

Compromised Skin Grafts and Flaps

Problem:

Over 1 million people will receive some type of skin graft or flap procedure in 2011. Of these procedures, an estimated 67% may experience some type of complication that will either lead to a costly intervention or failure, and possibly both.^{1,2} Compromised skin grafts and flaps represent a classical problem involving insufficient oxygen supply to tissue.

Skin grafts, by their very nature are hypoxic as they do not include their own blood supply. Skin grafts survive as oxygen diffuses into them from the underlying wound bed. Long-term survival depends on a new blood supply forming; when the wound bed does not have enough oxygen supplied to it, the skin graft will at least partially fail.

Common causes for this lack of oxygen may include previous radiation to the wounded area, diabetes mellitus, and certain infections. Factors such as age, nutritional status, and smoking, can also result in an unpredictable pattern of blood flow to the skin. If the graft is used to cover an area that is affected by these factors, the recipient site will most likely be ischemic and provide inadequate oxygen support to the graft. Thicker grafts demand even more blood supply and require a well vascularized recipient bed to survive.³

Reason:

The exact causes and biochemical processes leading to compromised skin grafts and flaps are actually well understood. To better comprehend these processes, it is important to clarify the differences between skin grafts and skin flaps.

Although each skin flap or graft is unique, inadequate oxygenation of the tissue is the most common factor leading to compromise and/or necrosis.

There are two general categories of *skin grafts*: **full thickness** and **partial thickness**. A full thickness graft contains the epidermis and dermis. A partial thickness graft includes the epidermis and only a small portion of the dermis. They involve a transfer of a portion of the skin without its blood supply as opposed to a *skin flap* which consists of skin and deeper tissues; to include muscle when needed. Flaps are transferred either with their own original blood supply (**pedicle flap**) or with detached blood vessels which are attached at the site of the wound (**free flap**).

There are many etiologies of flap compromise. These can range from random ischemia to venous congestion or occlusion to arterial occlusion. In addition, free tissue transfers describing a flap in which the arterial and venous blood supply is divided and reattached to another location by microsurgical anastomosis can have their own special problems. Free flaps can be exposed to both ischemia-reperfusion injury and secondary ischemic insults which can compromise the viability of the flap.⁴



Photo courtesy of Sechrist Industries, Inc.

Solution:

The **Advanced Wound Center (AWC)** at *Community Anderson* offers a multidisciplinary approach to the management of these complicated wounds. Oftentimes, the amount of care required for desirable outcomes surpasses the resources which any single physician can provide. Wound healing at the AWC is achieved in cooperation with referring physicians, surgeons, podiatrists, and other specialists as required.

When skin grafts/flaps appear to be compromised, the AWC team can offer the patient an adjunctive therapy called Hyperbaric Oxygen Therapy (HBOT). A freshly applied graft or flap receives no oxygen until capillaries from the recipient site can grow into it. Such capillary angiogenesis normally takes place over a two to three day period. However, if this does not happen, it is not likely that the graft will survive. HBOT improves the chances that a graft/flap will succeed by both supplying oxygen and promoting capillary growth. Hyperoxygenation causes an increase in the effectiveness of the blood that reaches the site and increases the oxygen tension in the graft bed and wound margins up to 1500 percent. The high oxygen tensions achievable with HBOT induce large oxygen gradients, increasing macrophage migration, proline synthesis, and neovascularization. Once this occurs, the beneficial effects for organs begins. Among other things, fluids begin to flow to tissues and organs more readily, limiting damage from reperfusion injury.⁵

Hyperbaric oxygen therapy also ameliorates the post operative swelling of grafts and flaps. The anti-edema effect of HBOT improves tissue oxygenation by reducing the distance oxygen must diffuse, and by improving perfusion.

(continued on back)

Hyperbaric oxygen treatments are neither necessary nor recommended for the support of normal, uncompromised skin grafts and flaps. Hyperbaric oxygen can help maximize the viability of the compromised tissue and reduce the need for regrafting or repeat flap procedures. A number of studies have shown the efficacy of HBOT on enhancement of graft and flap survival in a variety of experimental and clinical situations. Salvage rates of 75% for HBOT groups are indicated as compared to 46% for the controls, with near 100% salvage when the patient is treated within 72 hours post-operatively.⁶

Clinical opinion varies as to what constitutes an appropriate timeframe of when to utilize HBOT as an intervention. As indicated previously, the survival of a graft or flap is typically an "acute" condition; many failing or compromised grafts/flaps present within **2 weeks** of the procedure.

CMS (Medicare) approves coverage of HBOT for graft or flap salvage in cases where hypoxia or decreased perfusion have compromised viability. Many policies outline the following provisions for coverage:

- Documented date of skin graft or flap placement, including date(s) of any previous graft/flap procedures
- Documented compromised state of graft site
- Should a graft or flap fail, HBO therapy may be used to prepare the already compromised recipient site for a new graft or flap (this does not apply to the **initial** preparation of the body site for a graft)
- Medicare coverage does NOT apply to artificial skin grafts such as Apligraf, Dermagraft, etc.*

*Always check the HBOT policy (LCD) of your local Medicare payor (MAC) to ensure compliance with both clinical and documentation requirements. In the event a local policy does not exist, refer to guidelines utilized by the Advanced Wound Center.

Treatments are given at a pressure of 2.0 to 2.5 ATA and a range of 90–120 minutes. Consideration should be given to initial BID treatments and then once per day when the graft/flap appears more viable and stable.

The Center for Advanced Wound Healing
Community Hospital Anderson, 4th floor
Phone: 765-298-2121
CommunityAnderson.com/woundhealing

Program Director
Cindy Swisher, MSW
Phone: 765-298-2124
E-mail: CSwisher@eCommunity.com

Referrals:

Patients can be referred to the **Advanced Wound Center** for aggressive, outcome-based wound management. The physicians at the AWC provide specialized care in close coordination with the patient's primary physician. Care includes the application of advanced wound care

Patients can be referred to the Advanced Wound Center for aggressive, outcome-based wound management.

technology and hyperbaric oxygen treatment, as indicated, based on evidence-based clinical pathways. The referring physician will continue to provide overall medical care for the patient and will receive frequent updates on the patient's response to care at the AWC.

A major emphasis of the AWC program is the treatment of wounds in patients with diabetes, compromised flaps and grafts and other types of chronic wounds. Consider referring graft/flap patients when:

- Swelling and/or erythema is present at bed site
- Graft/Flap is cyanotic and/or partially necrotic
- Wound separation (loss of vascularity, fibrin/collagen attachments) occurs
- Any signs/symptoms of infection become evident

Discharge education focuses on patient follow-up with their primary physician, and other specialists as appropriate. In this manner, prevention and/or a rapid response to injury will become a more significant aspect of care for these patients.

References:

1. <http://www.webmd.com/skin-beauty/guide/reconstructive-surgery>
2. Habel DW. "Surgical Complications in Irradiated Patients" *Arch Otolaryngol*. 1967;82:382-386
3. Revis, Don R., Jr., MD, and Michael B. Seagal, MD. "Skin Grafts, Full-Thickness." *eMedicine*, May 17, 2002 [cited June 25, 2003]
4. Gruber RP, Brinkley FB, Amato JJ, et al.: Hyperbaric oxygen and pedicle flaps, skin grafts, and burns. *Plast Reconstr Surg* 1970;24-30
5. Bowersox JCC, Strauss MB, Hart GB: Clinical experience with hyperbaric oxygen therapy in the salvage of ischemic skin flaps and grafts. *J Hyperbaric Medicine* 1:141-149, 1986.
6. Undersea and Hyperbaric Medical Society: *Hyperbaric Oxygen Therapy Indications*; 12th Edition;: 169-177

The Curespot

A Publication of Acelecare Wound Centers

William J. Ennis, D.O. Chief Medical Officer

Michael J. Crouch, CHT Editor

10900 NE 4th Street, Suite 1920
Bellevue, WA 98004
425-974-1200

www.acelecare.com