Chapter 4: Vascular Wounds

INTRODUCTION

CHAPTER OBJECTIVES

At the end of this chapter, the learner will be able to:

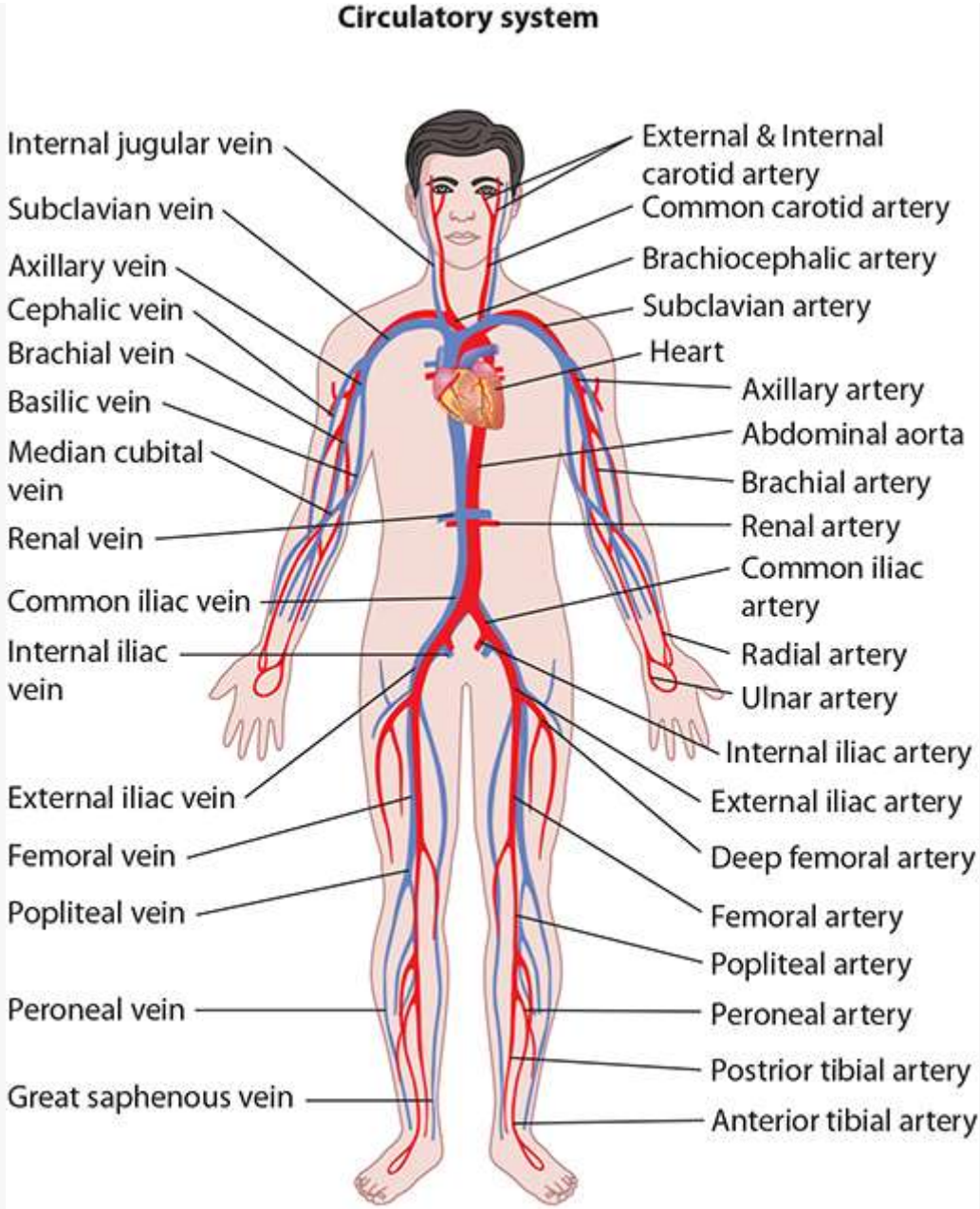
1. **Relate the pathological changes in the vascular anatomy to the formation of arterial and venous wounds.**
2. **Differentiate between arterial and venous wounds.**
3. **Perform a vascular screening and interpret noninvasive vascular studies for arterial and venous disorders.**
4. **Use the information obtained from vascular studies to develop a plan of care for arterial wounds (before and after surgery) and venous wounds.**
5. **Determine when and if surgical intervention is needed for patients with arterial and venous wounds.**
6. **Select the appropriate compression therapy for patients with lower extremity vascular wounds based upon vascular studies.**

The vascular system is an intricate system of arteries, veins, and lymphatic vessels designed to transport the blood from the heart to the core and peripheral tissue, providing tissue with the oxygen and nutrients necessary to sustain life, and from the same tissue back to the

heart and lungs for recirculation (**FIGURE 4-1**). An interruption to blood flow in any one or more of the vessels can cause significant and critical pathologies that result in integumentary changes, wounds, or impaired healing. If the pathology is in the arterial system, the wound is termed *ischemic*; if it is in the venous system, it is termed *venous*. Both types have very defining characteristics and predictable vascular study results that are used to determine the optimal plan of care for the individual patient. This chapter focuses on the pathophysiology, prevention, and treatment of arterial and venous wounds; lymphatic disorders are discussed in Chapter 5, Lymphedema.

FIGURE 4-1

Anatomy of the arterial and venous circulatory systems The circulatory system consists of the cardiac, arterial, venous, and lymphatic systems. The arterial system is further delineated into the macrocirculation (arteries large enough to be named) and microcirculation (capillaries and arterioles too small to be named). The lymphatic system is illustrated in Chapter 5.



Vascular diseases such as peripheral artery disease (PAD) and chronic venous insufficiency (CVI) cause the majority of lower extremity wounds; the majority of arterial wounds are caused by PAD. The clinical spectrum of PAD ranges from asymptomatic disease to mild claudication, to tissue loss or gangrene of the foot or lower extremity. When patients with PAD have an ulcer or gangrene of the lower extremity, it is termed *critical limb ischemia* (CLI). The major cause of

CLI is a reduction in distal tissue perfusion below the resting metabolic requirements usually associated with atherosclerosis; however, other conditions may cause wounds that appear to be arterial or ischemic (**TABLE 4-1**). Diabetes mellitus (DM) is one of the most serious and prevalent of these disorders. The combination of DM and PAD may lead to foot ulceration or gangrene, which may result in amputation. The overall risk of amputation is 15 times higher for patients with ...

Chapter 9: Flaps and Skin Grafts

INTRODUCTION

CHAPTER OBJECTIVES

After studying this chapter, the learner will be able to:

1. **Describe a pedicled and a free flap.**
2. **Assess and determine an appropriate classification for a specific flap.**
3. **Distinguish the vascular anatomy of the skin, muscle, fascia, and perforator flaps.**
4. **Integrate the concepts of angiosomes and venosomes and their effects on flap design.**
5. **Discuss flap physiology, including delay phenomenon and tissue expansion.**
6. **Assess and monitor a flap for tissue viability.**
7. **Recognize common flap complications.**
8. **Define the types of skin grafts.**
9. **Recognize skin anatomy relevant to flaps.**

10. **Integrate skin graft healing physiology into a plan of care.**
11. **Recognize signs of graft failure.**
12. **Explain relevant elements of donor site selection.**

Primary closure of a surgical wound is the simplest and fastest way of approximating wound margins; however, in many instances it is neither feasible nor desirable to close a wound with this method. Using principles of moist wound healing results in a wound being left open to heal by secondary intention. Primary closure results in minimal scarring and re-epithelialization; wounds left to heal by secondary intention may have more extensive scarring with subsequent contraction and deformity.

When there is a relative or absolute soft tissue deficit appropriate for coverage, a flap or skin graft can be used to fill the defect. The extent of the deficit and its location, among other factors, dictate the type of coverage needed. The first section of this chapter discusses and illustrates different types of flaps, followed by a succinct description of flap monitoring and common complications. The second section demonstrates the principles and applications of skin grafting.

While this chapter is not an exhaustive reference on the subject, it is intended to be comprehensive to wound care providers, focusing on essential concepts related to flaps and grafts that will help the clinician understand the indications and postoperative care. For those readers who require more detailed information on the topics presented in this chapter, a thorough reference list is provided for further study.

FLAPS

Definition

A flap is a unit of vascularized tissue that may be transferred from one part of the body to another.[1] It is more simply defined as specific tissue that is mobilized on the basis of its vascular anatomy.[2] A flap may contain a single tissue (for example, skin, muscle, fascia, fat, bone, tendon, nerve) or a combination of tissues. A flap may also be comprised of enteric components such as jejunum, colon, stomach, or omentum. The critical concept to understand about flaps is the relationship to its blood supply, which is necessary for the flap to survive. Because of the thickness and/or composite nature of flaps, the tissue being transferred cannot initially survive by diffusion from the recipient bed; it must have its own inflow and outflow of blood. A flap is termed *pedicled* if it maintains its blood vessel continuity ...

Chapter 11: Factors That Impede Wound Healing

INTRODUCTION

CHAPTER OBJECTIVES

At the end of this chapter, the learner will be able to:

1. **Identify wounds that are not healing due to the influence of impeding factors.**
2. **Identify the impeding factors based on subjective and objective evaluations.**

3. **Select the tests necessary to confirm suspected impeding factors.**
4. **Adapt plan of care to minimize the effect of impeding factors on the wound healing process.**
5. **Educate patients and care givers on strategies to minimize or eliminate effects of impeding factors.**

Chapter 3, Examination and Evaluation of the Patient with a Wound, presented the two questions that need to be answered in order to successfully treat a patient with a wound: (1) Why does the patient have a wound? and (2) Why is the wound not healing? Once a wound diagnosis has been determined and standard care has been initiated, the wound should progress through the stages of wound healing discussed in Chapter 2, Healing Response in Acute and Chronic Wounds. When progress is not observed, the second question—Why is the wound not healing?—becomes even more imperative to answer. Sometimes the wound will respond initially and make measureable progress, then stall again for no apparent reason. This chapter focuses on those factors that are known to impede wound healing, some more obvious than others, and provides suggestions on how to identify and minimize the effect on the healing process. The factors are categorized into infection, medications, nutritional deficits, comorbidities, and extrinsic/psychosocial behaviors.

TABLE 11-1 provides laboratory values, always a good starting place for solving the conundrum, with normal values, trends that are typical when a patient does not have the normal healing response, and clinical

presentations that accompany abnormal lab values.**CASE STUDY**

INTRODUCTION

Mr RG is a 45-year-old male with a 3+ year history of a non-healing wound on the right anterior leg (**FIGURE 11-1**). His medical history includes the following:

- History of HIV for more than 15 years
- History of Kaposi sarcoma on the right anterior leg at the site of the current wound, treated with radiation and chemotherapy (doxol or doxorubicin)
- History of recurrent cellulitis, treated with both IV vancomycin and oral Xyvox

FIGURE 11-1

Case study at the time of initial evaluation Non-healing wound on the lower extremity of a patient with multiple factors that impede wound healing.

His HIV status is controlled with medication; he has an undetectable viral load and a low white count (≤3).

DISCUSSION QUESTIONS

1. What subjective information is needed to determine the factors that have prevented this wound from healing?
2. What questions would be helpful in obtaining this information?
3. What tests and measures are indicated in order to establish a plan of care?