Wounds, Grafts & Flaps

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Wound

- Wound is: breach of skin/mucosa or loss of integrity of connective tissues (muscles, nerves, bones) or both

- Wounds can be caused by:

*Physical*
- Incision
- Crushing
- Overheating
- Overcooling
- Desiccation
- Irradiation
- Compromised blood flow

*Chemical*
- Agents with unphysiologic pH
- Agents with unphysiologic tonicity
- Proteases
- Vasoconstrictors
- Thrombogenic agents
Wound Healing

• Healing is restoration of tissue integrity

• Healing is a natural & spontaneous process which occurs irrespective of the surgeon

• The surgeon role is to provide the best environment and control the factors for optimal healing

• Healing is affected by many factors
Regeneration Vs. Repair (fibrosis)

Our target but can’t be achieved 100% except in: Bone & Liver tissues

All tissues, can’t be avoided 100% except in bone & liver

• Some tissues can never regenerate: *nerve tissue, cardiac muscle*
• Surgeon's goal is not to prevent a scar, but *to produce a scar that looks fine & causes no loss of function (contracture)*
Wound Care

I. Wound Débridement:

“Cleansing the wound with removal of foreign bodies and excision of necrotic tissues (refreshment)”

- Achieve hemostasis first

- A bloody granulation tissue bed is optimal for healing

- Wound débridement can convert a contaminated or infected wound into a clean wound

- Antiseptics can be used
II. Closure or not?

- Types of Healing:
  1. Primary healing (first intention)
  2. Secondary healing
  3. Tertiary healing (delayed primary)
• **Primary healing** means approximation of a clean wound margins together by sutures or tapes, adhesives, staples, bone plates..

• Primary healing doesn’t mean complete regeneration with no scar (except...)

• For primary healing: *the wound should be vital, clean and blood supply is not compromised*

• **Secondary healing** means to leave the tissue to heal by itself by fibrosis and scarring (repair only), this is not suitable for bone
Options for Primary Healing

- Stitches
- Steri-strips
- Staples
- Gluture
Direct (primary) healing
III. Dressing:

• Objectives:
  1. Controlling the moisture content, so that the wound stays moist or dry
  2. Protect the wound from trauma
  3. Protecting the wound from contamination
  4. Maintaining the optimum pH and temperature to encourage healing

• Dressings can be gauze with plaster or bandages or strips
• Dressings must be changed regularly until aims achieved
Stages of Wound Healing

I. Inflammatory phase (reactive): 3-5 days
II. Proliferative phase (regenerative): 3-4 weeks
III. Remodeling phase (maturation): 1-2 years
Surgical Site Infection (SSI)

- A wound infection that occurs after an surgery
- This occurs when pathogenic organisms multiply in a wound giving rise to local signs and symptoms, for example, heat, redness, pain and swelling, and (in more serious cases) with systemic signs of fever or a raised white blood cell count
- SSI may cause wound dehiscence
• The risk of SSI is markedly increased if a surgical site is contaminated with \( >10^5 \) microorganisms/gram of tissue
Factors Increase Risk of SSI

1. Wound class
2. Age of patient
3. Nutritional status
4. Diabetes
5. Smoking
6. Obesity
7. Malignancy
8. Surgical drains
9. Poor closure
10. Tissue trauma
11. Duration of surgical scrub
12. Preoperative shaving
13. Preoperative skin preparation
14. Length of surgery
15. Length of preoperative stay
16. Operating room ventilation
17. Coexistent severe disease that limits activity
18. Inadequate instrument sterilization
19. Foreign material in the surgical site
20. Coexistent infections at a remote body site
21. Contamination during surgery
22. Surgical technique including hemostasis
23. Immunosuppression (steroids or immunosuppressant drugs)
## Surgical Wound Classification

<table>
<thead>
<tr>
<th>Class</th>
<th>Definition</th>
<th>Risk of SSI</th>
<th>Antibiotics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean</td>
<td>Incision in non-inflamed tissue, without break in sterilization and the respiratory, genitourinary or GI tracts are not entered</td>
<td>1-2%</td>
<td>No</td>
</tr>
<tr>
<td><strong>Clean-Contaminated</strong></td>
<td>Incision in which the respiratory, GI, or genitourinary tract is entered under controlled conditions with no contamination</td>
<td>5-9%</td>
<td>Prophylactic?</td>
</tr>
<tr>
<td>Contaminated</td>
<td>Major break in sterile technique or gross spillage from GIT, or an incision in acute, but non-purulent inflamed area</td>
<td>12-20%</td>
<td>Prophylactic</td>
</tr>
<tr>
<td><strong>Dirty (infected)</strong></td>
<td>Viscera is perforated or when acute infection is encountered, and for traumatic wounds where there is fecal contamination, or necrotic tissue is present</td>
<td>40%</td>
<td>Therapeutic</td>
</tr>
</tbody>
</table>
• Open traumatic wounds that are more than 6 hours old are considered contaminated wounds (except face: 24h)

• Intra Oral surgery falls under clean-contaminated surgery at best and can never be clean surgery

• Prevention of SSI (wound infection) is better than management

• Preventing SSI has 3 phases:
  1. Preoperative
  2. Intraoperative
  3. Postoperative
• **Antibiotic prophylaxis against SSI:**

1. Give antibiotic prophylaxis to patients before:
   • *Clean surgery involving the placement of a prosthesis or implant*
   • *Clean-contaminated surgery (except minor oral surgery)*
   • *Contaminated surgery*

2. Do not use antibiotic prophylaxis for clean non-prosthetic uncomplicated surgery

3. Inform patients before the operation if they will need antibiotic prophylaxis, and afterwards if given

4. Consider giving a *single dose of antibiotic prophylaxis intravenously on induction (anesthesia)*

5. Ensure that *surgery starts within 30 minutes of prophylaxis*

6. Give antibiotic treatment postoperatively (in addition to prophylaxis) for infected (dirty) wound only
7. Give repeat dose of antibiotic prophylaxis (re-dosing) if:
   - The operation is longer than the half-life of the antibiotic given (or every 4h)
   - Major blood loss (> 1500 ml) where the patient received fluid/blood resuscitation

8. Antibiotic prophylaxis is **useless** after incision is made or after suturing

9. Be careful of allergies especially in children with unknown history
Grafts & Flaps

• Tissues can be lost due to trauma or surgery (excision)

• **Missing tissues can be restored by various options:**
  1. **Primary closure** if possible → Ideal
  2. **Secondary healing** (not in the face)
  3. **Grafts:** *skin, gingiva, subcutaneous, fat, nerve, vessels, cartilage, bone*
  4. **Local flaps**
  5. **Regional flaps**
  6. **Distant flaps**
Definitions

- **Graft:** a tissue transferred *without bringing its own blood supply with it* from one site to another on the body (autograft), or from another person (allograft) or from animal (xenograft) or synthetically manufactured (alloplast)

- **Flap:** a tissue is elevated &/or moved from one site to another adjacent or distant site, but *carrying its own blood supply with it*

- **Donor** site Vs. **Recipient** site
I. Skin Grafts

- Skin grafts contain the epidermis and some or all of the dermis

- **Skin Grafts are 2 types:**
  1. **Split thickness skin graft:** epidermis + some dermis
  2. **Full thickness skin graft:** epidermis + all the dermis

- Both contains *capillaries + skin appendages* (hair follicles, sebaceous & sweat glands), more in the full thickness grafts than split thickness grafts

- If deeper tissue is included with the skin (e.g. cartilage) then it will be called: a **Composite Graft**
• Options of harvest of **split thickness** skin graft:
  1. **Manual dermatome**
  2. **Electric dermatome**

  *Donor site is covered with antibacterial cream & dressing, then left to heal which may take 3 weeks (usually without scar)*
Meshing?
• **Full thickness skin graft of a defect in the face** are best harvested from *supra-clavicular area*. Other options: *post auricular, under arm, eyelid*

• **The donor site is closed primarily (sutured)**, If this is not possible: you can graft it with split thickness skin graft
cut out the exact shape of the defect in paper or aluminium foil

draw out the pattern of the defect and mark out the ellipse at the same time
• Skin grafts undergo 2 contractions:
  1. Primary contraction: immediate shrink when harvested
  2. Secondary contraction: later during healing (fibrosis)

- Primary contraction is greater in **full thickness grafts**
- Secondary contraction is greater in **split thickness grafts**

• Graft success ‘*Take*’ depends on:
  1. Vascular bed
  2. No hematoma or seroma (most common cause of failure)
  3. No contamination (bacterial count < $10^5$/g of tissue)
  4. Adherence & contact
  5. Fixation without tension

*(Split thickness grafts can withstand non-ideal environment better than full thickness grafts)*
• Healing of skin grafts:
1. **Serum Imbibition** (*plasmatic circulation*): absorption of serum plasma, lasts 24-48h
2. **Inosculation phase**: capillaries of both the graft & recipient bed are aligned, lasts from 48-72h
3. **Revascularization phase**: starts on day 3-4 but effective on day 5-6, the graft starts to be more red and purple

• **Skin grafts regain sensation** from the sensory nerves of the recipient bed. **Split thickness grafts** are *innervated more quickly* than full-thickness skin grafts, *but not as completely*

**Q. Can we use skin grafts for oral cavity?**

**Q. Can we skin graft an exposed bone?**
II. Local Flaps

• **Local flaps can be:**
  - **Skin flap** (skin + subcutaneous tissue)
  - **Musculocutaneous flap** (deeper, including muscle)

• Local flaps are *still attached to adjacent tissue in its base* through a *pedicle*
• Types of local flaps:

1. Flaps rotating around a pivot:
   a. Z-plasty (Interpositional flap)
   b. Rotation flap
   c. Transposition flap
   d. Interpolation flap

2. Advancement flaps:
   a. Single advancement flap
   b. Double advancement flap
   c. V-Y flap
Z-Plasty

• Creating a Z incisions usually with 60° angles

• Indications:
  1. Re-orient a scar to be more aesthetic (parallel to skin lines)
  2. Contracture release
  3. Lengthening a tissue
• Examples:
Rotation Flap

- A semicircular flap created adjacent to a defect
Transposition Flap

1. Single transposition flap
2. Bilobed flap (double transposition flap)
3. Rhomboid flap (Limberg flap)
• Examples:
Interpolation Flap

• Same idea as transposition flaps but the flap base is away from the defect and the flap pedicle cross over (or under) intact area of skin

• Interpolation flaps usually require 2nd surgery to release the donor site from the recipient site (pedicle division), usually after 3 weeks

• A famous interpolation flap in the face is the: forehead flap to reconstruct the nose
• **Nasiolabial flap** is an important interpolation flap in plastic surgery of the face and in maxillofacial surgery
  - You can reconstruct lip, cheek and nose defects
  - Bilateral nasiolabial flap can reconstruct a whole lip
  - The flap has the advantage of abundant tissue and the scar is hidden in the nasiolabial fold
  - It can be tunneled through the cheek to cover intraoral defects
• **Lip-switch flap** can be used to reconstruct 1/3rd of the lip using the other lip
• **Tongue flap** can be used to close large oroantral or oronasal fistulas
Single & Double Advancement Flaps

• Advancement flaps have a linear configuration and are advanced into the defect along a single parallel vector

• Indicated when the adjacent skin has good laxity and the resulting incision lines can be hidden in natural creases (skin lines)

• Advancement flaps are created by parallel incisions matching approximately the width of the defect

• Helpful in the forehead, lips, and cheek
“dog ears” are usually resulted and are managed with excision
Intraoral uses of advancement flaps include covering oroantral fistulas and alveolar clefts (e.g. **Buccal advancement flap**).
V-Y Flap
III. Regional Flaps (for the face)

1. Pectoralis major flap
2. Deltopectoral flap
3. Temporalis muscle flap
4. Sternochleidomastoid flap
5. Trapezius flap
6. Latissimus dorsi flap
Pectoralis Major Flap

- A reliable method of large soft tissue & hard tissue reconstruction of the face, mandible and maxilla
- Based on 2 arteries

- Internal mammary artery
- Thoracoacromial artery (mainly pectoral branch)
Deltopectoral Flap

- Used as an alternative to the pectoralis major myocutaneous flap for soft tissue reconstruction of the mandible and maxilla
- This flap is composed of fascia, subcutaneous tissue, and skin but does not contain muscle
- The secondary defect is covered with a skin graft
Temporalis Flap

• Useful for covering **intraoral defects**
• An osteotomy of the zygomatic arch is often needed to facilitate placement of the muscle into the mouth
• **Disadvantage** of the temporalis flap is the cosmetic deformity of depression in the temporal region; this can be corrected with autogenous or alloplastic materials
Sternocleidomastoid Flap
IV. Distant Flaps (free flaps)

- Also called ‘microvascular free tissue transfer’

“The tissues are obtained from distant site and separated completely from its donor along with its vessels, then microvascular surgery is done at the recipient site for anastomosis (connection) of the flap vessel with the main vessel of the recipient area”

- **Common free flaps for the facial defects:**
  1. Radial forearm flap
  2. Fibula free flap
  3. Iliac crest free flap
Thank You