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NURSING CARE IN HIRUDOTHERAPY AND OXYGEN THERAPY

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Abstract
Hirudotherapy and oxygen therapy are important therapeutic methods widely used in modern healthcare for the management of various medical conditions. Hirudotherapy, which involves the medical application of leeches, has been recognized for its anticoagulant, anti-inflammatory, analgesic, and microcirculation-enhancing effects. Oxygen therapy, on the other hand, is an essential supportive treatment used to improve tissue oxygenation in patients suffering from respiratory, cardiovascular, and other systemic disorders. Effective nursing care plays a crucial role in ensuring the safety, effectiveness, and successful outcomes of both therapeutic procedures.

Keywords: Hirudotherapy, oxygen therapy, nursing care, patient monitoring, oxygen administration, medicinal leeches, infection prevention, respiratory support

Introduction

Hirudotherapy (medicinal leech therapy) and oxygen therapy are clinically recognized medical interventions used in modern healthcare systems, where nursing care plays a central role in ensuring patient safety, treatment effectiveness, and prevention of complications. Both therapies are strongly supported by evidence-based clinical guidelines and scientific publications from international medical databases such as PubMed and professional clinical organizations.

Hirudotherapy is primarily used in reconstructive surgery, microsurgery, and plastic surgery to relieve venous congestion and improve microcirculation. Medicinal leeches secrete biologically active substances such as hirudin (anticoagulant), calin (platelet aggregation inhibitor), and hyaluronidase (tissue permeability enhancer), which contribute to improved blood flow and tissue survival.

A systematic clinical review published in 2023 (PubMed ID: 37244746) confirms that medicinal leech therapy is effective in treating venous congestion in reconstructive procedures and flap survival cases.

Oxygen therapy is a life-supporting intervention used in conditions such as hypoxemia, chronic obstructive pulmonary disease (COPD), pneumonia, heart failure, and acute respiratory distress syndrome (ARDS). According to the World Health Organization clinical guidance (updated 2023), oxygen is classified as an essential medicine and must be administered safely with continuous monitoring.

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Main Part

Nursing care in hirudotherapy and oxygen therapy can be systematically analyzed through laboratory parameters, physiological indices, and clinically accepted medical formulas. Modern evidence-based practice (WHO guidelines 2023, AARC standards 2022, PubMed clinical studies 2020-2024) emphasizes that nursing decisions must be supported by measurable numerical indicators to ensure patient safety, treatment effectiveness, and prevention of complications.

In hirudotherapy, the nursing process begins with laboratory evaluation of the patient's hematological status. Hemoglobin concentration is one of the most important indicators. Normal hemoglobin values are approximately 12-16 g/dL for females and 13-17 g/dL for males. Clinically, when hemoglobin falls below 10 g/dL, the risk of excessive bleeding increases significantly, and below 8 g/dL hirudotherapy is generally considered contraindicated due to potential hemodynamic instability. Hematocrit values, normally between 36–48%, are also used to evaluate blood oxygen-carrying capacity. Platelet count, normally 150–400 × 10^9/L, is critical in assessing clotting ability, and values below 100 × 10^9/L indicate a high risk of bleeding complications during leech therapy.

Coagulation parameters are essential in nursing assessment before initiating hirudotherapy. Prothrombin time normally ranges from 11 to 13.5 seconds, while activated partial thromboplastin time ranges from 25 to 35 seconds. The international normalized ratio (INR) is typically between 0.8 and 1.2. When INR exceeds 1.5, the risk of uncontrolled bleeding increases due to impaired coagulation cascade function. These parameters are essential for nurses to determine whether the patient is suitable for therapy or requires medical correction before treatment.

From a physiological perspective, hirudotherapy affects the coagulation system through bioactive substances such as hirudin. Hirudin inhibits thrombin activity, which directly affects fibrin formation. Normally, thrombin converts fibrinogen into fibrin, forming a stable clot. When hirudin is present, thrombin activity decreases, leading to reduced fibrin formation and prolonged bleeding time. This mechanism explains why continuous nursing monitoring is required during and after the procedure.

Blood loss estimation is an important nursing responsibility after leech application. Clinical observation shows that bleeding from leech bite sites may continue for several hours. Blood loss can be estimated by considering duration and saturation level of dressings. For example, if bleeding continues for approximately 360 minutes with an average loss of about 1 mL per minute, total blood loss may reach around 360 mL. When blood loss exceeds 500 mL, there is a risk of hypovolemia, requiring immediate clinical intervention. Mean arterial pressure is calculated using the formula MAP = (SBP + 2DBP) / 3, and values below 65 mmHg indicate inadequate tissue perfusion, requiring urgent nursing response.

In oxygen therapy, nursing care is based on respiratory laboratory parameters and gas exchange measurements. Oxygen saturation (SpO_2) is a key indicator and is calculated as the ratio of oxygenated hemoglobin to total hemoglobin multiplied by 100. Normal SpO_2 values range between 95 and 100 percent. Values between 90 and 94 percent indicate mild hypoxemia, 85 to 89 percent indicate moderate hypoxemia, and values below 85 percent indicate severe respiratory failure requiring immediate intervention.

Arterial blood gas analysis provides more detailed information about respiratory function. Normal arterial pH ranges from 7.35 to 7.45, partial pressure of oxygen (PaO_2) ranges from 80 to 100 mmHg, and partial pressure of carbon dioxide ($PaCO_2$) ranges from 35 to 45 mmHg. When PaO_2 falls below

60 mmHg, it indicates significant respiratory insufficiency. Oxygen content in blood can be calculated using the formula $CaO_2 = (1.34 \times Hb \times SaO_2) + (0.003 \times PaO_2)$, which reflects the total oxygen-carrying capacity of blood.

Oxygen delivery to tissues is calculated using $DO_2 = CO \times CaO_2 \times 10$, where CO is cardiac output. For example, if cardiac output is 5 liters per minute and oxygen content is approximately 19.77 mL/dL, total oxygen delivery is around 988.5 mL per minute, which is close to normal physiological levels. This demonstrates the importance of maintaining both adequate hemoglobin levels and oxygen saturation in clinical nursing practice.

Oxygen administration also requires careful calculation of delivered oxygen concentration. In nasal cannula therapy, FiO_2 increases approximately by 4 percent for each liter per minute of oxygen flow. For example, 2 liters per minute provides approximately 28 percent oxygen concentration, while 5 liters per minute provides approximately 40 percent. Excessive oxygen administration above FiO_2 of 0.6 for more than 24 to 48 hours may lead to oxygen toxicity due to increased production of reactive oxygen species such as superoxide radicals, which can damage lung tissue.

Alveolar oxygen exchange can be described using the alveolar gas equation $PAO_2 = FiO_2 (Patm - PH_2O) - PaCO_2 / R$, which explains oxygen diffusion efficiency in the lungs and is essential in critical care nursing assessment.

Conclusion

Nursing care in both hirudotherapy and oxygen therapy is a scientifically structured clinical process that is fundamentally based on continuous assessment, laboratory data interpretation, and evidence-based decision-making. Analysis of clinical parameters such as hemoglobin, hematocrit, platelet count, coagulation indices (PT, aPTT, INR), oxygen saturation (SpO_2), arterial blood gases (PaO_2, $PaCO_2$, pH), and hemodynamic indicators (MAP, DO_2) demonstrates that nursing interventions are directly linked to measurable physiological stability.

In hirudotherapy, the main clinical challenge is the balance between therapeutic anticoagulation and prevention of excessive blood loss. The action of hirudin and other bioactive substances significantly affects thrombin activity, leading to prolonged bleeding and changes in coagulation dynamics. Therefore, nursing care must ensure strict monitoring of hematological parameters, accurate estimation of blood loss, and timely prevention of hypovolemia. Evidence-based clinical practice confirms that proper nursing supervision significantly reduces complications and improves tissue recovery outcomes in reconstructive and microsurgical patients.

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