

CONTROVERSIES IN DERMATOLOGY

Complications in Dermatologic Surgery

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Abstract. Surgical complications are any deviation from the expected course of the surgical procedure. They occur as a consequence of one or more unexpected events, which can be avoided in the majority of cases through careful planning, a precise surgical technique, and correct postoperative care. Some complications, such as cardiac arrhythmias, anaphylaxis, and cardiorespiratory arrest, are life-threatening whereas others, occurring as a direct result of surgery, can affect the healing process and the final cosmetic appearance of the scar. We must therefore have not only the relevant training in dermatologic surgery, but also in basic and advanced cardiopulmonary resuscitation. In this review we discuss the perioperative measures necessary to avoid the onset of complications in dermatologic surgery and we define the various complications that can develop.

Key words: dermatologic surgery, complications, dehiscence, necrosis, hematoma, infection.

COMPLICACIONES EN DERMATOLOGÍA QUIRÚRGICA

Resumen. Las complicaciones quirúrgicas son desvíos de la evolución esperada en la realización del acto quirúrgico. Ocurren como consecuencia de uno o varios sucesos inesperados que, en la mayoría de los casos, podrían evitarse con una planificación previa minuciosa, una atención máxima durante la cirugía y unos cuidados postoperatorios adecuados. Algunas complicaciones son vitales, como la aparición de arritmia cardíaca, anafilaxia o parada cardiorrespiratoria, y otras, derivadas directamente de la cirugía cutánea, pueden afectar al proceso de cicatrización y al aspecto estético final de la cicatriz. Por lo tanto, no solamente debemos tener una formación adecuada en cirugía cutánea, sino también en reanimación cardiopulmonar básica y avanzada. En esta revisión comentaremos las medidas perioperatorias necesarias para evitar la aparición de complicaciones en la cirugía dermatológica y definiremos las diferentes complicaciones que pueden aparecer tras la misma.

Palabras clave: cirugía dermatológica, complicaciones, dehiscencia, necrosis, hematoma, infección.

INTRODUCTION

Although in the majority of cases complications are not life-threatening, they can affect the healing process and the final cosmetic appearance of the scar, and may lead to superinfection necessitating systemic antibiotic treatment with closer follow-up and a more meticulous care regime than normal. They may also cause necrosis or hematomas that require curettage, debridement, or frequent drainage.

Many surgical complications can be prevented if the dermatologist conducts a preoperative workup (the first stage in surgery) including a detailed medical history and physical examination, thereby identifying potential factors predisposing to poor healing (infections, medical treatment, or previous disease), which can complicate the course of the surgical lesion. The other 2 influential periods affecting skin surgery outcomes are the intraoperative period, in which the careful planning and correct performance of the surgical technique are fundamental, and the postoperative period, both of which are discussed in this review.

Preoperative Workup and Measures

The initial consultation should include a detailed case history and physical examination. We should assess those factors that can lead to deficiencies in the normal

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Table 1. Preoperative Factors That Should be Included in the Case History

<i>Personal History</i>
Age and any protein, vitamin (C and A), or trace element deficiencies
Peripheral vascular disease and arteriosclerosis
Metabolic diseases (diabetes, Cushing syndrome)
Chronic diseases (hypertension, kidney failure, liver failure)
Hereditary diseases (Ehlers-Danlos syndrome)
Previous local abnormalities (radiation therapy)
<i>Usual Medication</i>
Corticosteroids
Cytostatic agents
Oral platelet aggregation inhibitors and oral anticoagulants
Nonsteroidal anti-inflammatory drugs
Penicillamine
<i>Habits</i>
Alcohol
Smoking

coagulation and healing processes (Table 1), and establish the regimen for antibiotic prophylaxis.

Factors That Affect Normal Coagulation

Bleeding disorders are one of the most frequent causes of failure in the final outcome of surgery. These may be caused by defects in the coagulation system, the platelets (due to alterations in production, half-life, or function), or in both systems.¹ Blood tests usually include a simple platelet count, but this only identifies quantitative problems. In daily practice, at least the prothrombin time, which assesses abnormalities in the extrinsic pathway of the coagulation process, and the activated partial thromboplastin time, to detect abnormalities in the intrinsic pathway, are measured.² However, some authors consider it is unnecessary to assess coagulation provided there is no evidence of systemic disease in the case history and examination and the patient is scheduled for a minor intervention.³ In this regard, we understand minor dermatologic surgery to mean a procedure that involves the surface tissues that are easily

accessed (such as skin, mucous membranes, subcutaneous tissue, and skin flaps), with a simple technique using local anesthesia (local infiltration), direct closure of the defect, and minor instrument requirements. In general, this type of intervention is short (15-30 min), although complications are possible, and the postoperative care is simple. When performing other techniques that differ from the foregoing, we are referring to major dermatologic surgery, which is defined as the group of surgical repair methods used to treat accidental or therapeutic loss of skin substance by using skin from the patient or donors. In general, this involves skin flaps and grafts. These procedures require more complex operating room techniques (instruments, personnel, and anesthetics), and greater postoperative monitoring.

Any drugs taken by the patient should be documented. Acetylsalicylic acid (ASA) irreversibly inhibits platelet aggregation by the acetylation of cyclooxygenase. Acetylsalicylic acid should be interrupted at least 5 to 7 days before the surgical intervention and restarted 5 to 7 days later, providing the risk of stroke or myocardial infarction is not high. To a lesser extent, other nonsteroidal anti-inflammatory drugs, such as ibuprofen and naproxen, can cause inhibition, and thus the risk of withdrawing them should also be assessed. Warfarin is commonly used as an anticoagulant. There is a certain level of debate on the recommendation to interrupt it or not before surgery. Many authors consider this is unnecessary, providing two conditions are fulfilled: the international normalized ratio (INR) is maintained below 3, and careful hemostasis is performed during surgery. Nevertheless, in a series of 65 patients, Blasdale and Lawrence demonstrated that the risk of perioperative bleeding was no greater (or was only minimally greater) in patients taking warfarin compared to controls, and also that, when bleeding occurred, it was not related to therapeutic INR levels.⁴ If the decision to interrupt warfarin is taken, it should be withdrawn 2 to 4 days before the operation and replaced with subcutaneous heparin, then reintroduced the following day.⁵⁻⁷ A recent metaanalysis reviewed the frequency of postoperative complications in patients on antiplatelet or anticoagulant medication and who underwent dermatologic surgery. It demonstrated that ASA (antiplatelet) and warfarin (anticoagulant) carried a greater risk (although low) of postoperative bleeding and complications compared to controls, and that, on comparison of the two treatments, the risk was greater with anticoagulation.⁸

Factors That Affect Normal Healing

Several factors can affect the normal healing process, the most important groups being drugs, lifestyle, and chronic disease.

In all cases, the age of the patient must be recorded as well as any deficiencies in protein, vitamins (especially C and A), or trace elements. Protein deficiency affects the skin metabolism and can alter collagen synthesis and connective tissue synthesis; vitamin C deficiency leads to altered tissue repair and wound dehiscence; vitamin A deficiency affects glycoprotein and proteoglycan synthesis and is also a cofactor in collagen synthesis.⁹ Trace elements also play an important role in healing. Zinc deficiency retards epithelialization and fibroblast proliferation, iron deficiency alters the bactericidal capacity of phagocytes, copper deficiency leads to abnormalities in collagen formation, and magnesium deficiency prevents the activation of enzymes essential to energy production and protein synthesis.¹⁰ Finally, serious malnutrition causes immunosuppression, which leads to an increased risk of infection and also affects healing through abnormal cytokine and growth factor function.¹¹

Use of Medication

Glycocorticoids reduce vascularization, inhibit fibroblast proliferation, reduce protein and collagen synthesis, and decrease epithelialization. Immunosuppressive drugs, such as azathioprine, and cyclosporine, impair the response of cells responsible for the inflammatory phase of healing, causing altered tissue repair. Chemotherapeutic agents inhibit DNA and RNA synthesis, cell division, and protein synthesis, and have a negative impact on healing mainly during the proliferative phase. This group of drugs can also cause neutropenia and predispose to infection. In isolated cases, isotretinoin has been shown to cause abnormal healing and excess granulation tissue, and thus it is recommended that any intervention should be delayed, if possible, for 12 months after concluding treatment.¹²

Lifestyle

The literature provides information on the specific prevalence and incidence of different surgical complications in relation to technique, anatomical region, or predisposing factors. Studies by Kinsella et al¹³ and Goldminz and Bennett¹⁴ show that the probability of skin flap necrosis among smokers (more than 20 cigarettes a day) is 2.5-to-3 times higher than among nonsmokers (defined as former smokers who have not smoked for at least 1 year, occasional smokers, and nonsmokers). The findings of these studies suggest a prevalence of necrosis in up to 37% of smokers versus 17% in any of the other groups.

Chronic Disease

Diseases such as diabetes, chronic heart failure, vascular disease, and hypertension can delay healing or lead to the development of infections. Diabetes mellitus is associated with a greater susceptibility to wound infections, disturbances of the microcirculation, peripheral neuropathy (which predisposes to repeated microtrauma), altered leukocyte function, and direct detrimental effects on the healing process such as decreased connective tissue synthesis. Similar disturbances occur in chronic diseases such as arterial hypertension and kidney or liver failure. Patients may have a history of hereditary tissue disorders (for example, in Ehlers-Danlos syndrome) or some previous local abnormality (radiation therapy). Finally, patients should be questioned about a family or personal history of abnormalities in healing (hypertrophy, keloid) and, if absent, the patient warned these types of disorder can develop in certain areas (shoulders, midthoracic region).

Antibiotic Prophylaxis in Skin Surgery

During healing it is advisable to take into account the possible factors that can cause a delay—as reviewed above—including local wound infection. Dermatologic surgery is, in general, clean surgery and antibiotic prophylaxis is not initially required. Attention should be paid to specific perioperative factors such as identifying risk factors and factors derived from laboratory findings, carefully planning the operation (from planning the technique to preparing the operating field), or deciding which technique to use. Current guidelines for antibiotic treatment recommend prophylaxis in the following situations: high risk of infection, prolonged procedures, formation of “blind sac” during the operation, wounds under high tension (for example, on the back, scalp, or lower limbs), inflammation (in glandular areas such as skin folds and nasal tissue), grafting (especially cartilaginous grafts), and skin flaps (especially in the nasal region). It is recommended to administer antibiotics 30-to-60 minutes before the operation and to continue treatment for up to a week. The guidelines for skin and mucous membranes are shown in Table 2.¹⁵⁻¹⁷

The Surgical Intervention

During the surgical intervention, various factors may predispose to postoperative complications, and these basically occur when performing the secondary aim of intervention, that is, wound closure. Nevertheless, during the main part of the procedure, ie, complete removal of the tumor lesion

Table 2. Guidelines for Antibiotic Therapy in the Prophylaxis of Surgical Infection

<i>Skin and Mucous Membranes (Except Oral)</i>
Cephalexin 2 g orally
<i>Patients allergic to penicillin</i> Clindamycin 600 mg orally, azithromycin 500 mg orally, or clarithromycin 500 mg orally
<i>Oral Mucous Membrane</i>
Amoxicillin 2 g orally
<i>Patients allergic to penicillin</i> Clindamycin 600 mg orally or cephalexin (if there is a type-1 hypersensitivity reaction) 2 g orally, azithromycin or clarithromycin 500 mg orally

**Figure 1.** Tension in the suture can be a cause of possible future complications.

including safety margins, the specialist may make mistakes: errors of judgment, planning, and execution. Errors of judgment can be avoided by having a clear understanding of the tumor (using previous biopsy if required), and planning errors can be minimized by clinical planning sessions before surgery and by having thorough knowledge of the techniques with which to perform the intervention.

Principal Complications During Dermatologic Surgery

Wound Tension: Dehiscence

Excessive tension at the closure site can lead to various complications in the surgical wound (Figure 1): dehiscence,

tissue necrosis, local pain once the effect of the anesthetic has passed, and “train track” scars due to overtight sutures at borders that tend to open. Dehiscence can also be caused by an infection, a “dead space” deep in the wound, or necrosis at the borders of the wound.

Subcutaneous sutures should be used to prevent tension in the superficial sutures, and closure oriented according to the direction of tissue movement; when this is not possible, a skin flap or graft should be used to close the wound, and some areas should even be left to heal by second intention. The sutures should be removed gradually and, if dehiscence occurs, a new suture could be considered providing there is no infection, hematoma, or necrosis.

Skin Flap Necrosis

Flap necrosis is due to complete or partial loss of the blood supply. This stems from excessive compression of the pedicle or wound borders during surgery, and is usually caused by tension secondary to factors such as poor placement of the flap, a tight suture, or immediate postoperative compression aimed at preventing hematomas while holding the flap in position (Figure 2). During the operation, certain clinical signs can warn of the possibility of flap necrosis: pallor, cyanosis, and ecchymosis (Figures 1 and 2). Once necrosis is established, the primary lesion is an ulcer, defined as tissue loss or the presence of devitalized tissue that may include the dermis and even subcutaneous cellular tissue. The necrosis can lead to partial or complete loss of the flap. Necrosis is usually localized, and typically appears at the distal border (Figures 3 and 4).¹⁸

Healing by second intention is usually the most advisable course for small areas of necrosis (Figure 3), but if these are large or deep the best option is reconstructive surgery.

Damage to the Nervous System

During cutaneous surgery, sensory and motor nerves may be damaged or sectioned, both during locoregional anesthesia, leading to temporary nerve deficits that persist for 6 to 12 hours, and during the operation, causing a permanent defect. The principal areas for anesthesia of the face and the main effects of the damage that may be caused (Figure 4)¹⁹ should be noted:

1. Great auricular nerve: dysesthesia of the lower two-thirds of the ear.
2. Temporal branches of the facial nerve: frontal paralysis.
3. Marginal mandibular branch of the facial nerve: smile paralysis, inability to reveal the lower teeth.



Figure 2. Distal partial necrosis in a bilobulate flap in the nasal area.



Figure 3. Healing of the partial necrosis by second intention.

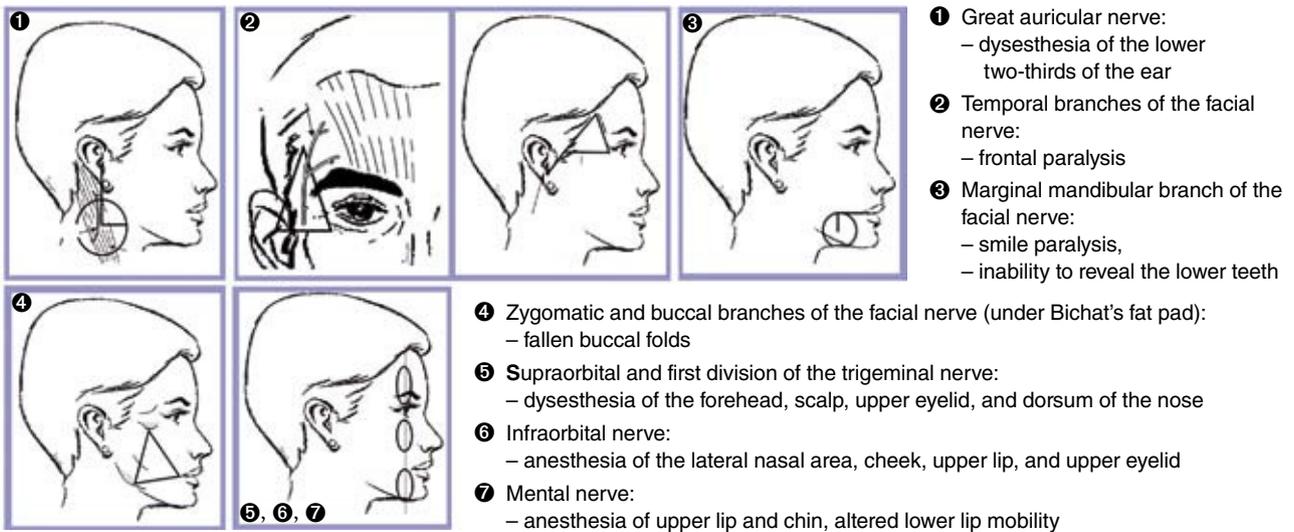


Figure 4. The critical sites of anesthesia in the facial region.

4. Zygomatic and buccal branches of the facial nerve (under Bichat's fat pad): deviation of the buccal commissure.
5. Supraorbital and first division of the trigeminal nerve: frontal dysesthesia of the forehead, scalp, upper eyelid, and dorsum of the nose.
6. Infraorbital nerve: anesthesia of the lateral nasal area, cheek, upper lip, and upper eyelid.
7. Mental nerve: anesthesia of upper lip and chin, altered mobility of the lower lip.

Hemorrhages/Hematomas/Ecchymoses

Most cases of hemorrhage occur after the first 6 hours and are generally due to insufficient hemostasis during the

surgical intervention. The use of local vasoconstrictors can often lead to this situation; more rarely it is due to incorrect hemostasis during the operation. This complication can be prevented by using a compressive bandage (nonischemic) after the procedure and instructing the patient to not remove it for 24 h. In cases in which the defect is large, the tissue is highly vascular, or cavity formation is predicted, a drain should be inserted and blood loss monitored daily.

Hematoma formation is due to the accumulation of coagulated blood in a cavity created during the intervention. It usually presents as local swelling and, when large, with acute pain. As this is a clot, it is usually easily extracted through an incision (under local anesthesia), cleaning the cavity (it is sometimes necessary to resuture the deep planes) and administering prophylactic antibiotic treatment.²⁰



Figure 5. Ecchymosis after surgery in the periocular region.

Ecchymoses are small losses of blood into the interstitial space that normally change from purple, to blue-black, and finally to yellow. They usually occur in soft tissues and tend to migrate in the direction of gravity. The periorbital region is commonly affected during surgery to the nose (Figure 5).

Infections

The majority of infections occur during surgery, although they can also occur in the postoperative period, and are usually caused by *Staphylococcus aureus*. They generally begin a few days after the operation and present as local erythema and pain (Figure 6). The onset of fever and lymphangitis indicate that the infection is spreading. When an increase in wound size is observed we should rule out abscess formation. If this occurs, it should be drained (the wound should sometimes be reopened), the interior of the cavity cleaned with antiseptic, and empirical antibiotic treatment started and then changed to a specific treatment after culture. The current guidelines for antibiotic treatment are shown in Table 2.

The Appearance of the Wound

The final appearance of a surgical wound can be affected by the anatomical area in which the operation is performed. Before the operation, the dermatologist should inform the patient of all possible cosmetic outcomes, since numerous local and systemic factors can hinder the normal healing process (Table 3).

The development of hypertrophic scars and keloids is due to the idiosyncrasies of the patient and not to the



Figure 6. Infection occurs a few days after intervention and appears in the form of local erythema, swelling, and pain.

surgical technique itself. There are certain predisposing causes for these disorders of healing, such as a family history and greater prevalence in black and eastern races. The areas that are more susceptible are the shoulder girdle (shoulders, thorax, and upper back) and the ear lobes.

Overriding or “train track” scars are caused by tight sutures that have been left in place for too long. As mentioned, this type of scar can be avoided by selecting the best possible procedure in each area, avoiding suturing on lines of tension, and using subcutaneous sutures. A “trapdoor” scar in a transposition flap can be prevented by wide separation of the tissues during reconstruction, cutting the borders of the wound at an angle instead of in a circle, and by eliminating excess subcutaneous fat from underneath the flap. The formation of hypertrophic scars and keloids and scar pigmentation abnormalities (hypopigmentation and hyperpigmentation) should be mentioned. There is family predisposition to these disorders. Hypopigmentation and hyperpigmentation occur with the highest frequency among patients with a high skin phototype, so the patient should be informed of the possible changes in color and should apply strict ultraviolet radiation protection.

It is essential to avoid creating retractile scars near natural cavities by careful planning or by z-plasty.

Treatment Measures: Debridement and Closure by Second Intention

When a moderate or severe surgical complication occurs, whether due to dehiscence, necrosis, or infection, resuturing or local cleaning of the wound is often impossible. The debridement of “unwanted” tissue (scabs and necrotic tissue) can be an almost constant procedure during postoperative care, and in some cases closure by second intention will be required. Debridement has 3 main aims: eliminate necrotic material, thus increasing the capacity of the tissue to fight infection, reduce inflammation, and create a clean wound border. The procedure can differ depending on the means used; we speak of surgical debridement, which may be associated or not with chemical or enzymatic debridement using proteolytics or fibrinolytics such as collagenase, mechanical debridement (gauze swabs), biological debridement (insect larvae), or autolytic debridement using hydrogels. As known, though still performed almost routinely, wounds should not be cleaned with topical antiseptics based on povidone-iodine, hydrogen peroxide, acetic acid, or sodium hypochlorite solution, since these are toxic substances and inhibit the healing mechanism. Healing by second intention is based on the formation of new tissue from unaffected neighboring tissue, and is thus a slow process requiring well-developed granulation tissue. When the wound is in a skin fold or an area which is difficult to access, or when it is large, it should be taken into account that healing by second intention can cause a large, retracted, and unsightly scar.

In conclusion, most surgical complications can be prevented if the different stages of surgery are correctly approached. In the preoperative phase, a careful case history and physical examination are required, as well as a complete preoperative workup that details existing diseases, medication, and even the habits and nutritional status of each patient, and that also identifies any possible unknown diseases that may complicate the course of the surgical wound. Before the operation, patients should be informed about their disease, the different techniques available and the possible cosmetic outcome, and they should authorize the procedure by giving their informed consent. During this phase, careful planning is needed and a precise surgical technique chosen by the dermatologist based on experience. Postoperative follow-up should be sufficiently long to ensure an acceptable result, and should include any curative procedures needed for this purpose.

Table 3. Factors That Can Affect the Healing Process

Local	Systemic
Poor surgical technique	Age, malnutrition
Hematomas	Vascular disease
Infections	Metabolic disease (diabetes)
Edema	Hereditary disease (Ehlers-Danlos syndrome)
Foreign body reaction	Hypertension, immunologic disease
Corticosteroids	Drugs: corticosteroids, oral contraceptives, salicylates, cytostatics
Microvascular disease	

Conflict of Interest

The authors declare no conflicts of interest.

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