Perioperative Oxygen Administration Influences Postoperative Wound Healing

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Continuous supply of oxygen to the tissue through microcirculation is vital for the healing process and for resistance to infection. Evaluation of tissue perfusion and oxygenation is important in all types of wound patients.

Introduction

Surgical wound infections are common and serious perioperative complications. The major defense against surgical pathogens is oxidative killing by neutrophils. Wound oxygen availability is a complex function of arterial oxygen tension and local flow. It is widely known that wounds do not heal in tissue that does not bleed, and that they heal in tissue that bleeds extensively.

The extent to which increasing inspired oxygen tension augments tissue oxygen tension in clinical practice is widely unclear. Apart from its central role in oxidative phosphorylation to produce biological energy in the form of adenosine triphosphate (ATP), molecular oxygen is used as substrate by two other enzyme systems for the killing of bacteria in the phagocytes and for collagen synthesis by the fibroblast during wound healing.

Oxygen supplementation increases the O₂ content of blood, increases the partial pressure of oxygen (PO₂) in the capillary blood, and improves tissue delivery of O₂. In addition to improving tissue oxygenation, the administration of O₂ may improve the function of O₂-dependent cellular systems, such as the cytochrome P450 system, which is important to drug metabolism and nitric oxide synthase, which regulates vasodilatation and host defense systems.

Clinical Aspects

Acute postoperative systemic hypoxia occurs frequently in the clinical setting following surgery, as a result of complications such as pain, hypoventilation due to central pharmacological depression, diffusion hypoxia, increased metabolic rate due to shivering, pneumonia, pulmonary edema, or the acute respiratory distress syndrome.

It is also known that supplemental perioperative fluid administration significantly increases tissue perfusion and tissue oxygen partial pressure.

Numerous reports support the concept that tissues require an adequate oxygen supply to heal well and to prevent complications of infection. Adequate oxygen supply to tissue depends on perfusion as well as arterial oxygen tension, and tissue oxygen tension, particularly in peripheral tissues, is dependent on adequate vascular volume. Therefore, potential ben-
efits to wound healing and reduction in infection in post surgical patients might be attained by supplemental oxygen in the perioperative period.

Intraoperative arterial oxygen tension was three-fold greater in patients given 80 % than 30 % oxygen and postoperative arterial oxygen tension was also significantly greater resulting in a reduced wound infection rate. These findings are consistent with pooled histograms of mean tissue skeletal muscle oxygen tension of patients undergoing general anesthesia (Fig.) and a clinical study published recently by Kalliainen et al. using adjunctive hyperbaric oxygen therapy.\(^7\)

**Monitoring**

Evaluation of tissue perfusion and oxygenation is important in all types of wound patients. Monitoring systems should measure the hemodynamic situation, oxygen blood saturation, blood gases, and the ability of the cardiovascular system to deliver an adequate volume of oxygen to meet the metabolic demands of the peripheral tissue.\(^8\)

**Literature:**

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