trying to save has had a successful transplant from a brain stem dead donor. The son is also now in good health.

Some donors are very grateful to have been given the opportunity to try and save their loved one. This is understandable when the operation is successful, but we have even had expressions of gratitude for being given the opportunity from relatives who have lost their loved one. They have been grateful to be allowed to make this last attempt to help them.

A survey of renal transplant centres in the US showed that 88% of 126 centres accepted spouses, and 83%, friends, as potential donors.⁶ The altruistic stranger is a real challenge.⁷ What is the motive? Is money involved? Does the prospective donor have some psychopathology or is he or she perhaps a genuine altruist? As this is a new procedure, with the risks and benefits not yet fully documented, we consider that all donors should be over 18 years of age. With younger children there is always the risk of parents exerting pressure on younger siblings.

Given the intensive investigations and counselling described above and compliance with the legal requirements in a given country, the author can see no objection to living lung lobe donation. Indeed, to give something one can do without, at minimal risk to oneself, which can save the life of another human being, seems to be entirely acceptable from both a modern secular ethical point of view and also from a Christian viewpoint.

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