Tissues that are able to extract and use the oxygen delivered through the capillaries are maintained primarily by the cardiovascular system and depend on four physiologic components.

1. A cardiac output sufficient to meet bodily requirements
2. An uncompromised vascular system, in which the vessels have a diameter sufficient to allow unimpeded blood flow and have good tone (the ability to constrict or dilate to maintain normal pressure)
3. A volume of blood sufficient to fill the circulatory system, and a blood pressure adequate to maintain blood flow
4. Tissues that are able to extract and use the oxygen delivered through the capillaries

In a healthy person, these components function as a system to maintain tissue perfusion. During shock, however, one or more of these components are disrupted. An understanding of basic hemodynamics is necessary to understand the pathophysiology of shock.

• **Stroke volume (SV)** is the amount of blood pumped into the aorta with each contraction of the left ventricle.
• **Cardiac output (CO)** is the amount of blood pumped per minute into the aorta by the left ventricle. CO is determined as follows:

\[ CO = SV \times HR \]

Where:
- **CO** = Cardiac output
- **SV** = Stroke volume
- **HR** = Heart rate

**PATHOPHYSIOLOGY**

**Overview of Cellular Homeostasis and Hemodynamics**

To maintain cellular metabolism, cells of all body organs and tissues require a regular and consistent supply of oxygen and the removal of metabolic wastes. This homeostatic regulation is maintained primarily by the cardiovascular system and depends on four physiologic components.

1. **Cardiac output** (CO) is the amount of blood pumped per minute into the aorta by the left ventricle. CO is determined as follows:

\[ CO = SV \times HR \]

Where:
- **CO** = Cardiac output
- **SV** = Stroke volume
- **HR** = Heart rate

**THE CLIENT EXPERIENCING SHOCK**

**Shock** is a clinical syndrome characterized by a systemic imbalance between oxygen supply and demand. This imbalance results in a state of inadequate blood flow to body organs and tissues, causing life-threatening cellular dysfunction.

**DIAGNOSES**

- **Ineffective breathing pattern** related to multiple bruises and abrasions on the right side of the chest, and respiratory difficulty
- **Deficient fluid volume** related to acute internal blood loss (presumed because no active bleeding can be found)

**EXPECTED OUTCOMES**

- Maintain adequate oxygenation.
- Maintain adequate circulating blood volume.

**PLANNING AND IMPLEMENTATION**

- Monitor airway and assist in any needed airway management.
- Explain all procedures.
- Monitor the effects of fluid and blood administration, including any changes in blood pressure and pulse.
- Prepare for transfer to the operating room for emergency surgery.
- Keep family informed about her condition.

**EVALUATION**

Jane is transferred to the operating room, where it is determined that she has a ruptured spleen and a serious pelvic fracture. Jane's treatment continues in the operating room.

**Critical Thinking in the Nursing Process**

1. Is the nursing diagnosis deficient fluid volume appropriate for Jane Souza? Why or why not?
2. The assessment of a client who has experienced trauma is, in order: A = airway, B = breathing, and C = circulation. What is the rationale for this sequence?
3. Following surgery, Jane is moved to the surgical intensive care unit. She is very anxious and restless. What assessments would you make to identify the cause of her restlessness?
4. Infection is a common complication for the trauma client. Describe five risks for infection that are present from the time of injury to the time of hospital discharge.

See Evaluating Your Response in Appendix C.