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Case Report

The helpful twin: Skin graft donation in a challenging burn case

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ABSTRACT

Objectives: This is the first report of a successful skin grafting between monozygotic twins in the United Kingdom (UK). We discuss the process of assessing the suitability of the patients for the procedure, gaining approval and extraordinary funding from the relevant bodies, developing a new protocol within the trust and the logistics of carrying out the procedure safely.

Methods: We describe the case of a 61-year-old paraplegic woman with insensate legs who presented with a 5-week old 2% TBSA deep dermal to full-thickness scald burn which was sustained accidentally in the shower. In view of the prolonged healing time and the risk of burn wound infection, skin grafting of the wound was the recommended treatment. However, given the high risk of impaired wound healing in denervated skin of quadriplegic individuals, the patient was warned of potential donor site wound healing problems. This, along with concerns over the donor site area interfering with the use of her mobility aids prompted her homozygotic twin sister to donate the necessary skin. The process was risk assessed and approval was sought from the Trust's Caldicott Guardian, NHS Specialist Commissioners and the Trust's Human Tissue Authority (HTA) Designated Individual (DI). A new protocol for the pathway in line with HTA guidance was developed. Specific patient information documents were written, psychological assessments performed and specific consent for skin donation undertaken. One week prior to and again on the day of the procedure, the donor was serologically screened for communicable diseases. A donor medical and social history assessment was also carried out.

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Results: There was 100% graft take at day 5 post-surgery. The sister's donor site healed well by day 13. At 3 months, there were no signs of hypertrophic scarring. No additional outpatient or dressing clinic appointment were required.

Discussion: This is the first case of successful skin homografting between monozygotic twins in the United Kingdom. Donation of skin grafts between such patients, however, requires clinical justification, twin zygosity DNA testing, approval from the HTA and NHS commissioners with appropriate protocols and procedures in place to ensure patient safety. Liaising with the local Tissue Bank can facilitate this process.

Conclusion: Skin grafting between identical twins is a feasible and successful procedure and offers an alternative treatment modality when wound healing in the recipient twin is suboptimal or when severely burnt. This principle should also be considered, in appropriate cases, for composite tissue transfer in situations where complex reconstructions are required.

Introduction

The standard treatment for deep dermal and full thickness burns is debridement of the burned skin and dressing with split thickness skin graft harvested from a non-burned area with the anterolateral thigh being a common site. However, skin graft donor sites can be problematic and lead to morbidity especially in those with reduced sensation or co-morbidities where wound healing may be impaired.[1] Donation of skin from a healthy homozygotic twin may avoid these issues in certain cases.

Successful skin grafting between homozygotic twins was first reported by Bauer in 1927.[2] The procedure has since been successfully replicated in select identical twin patients (often severely burned) in various centres around the world.[3–8] Tissue rejection was not encountered in any of the reported cases and recipients did not require immunosuppression.[9]

We describe the first case of skin grafting between homozygotic twins in the UK and discuss the implications for more complex reconstructions.

Case presentation

A 61-year-old paraplegic woman with insensate legs presented to the burns unit at Queen Victoria Hospital with an isolated 5-week old scald burn which was sustained accidentally in the shower. Clinical assessment revealed a non-infected 2% TBSA deep dermal to full-thickness burn with an eschar on the postero-medial aspect of her left leg (Figure 1). In view of the prolonged healing time and the risk of burn wound infection skin grafting of the wound was considered as the primary treatment.

However, given the high risk of impaired wound healing in denervated wounds of quadriplegic individuals,[3] the patient was warned of potential donor site healing problems if the skin graft was harvested from her thighs. Although other sites in areas that had sensation (and therefore a higher chance of complication-free healing) were considered, the patient felt that these may interfere with the use of her wheelchair and hoist. Instead, she proposed that her identical twin sister could donate the necessary skin. In view of the complete histocompatibility between homozygotic twins (confirmed previously) and full engagement of the able-bodied twin sister with this process, it was agreed to plan a skin graft from one sister to the other.

Figure 1. Clinical appearance of the 5-week old scald burn at presentation.

The process was risk assessed and approval was sought from the Trust's Caldicott Guardian, NHS Specialist Commissioners (to seek extraordinary funding) and the Trust's Human Tissue Authority (HTA) Designated Individual (DI). Guidance was also sought from the HTA. The donation procedure was carried out under the Trust's existing HTA license but as this was a unique case for the hospital several issues had to be addressed: a new protocol for the pathway in line with HTA guidance was developed, specific patient information documents were written, psychological assessment performed and specific consent for skin donation undertaken. The donation, screening and consent protocols for living related tissue donation were developed in conjunction with the Trust's HTA Designated Individual. One week prior to and again on the day of the procedure, the donor was serologically screened for HIV, Hep BsAg, Hep B core, Hep C, HTLV, and Syphilis. Nucleic acid testing for HIV RNA, HBV DNA, HCV RNA and HEV RNA was also done.

A donor medical and social history assessment was carried out along with a medical history questionnaire completed by the donor's GP to identify any additional risk of disease transmission which would preclude donation. The questionnaires were reviewed by the DI prior to the tissue donation. It was confirmed by the Living Donation Assessment Team (LDAT) at the HTA that the donation of living related allogeneic skin falls outside of the authorization requirement for Accredited Assessor (AA) and Independent Assessor (IA) pathways. However, it was decided as best practice prior to donation for both donor and recipient to be independently assessed by the Trust's psychological therapy team to ensure participation was autonomous and not coerced. Informed consent to the procedure was gained from the donor by the Trust's tissue donation coordinator who is trained in donor consent. All documents were included in the Trust's quality management system and records of the transplant are to be held for 30 years.

Although this process took several weeks, it allowed optimum wound bed preparation and exclusion of infection with appropriate dressings (Figure 2). It also gave time to the patient and her sister to be fully informed and assessed for the procedure.

On the day of surgery, the skin graft was harvested with a dermatome from the donor twin's thigh under local anesthetic, meshed to a ratio of 1.5:1, stored in saline soaked gauze for the theater turnover time (approximately 30 min) and secured onto the recipient twin's burn wound with dissolvable sutures. At day 5 post-surgery, there was 100% graft take (Figure 3). The sister's donor site healed well by day 13. At 3 months, there were no signs of hypertrophic scarring (Figure 4). No additional outpatient or dressing clinic appointment were required.

Discussion

This is the first case of successful skin homografting between monozygotic twins in the United Kingdom. The transplantation of skin from the willing isogenic donor resulted in complete healing of the burn wound in the quadriplegic patient. Donation of skin grafts between such patients, however, requires clinical justification, twin zygosity DNA testing, appropriate HTA licenses, and approval from the HTA and NHS commissioners. Specific protocols and procedures must be in place to ensure patient

Figure 2. Clinical appearance of the burn prior to grafting.

Figure 3. 100% graft take 5-days post-surgery.

Figure 4. Clinical appearance of the grafted burn wound at 8 months.

safety. Liaising with the local Tissue Bank can facilitate this process by adapting pathways already in place for other forms of tissue donations (e.g. live and cadaveric allogeneic organ and tissue donation).

This case also serves as a reminder of the potential for free tissue transfer (e.g. perforator flaps) between monozygotic twins in the reconstruction of larger wound defects if autologous donor tissue is deficient or wound healing is deemed problematic. Perforator free flaps have gained in popularity, with the DIEP flap representing the gold standard for autologous microvascular breast reconstruction after mastectomy. However, several patient factors including nulliparity, history of failed breast reconstruction, previous abdominal surgery (e.g. abdominoplasty, liposuction) and thin body habitus with little excess abdominal or gluteal tissue may render patients seeking autologous breast reconstruction unsuitable candidates. Where such challenges arise, perforator flap transplantation between monozygotic twins has been shown to be a successful alternative reconstructive option in patients desiring the autologous technique without immunologic barriers.[10] The donor twin is however left without a potential donor site for their own reconstruction should they subsequently develop breast cancer. Adequate counselling must therefore be offered pre-operatively.

Conclusion

Skin grafting between identical twins is a feasible and successful procedure and offers an alternative treatment modality when wound healing in the recipient twin is sub-optimal or if extensively burnt. We provide a summary of what would be required for those considering such a procedure. This principle should also be considered, in appropriate cases, for composite tissue transfer in situations where complex reconstructions are required. This is especially relevant in the context of cancer resections where post-operative immunosuppressive therapy can be avoided. As for ethical concerns, a voluntary uncoerced decision must be made by autonomous individuals once all essential information is given and sufficient time is allowed for deliberation.

The patient gave consent for publishing her medical photographs.

Declaration of Competing Interest

None declared

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Ethical approval

Not required

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