Ethical, Financial, and Policy Considerations in Hand Transplantation

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KEYWORDS

• Hand • Transplantation • Ethics • Immunosuppression
• Financial • Program

In 1964, surgeons in Ecuador attempted the first hand transplant. However, this transplant was performed without the availability of modern immunosuppression, and the allograft was rejected in approximately 2 weeks. Although the next attempt to transplant a human hand was 34 years later, interest in the transplantation of composite tissue allografts continued in the laboratory. Advances in understanding of the immunology related to composite tissue allotransplantation and improved immunosuppressive medications, coupled with success in the clinical transplantation of organs such as lung and intestine, led surgeons to believe that the time was right to revisit clinical transplantation of the human hand.

The first successful hand transplant was performed on September 23, 1998, in Lyon, France. The recipient was a 48-year-old man who, in 1984, lost his right forearm in a saw accident.[1,2] Although initially the transplant was a success, the patient was noncompliant with his immunosuppression, resulting in multiple episodes of rejection, and he ultimately sought to remove the rejected allograft in 2001. This incident highlighted the importance of improving the selection process and revealed the psychological stresses experienced by a hand transplant recipient. Despite this initial setback, there have now been, according to the International Registry on Hand and Composite Tissue Transplantation, 49 hands transplanted onto 33 recipients.[3]

The 1-year graft survival on current immunosuppression has been excellent, and long-term survival is promising, with the longest surviving hand transplant now greater than 12 years.[3] In addition to allograft survival, reports have documented the return of varying degrees of motor function and sensation, and functional magnetic resonance imaging studies have shown cortical reintegration of the transplanted hand. The early success of hand transplantation has led some to consider hand transplantation as a standard of care for bilateral hand amputees. Hand transplants have now been performed at multiple institutions around the world and there is increasing evidence of the therapeutic and psychological advantages of these transplants compared with traditional options for upper limb amputees.

The success of the emerging field of reconstructive transplantation, in general, and hand transplantation, in particular, depends on the continued reevaluation of the critical nonsurgical issues such as the ethical and financial viability of hand transplantation. There are still critics who argue the ethics of transplanting a nonlifesaving organ such as the human hand. In addition, some investigators have suggested that hand transplantation may not be a cost-effective treatment of hand amputees (especially in unilateral cases). This article examines the critical issues surrounding the ethical justification and financial support for transplantation of the human hand. In addition, the importance of establishing rules and regulations to ensure the safety and continued viability of this exciting area of surgery is discussed.

ETHICAL CONSIDERATIONS

Hand transplantation, like any operation, is subject to a set of ethical guidelines. The ethical discussion for hand transplantation focuses on the following principles: risks versus benefits, nonmaleficence

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versus beneficence, paternalism versus autonomy, and informed consent.

Risk Versus Benefit

One of the central arguments against hand transplantation is that the risks of transplantation imposed on the recipient exceed its benefits. To truly grasp this concept, the risks and benefits of the procedure must be clearly defined and delineated.

In solid organ transplantation, such as liver, heart, and lung transplantation, the graft is essential for survival. Physicians rarely hesitate when faced with these life-sustaining operations. However, making decisions about hand transplantation is more complicated. The patient without a hand is not faced with the choice of receiving a transplant or dying, unlike potential recipients of solid organs such as liver. Transplantation of the hand is not essential for survival, and the act of undergoing hand transplantation has the potential to increase the recipient's chance of mortality. In addition, the value of hand transplantation can only be determined based on the quality of life derived from the procedure rather than the quantity of life added after a life-sustaining transplant.[4]

Thus, the critics of hand transplantation maintain that, given the level of risk, the mere improvement of the quality of life without the addition of quantity of life may not be an ethical bargain. Proponents acknowledge that hand transplantation is not lifesaving, but point out that other transplants, such as renal and pancreas, may also not be lifesaving.[5] Renal patients can be maintained on dialysis and, hence, do not absolutely require a renal transplant to preserve their quantity of life. Most physicians express few ethical concerns about transplanting a kidney to improve quality of life despite the risks. However, some of these same physicians question the validity of hand transplantation despite it being based on a similar exchange of risk for improvement of quality of life. What can account for this difference in attitude?

The defined risk to the recipient of a hand transplant is largely based on the need for long-term immunosuppression. The surgery itself carries particular risks, but most of the risk results from the patient's exposure to lifelong multidrug maintenance immunosuppression. Clearly, the transplant literature has shown that immunosuppression predisposes recipients to infection and malignancy. Along the same lines, reports also show development of malignancy and unique transplant-related problems such as posttransplant lymphoproliferative disease (PTLD). The medications themselves have side effects including hypertension, diabetes, nephrotoxicity, and Cushing syndrome.[6] Thus, some argue that administration of immunosuppression after hand transplantation is more likely to shorten life rather than prolong it.[7] These critics argue that potential hand recipients are, at baseline, generally healthier than solid organ transplant recipients and that subjecting them to the risks of immunosuppression does more harm than good.

The risks derived from the use of chronic immunosuppression may be more significant when an operation is performed that does not result in prolongation of life. This increase in risk rather than benefit may make the operation unethical, which is best illustrated by a case report published by Benatar and Hudson[8] where 2 children, aged 3 and 4 years, both lost their hands. After careful deliberation, it was decided not to perform hand transplantation in these 2 children. The surgeons believed that, although these children would benefit from hand transplantation from a functional standpoint, the chronic exposure and complications of immunosuppression at such a young age posed too much of a risk to justify the operation. However, this example is problematic because it complicates the calculation of risk and benefit by introducing the issue of performing these transplants in children.

The supporters of hand transplantation have argued that the risks of immunosuppression can be minimized with careful monitoring in the adult population. Remarkable progress and understanding in transplant immunology has taken place in the past several years. Newer immunosuppressive agents continue to expand the arsenal of medications and replace older, more risky agents. Combining and adding different medications may allow a decrease in the overall concentration of a single drug, effectively limiting its potential toxicity.[9] In addition, the good health status of hand transplant recipients may be a benefit when they are followed for possible side effects. The process of extrapolating the risks facing patients receiving hand transplants from those seen in solid organ studies where recipients are much sicker likely overestimate the risks.[9] Proponents of hand transplantation point out that the transplant does offer benefit in the restoration of self and the presence of a sensate hand. These benefits allow a hand recipient to integrate back into society and, in some cases, successfully return to work.[10]

Principles of Nonmaleficence Versus Beneficence

Given these risks, who ultimately chooses: the patient or the surgeon? This introduces the second critical concept of the principles of nonmaleficence