
Nursing Approach to Managing Vapor Inhalation Injuries

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Abstract:

Nurses play a critical role in the assessment and management of patients with vapor inhalation injuries. The initial approach involves thorough patient assessment, including obtaining a detailed history of the exposure and any presenting symptoms such as respiratory distress, cough, or wheezing. Nursing interventions focus on ensuring airway patency, administering supplemental oxygen as needed, and monitoring vital signs closely. Effective communication with the healthcare team is crucial for prompt intervention and potential transfer to specialized care. Additionally, nurses should educate patients and families about the dangers of vapor inhalation and the importance of preventative measures. In the wake of vapor inhalation injuries, ongoing monitoring and supportive care are fundamental to recovery. Nurses should implement individualized care plans that address both physical and emotional needs. This may involve managing pain, preventing infection, and facilitating rehabilitation services to aid recovery. Psychological support is also vital, especially for those experiencing anxiety or PTSD-related symptoms following the traumatic event. Collaboration with respiratory therapists and other specialists ensures comprehensive care, thus enhancing patient outcomes and facilitating a safe discharge plan.

Keywords: Vapor inhalation injuries, Patient assessment, Respiratory distress, Airway management, Vital signs monitoring, Preventative education, Supportive care, Pain management, Psychological support, Interprofessional collaboration

Introduction:

Inhalation injuries pose significant health risks, particularly in industrial and occupational settings where exposure to toxic vapors is prevalent. Vapor inhalation injuries occur when a person breathes in harmful substances, which can range from volatile organic compounds (VOCs) to chemical solvents, and even gases resulting from combustion. These injuries can lead to a complex spectrum of health complications that necessitate advanced care and management strategies. As frontline caregivers, nurses play a pivotal role in the assessment, treatment, and rehabilitation of patients suffering

from vapor inhalation injuries. This essay aims to provide a comprehensive introduction to the multidisciplinary nursing approaches that are critical in the effective management of these injuries [1].

Before delving into the nursing approach, it is essential to understand what vapor inhalation injuries entail. These injuries are often the result of exposure to hazardous vapors that can lead to acute respiratory distress, chemical pneumonitis, and systemic effects. When vapors enter the respiratory system, they can affect lung function, disrupt the pulmonary-capillary membrane, and initiate a cascade of inflammatory responses that can

complicate the patient's condition. Depending on the nature and concentration of the inhaled substances, symptoms can range from mild irritation of the upper airways to severe respiratory failure, requiring immediate medical attention [2].

The management of vapor inhalation injuries demands a multifaceted approach that encompasses immediate emergency response, thorough clinical assessment, implementation of supportive therapies, and meticulous long-term rehabilitation strategies. Nursing professionals are instrumental in each of these phases due to their close patient interactions, adaptability in emergency situations, and holistic understanding of human health [3].

The nursing approach begins with an acute assessment of the patient's condition as part of the emergency response team. Upon arrival at the scene or in the emergency department, nurses are responsible for rapid triage, evaluating airway patency, breathing efforts, and circulation. Recognizing the signs of respiratory distress, such as wheezing, cough, or cyanosis, is crucial for initiating appropriate interventions. Also, the nursing assessment may involve the use of standardized scales—such as the National Institutes of Health Stroke Scale (NIHSS)—to document the severity of the inhalation injury and determine the course of treatment [4].

In the emergency setting, the application of basic life support measures is paramount. Nurses collaborate with respiratory therapists to provide supplemental oxygen, manage airway obstructions, and initiate positive pressure ventilation if necessary. The administration of bronchodilators and corticosteroids may also be indicated, depending on the clinical presentation. Furthermore, effective communication with the medical team is essential to facilitate timely diagnostic imaging and laboratory tests, which can aid in formulating a specific treatment plan [5].

Once a diagnosis has been established, nursing care transitions toward therapeutic management. This phase is characterized by continuous monitoring and intervention to mitigate the impacts of the inhalation injury. Nurses are responsible for implementing ordered interventions, which may include intravenous fluid therapy to maintain hydration and

electrolyte balance, as well as continuous pulse oximetry to monitor oxygen saturation levels [6].

Additionally, the implementation of protective isolation measures may be necessary to prevent the exacerbation of pulmonary complications, particularly in cases where chemical exposure has led to susceptibility to secondary infections. Nursing professionals are equipped with the knowledge and skills to interpret changes in vital signs and laboratory results, which are critical for early identification of potential complications—such as acute respiratory distress syndrome (ARDS) or multi-organ failure [6].

Education plays an essential role in the holistic approach to managing vapor inhalation injuries. Nurses have a crucial responsibility in educating patients and their families about the effects of inhalation injuries, potential complications, and the importance of adherence to treatment plans. This includes instruction on respiratory therapy techniques, medication compliance, and recognition of adverse symptoms that may warrant immediate medical attention.

Following initial stabilization and acute management, the focus shifts toward long-term rehabilitation. Nurses facilitate access to pulmonary rehabilitation programs and support systems that can enhance recovery outcomes. These programs often incorporate physical therapy and psychological support to help patients regain functional independence and cope with any lasting effects related to their injuries [7].

Pathophysiology of Vapor Inhalation:

Vapor inhalation is a complex process that involves the introduction of gaseous substances into the pulmonary system, where they interact with biological tissues. This phenomenon can stem from a variety of sources, including industrial exposure, recreational use of vaping products, and accidental exposure to volatile organic compounds (VOCs). Understanding the pathophysiology of vapor inhalation is critical for several reasons: it informs prevention strategies, guides treatment protocols for acute and chronic exposures, and shapes public health policies. This essay will explore the mechanisms of vapor inhalation, the physiological responses elicited, the potential health effects, and the broader implications for society [8].

When vapors are inhaled, they enter the respiratory tract primarily through the mouth or nose, traveling down the trachea and subsequently into the bronchi and bronchioles, where gas exchange occurs. The respiratory system comprises a series of complex structures, including the upper and lower airways, alveolar sacs, and alveolar-capillary membranes. Vapors can vary widely in composition, ranging from water vapor and essential oils to hazardous industrial chemicals [9].

Upon inhalation, the size of the vapor particles plays a crucial role in determining how they interact with the respiratory tissues. Particles that are smaller than 10 micrometers can penetrate deeply into the lungs, while larger particles may be trapped in the nasal passages or upper airways. The alveolar region, where gas exchange occurs, is particularly susceptible to inhaled vapors due to its thin, permeable membranes [9].

Inhaled vapors can be comprised of numerous chemical constituents that may have varied health consequences. For example, vaping products often contain nicotine, propylene glycol, vegetable glycerin, and flavoring agents, while industrial vapors may consist of heavy metals, solvents, and other toxic substances. The physicochemical properties of these compounds—including molecular size, polarity, and solubility—impact their absorption rates and potential for toxicity.

The body's response to vapor inhalation can be classified as acute or chronic, depending on the duration and concentration of exposure. Acute responses tend to occur shortly after exposure and may include respiratory irritation, increased mucus production, and inflammation of the airways. Common symptoms can range from coughing and wheezing to more severe manifestations such as difficulty breathing and chest tightness [10].

The initial response to harmful vapors often involves the activation of sensory nerve endings in the respiratory tract, leading to a reflexive bronchoconstriction designed to limit further exposure. This bronchospasm results from autonomic nervous system activation, primarily involving the parasympathetic nervous system. Additionally, the presence of irritants can trigger the release of pro-inflammatory cytokines, promoting further inflammation in the airways and potentially

leading to acute respiratory distress syndrome (ARDS) in severe cases [11].

Chronic exposure to harmful vapors, particularly those found in industrial settings or prolonged use of vaping products, can lead to more significant and lasting changes. Conditions such as chronic bronchitis and asthma may develop, characterized by long-term airway inflammation, hyperreactivity, and structural changes to the airways known as remodeling. Prolonged inhalation of specific hazardous fumes can also increase the risk of lung cancer and other systemic diseases, as certain chemicals can have carcinogenic effects [12].

The health effects associated with vapor inhalation can be multifaceted and vary widely based on the chemical composition, concentration of exposure, and individual susceptibility. In the case of vaping, research has begun to uncover a spectrum of acute and long-term health concerns.

The inhalation of nicotine—a potent stimulant—can lead to heightened heart rates and increased blood pressure, contributing to cardiovascular strain. The inhalation of flavoring agents, such as diacetyl—a chemical linked to 'popcorn lung'—has raised significant health concerns. Additionally, synthetic cannabinoid vaporizers can lead to acute psychoactive effects as well as respiratory distress [13].

From an industrial health perspective, inhaling VOCs can have both short-term and long-term health ramifications. Acute exposure may lead to temporary eye irritation, headaches, and dizziness, while chronic exposure is associated with a higher risk of developing diseases such as chronic obstructive pulmonary disease (COPD), liver and kidney damage, and several types of cancer [13].

Assessment and Diagnosis of Inhalation Injuries:

Steam inhalation injuries represent a critical category of respiratory trauma that can occur under various circumstances, including accidents in the kitchen, industrial settings, or during steam therapy. The inhalation of hot steam can induce significant damage to the upper and lower respiratory tracts, leading to acute lung injury and, in severe cases, can become a life-threatening condition. Understanding the evaluation and diagnosis of steam inhalation

injuries is essential for effective management and treatment [14].

Steam inhalation injuries occur primarily due to the high temperature of the steam, which can exceed 100 degrees Celsius (212 degrees Fahrenheit). When steam is inhaled, it condenses upon contact with cooler surfaces in the respiratory tract, primarily the trachea and bronchi. This process releases thermal energy, resulting in cellular damage to the epithelial tissues. The extent of the injury can be influenced by various factors, including the temperature of the steam, duration of exposure, and the individual's baseline respiratory health [14].

The immediate pathophysiological effects include thermal burns to the airway mucosa, leading to edema, inflammation, and, in some cases, necrosis of the affected tissues. Additionally, the inhalation of steam can trigger a cascade of inflammatory responses in the lungs, resulting in bronchoconstriction, increased secretions, and compromised gas exchange. Secondary complications may also arise, such as infections or acute respiratory distress syndrome (ARDS), making timely evaluation and diagnosis paramount [14].

Clinical Presentation

Patients with steam inhalation injuries often present with a range of symptoms that can help guide evaluation and diagnosis. Early symptoms typically include:

- **Cough:** A common response to airway irritation, which may become productive as mucosal secretions increase [15].
- **Dyspnea:** Difficulty in breathing can arise due to airway edema or obstruction.
- **Stridor:** A high-pitched wheezing sound indicative of upper airway obstruction, usually caused by edema.
- **Chest pain or tightness:** These symptoms may arise due to inhalation injury as well as associated muscle strain from coughing.
- **Hoarseness or loss of voice:** This symptom can indicate laryngeal involvement and injury [15].

In more severe cases, patients may develop signs of respiratory distress, such as increased respiratory rate, use of accessory muscles for breathing, cyanosis (a bluish tint to the skin due to insufficient oxygen), and altered mental status due to hypoxia. The variability in symptoms can depend on the severity and location of the injury [15].

Diagnostic Procedures

When evaluating a patient suspected of suffering from steam inhalation injuries, a thorough medical history and physical examination are essential. Key components of the evaluation include:

1. History Taking:

- **Event Description:** Information about how the injury occurred, including the duration of exposure to steam and the temperature of the steam [16].
- **Pre-existing Conditions:** Any history of respiratory diseases such as asthma or Chronic Obstructive Pulmonary Disease (COPD) can influence injury severity and recovery [16].

2. Physical Examination:

- Focus on respiratory examination to assess airway patency, breathing effort, and overall respiratory status [17].
- Look for signs of stridor or wheezing, which indicate airway compromise.

3. Imaging Studies:

- **Chest X-ray:** Typically performed to evaluate for signs of pulmonary edema, fluid accumulation, atelectasis, or other injuries [17].
- **CT Scan of the Chest:** May be needed for detailed assessment of lung parenchyma and rule out other potential injuries [17].

4. Pulmonary Function Tests (PFTs):

- These tests can be helpful in evaluating the functional status of the lungs and understanding the impact of inhalation injury on breathing capacity [18].

5. **Fiberoptic Bronchoscopy:**

- In suspected cases of severe injury, direct visualization of the airway via bronchoscopy may be warranted. This procedure allows for assessment of the degree of airway edema, necrosis, and the presence of any debris or foreign material due to soot or other inhaled substances [18].

6. **Arterial Blood Gas (ABG) Analysis:**

- Performed to assess the oxygenation status of the patient and detect any acid-base imbalances due to hypoventilation or impaired gas exchange [19].

Management and Prognosis

The management of steam inhalation injuries primarily focuses on the supportive care and stabilization of the patient. Initial treatment involves:

- **Airway Management:** Maintaining an open airway is critical. In cases of severe airway edema, intubation may be necessary to secure a patent airway [19].
- **Oxygen Therapy:** Supplemental oxygen may be provided to counteract hypoxia and improve oxygen saturation.
- **Bronchodilators:** These may be utilized to relieve bronchospasm and improve airflow, particularly in patients exhibiting wheezing or asthma-like symptoms.
- **Corticosteroids:** In some cases, the use of corticosteroids might be beneficial to reduce airway inflammation and edema, although their utility is subject to ongoing research and clinical discretion [20].
- **Fluid Management:** Adequate hydration is essential, especially in the presence of

respiratory distress and increased secretions.

The prognosis for steam inhalation injuries varies based on the severity of the injury, the timeliness of treatment, and the presence of any associated complications. Patients with mild to moderate injuries may recover with appropriate supportive care, while severe injuries could result in long-term respiratory impairment, necessitating rehabilitation and ongoing management [20].

Immediate Nursing Interventions and Emergency Response:

Steam inhalation injuries present a significant medical emergency, particularly in settings involving kitchen accidents, industrial mishaps, or household appliance failures. Such injuries can lead to severe trauma of the respiratory tract, including the upper airways (nose, throat) and lower airways (trachea, bronchi, and alveoli). The mechanism of injury is primarily thermal, arising from the high temperature of steam, which can cause burns and inflammation of the airway tissues. In this essay, we will explore the immediate nursing interventions and emergency responses necessary for managing steam inhalation injuries, ensuring that healthcare providers are well-prepared to deliver timely and effective care [21].

When an individual inhales steam, the hot vapor can cause thermal damage to the mucosal lining of the respiratory tract, resulting in swelling, edema, and possible airway obstruction. Clinical manifestations may include cough, difficulty breathing, wheezing, stridor, chest pain, and hemoptysis (coughing up blood). Patients may also exhibit signs of respiratory distress, such as increased respiratory rate, nasal flaring, retractions of the chest muscles, and cyanosis due to inadequate oxygenation. The extent of injury often correlates to the temperature of the steam, the duration of exposure, and the individual's overall health status [21].

Initial Assessment and Immediate Interventions

Upon arrival at the emergency department or at the scene of the injury, the healthcare provider, particularly the nurse, must perform a thorough assessment to establish the severity of the injury. The first step is the ABC protocol: assessing Airway, Breathing, and Circulation [21].

1. **Assessment of Airway:** The primary concern in cases of steam inhalation is airway compromise due to edema and inflammation. Nurses should quickly assess the patient's airway for patency and signs of obstruction. This involves looking for any audible stridor or gurgling sounds, which indicate severe swelling and impending airway blockage [22].
2. **Breathing Evaluation:** Monitoring the respiratory rate, depth, and effort is critical. The nurse should assess for abnormal breath sounds using auscultation, focusing on wheezes or diminished breath sounds indicative of obstruction or inadequate ventilation. Oxygen saturation levels should be monitored using pulse oximetry to determine the patient's need for supplemental oxygen.
3. **Circulation:** While less impacted initially, circulation assessment is essential in the overall evaluation. Nurses should check heart rate, blood pressure, and capillary refill, understanding that hypoxia can lead to cardiac instability [22].

Immediate Nursing Interventions

Following the assessment phase, immediate nursing interventions should be initiated to stabilize the patient:

1. **Maintain Airway Patency:** If the airway is compromised due to severe edema, the nurse must position the patient to facilitate optimal airway management, often in a semi-Fowler's position to decrease the work of breathing. In cases where the airway is significantly obstructed, advanced airway intervention, such as endotracheal intubation, may be necessary alongside coordination with emergency physicians [23].
2. **Administer Supplemental Oxygen:** To combat hypoxemia, supplemental oxygen should be implemented as soon as possible. Depending on the severity of respiratory distress, this may involve using simple face masks or requiring higher-flow systems

(non-rebreather masks, or even mechanical ventilation in severe cases) [23].

3. **Intravenous Fluid Administration:** In instances of significant smoke inhalation alongside steam exposure or when the patient's physiological stability is in question, IV fluids may be warranted to maintain perfusion and hydration [24].
4. **Medications:** Depending on the clinical judgment of the healthcare team, bronchodilators may be administered to alleviate bronchospasm. Corticosteroids can also be effective in reducing airway inflammation and edema in steam inhalation cases, although their use should be guided by clinical protocols.
5. **Provide Emotional Support:** Managing a severe injury can be distressing for patients and their families. Providing reassurance and clear information about the treatment process is a critical nursing intervention that can positively affect the overall care experience [24].

Continuous Monitoring and Collaboration

Following initial interventions, nursing care should shift to continuous monitoring to identify any changes in the patient's condition promptly. This includes regular assessments of vital signs, oxygenation levels, and respiratory status [24].

Moreover, collaboration with the interdisciplinary medical team ensures that all aspects of care are addressed. Nurses should maintain open lines of communication with physicians, respiratory therapists, and other support staff to ensure comprehensive management of the patient [24].

Long-Term Considerations and Education

While the immediate response to steam inhalation injuries is critical, nurses should also consider long-term implications. Patients may require follow-up visits to assess for residual lung damage, airway reactivity, or potential psychological impacts stemming from the injury. Education about avoiding steam inhalation incidents and recognizing early signs of respiratory distress is essential, particularly for those at risk due to age (young children or elderly

individuals) or pre-existing respiratory conditions [25].

Ongoing Patient Monitoring and Supportive Care:

Vapor inhalation injuries, resulting from exposure to harmful substances in the form of gas or aerosol, can pose significant health risks. Commonly seen in occupational settings, industrial accidents, or during fires, these injuries can lead to serious respiratory complications and require immediate medical attention. A comprehensive understanding of the mechanisms of injury, immediate response strategies, and the importance of continuous patient monitoring and supportive care is crucial for improving patient outcomes [26].

Vapor inhalation injuries occur when noxious gases or vapors are absorbed through the respiratory tract, leading to acute or chronic lung damage. These exposures may stem from a variety of sources, including industrial chemicals, household cleaners, byproducts of combustion, and medicinal agents. The physiological effects can vary based on the nature of the substance inhaled, the duration of exposure, and the individual patient's susceptibility [26].

The primary pathophysiological effects of vapor inhalation injuries may include airway edema, bronchospasm, chemical pneumonitis, and in severe cases, acute respiratory distress syndrome (ARDS). The initial response of the airway to these irritants can lead to inflammation, increased mucus production, and compromised gas exchange, significantly impairing the oxygenation of blood. Therefore, timely and effective intervention is central to minimizing harm and preserving lung function [27].

The management of vapor inhalation injuries begins with the prompt recognition of symptoms, which may manifest as cough, wheezing, dyspnea, chest tightness, and potentially altered mental status. It is crucial for healthcare providers to conduct a thorough assessment of the patient's exposure history, taking into account the type of vapor inhaled, as well as the duration and circumstances of the exposure [28].

Upon arrival at a healthcare facility, patients typically undergo several preliminary evaluations,

including vital signs, pulse oximetry to assess oxygen saturation, and imaging studies like chest X-rays and CT scans to evaluate the extent of lung injury. In cases of severe inhalation injuries, advanced airway management might be necessary, including the use of supplemental oxygen, nebulized bronchodilators, and in some cases, intubation and mechanical ventilation [28].

Continuous Patient Monitoring

The cornerstone of effective treatment for vapor inhalation injuries relies heavily on continuous patient monitoring. Monitoring should start with the implementation of standardized protocols that assess not only vital signs but also various other clinical parameters. Continuous electrocardiography (ECG) and pulse oximetry are standard practice, but more advanced monitoring techniques could be employed depending on the severity of the injury [29].

Key observations should include:

1. **Respiratory Parameters:** The frequency of respiratory rate, depth, and the presence of crackles or wheezing should be monitored closely. Frequent arterial blood gas (ABG) analysis can provide critical information regarding the patient's oxygenation and acid-base balance [30].
2. **Neurological Status:** Changes in mental status can indicate hypoxia or hypercapnia. Continuous or regular neurologic assessments can provide insight into the patient's respiratory effectiveness and overall stability.
3. **Fluid and Electrolyte Balance:** For patients with significant airway inflammation and fluid shifts, close monitoring of hydration status and electrolytes is essential to mitigate complications such as shock or ARDS.
4. **Signs of Secondary Infections:** Given that vapor inhalation can compromise mucosal barriers, these patients are susceptible to secondary infections. Monitoring for fever, increased white blood cell count, and purulent secretions from the respiratory tract is vital.

5. **Possible Metabolic Derangements:** Continuous monitoring enables early detection of metabolic acidosis or other imbalances that may arise in the context of ineffective respiratory function [30].

Supportive Care Strategies

In addition to continuous monitoring, the supportive care of patients with vapor inhalation injuries encompasses a multidisciplinary approach aimed at optimizing recovery outcomes. Essential components of supportive care include, but are not limited to:

1. **Airway Management:** Maintaining a patent airway is paramount. In the less severe cases, bronchodilators such as albuterol can be used as nebulized treatments to alleviate bronchospasm. For patients showing signs of severe distress, intubation may be necessary to secure the airway and provide mechanical ventilation [31].
2. **Oxygen Therapy:** For patients exhibiting hypoxemia, supplemental oxygen should be administered to maintain adequate oxygen saturation levels. In cases of carbon monoxide exposure, hyperbaric oxygen therapy may be warranted.
3. **Fluid Therapy:** Adequate hydration through intravenous fluids can help to support circulation and facilitate the management of any systemic effects of inhalation injury [31].
4. **Nutritional Support:** Patients recovering from significant respiratory injury may require nutritional support to promote healing and optimize overall health status. Early enteral nutrition should be considered to support metabolic needs.
5. **Psychosocial Support:** Given the potential for trauma and stress related to inhalation injuries, supportive psychological care plays a crucial role in rehabilitation. Counseling and social work services may be beneficial [32].

Pharmacological management of symptoms:

Pharmacological management of symptoms is a fundamental aspect of modern medicine, encompassing various strategies and interventions aimed at alleviating the manifestations of diseases and improving the overall quality of life for patients. Symptoms, which can range from pain and inflammation to anxiety and insomnia, are often the most distressing aspects of an individual's condition and can significantly affect their daily functioning. This essay explores the principles, methodologies, and implications of pharmacological management, highlighting its importance in medical practice while also addressing potential challenges and future directions [33].

Symptoms are subjective experiences reported by patients, and they play a crucial role in the diagnostic process. They can indicate underlying medical conditions and guide healthcare providers in formulating appropriate treatment plans. Common symptoms such as pain, fever, nausea, fatigue, and anxiety can arise from various etiologies, including infections, chronic diseases, mental health disorders, and acute injuries. The impact of these symptoms on patients is often profound, influencing not only their physical well-being but also their emotional and psychological states. Chronic symptoms can lead to decreased quality of life, increased healthcare utilization, and even disability [34].

Principles of Pharmacological Management

Pharmacological management of symptoms revolves around the use of medications to control or alleviate these manifestations. This approach is grounded in several key principles:

1. **Diagnosis and Symptom Identification:** Effective pharmacological management begins with a thorough assessment of the patient's symptoms and an accurate diagnosis. Understanding the underlying cause of symptoms is crucial for selecting the appropriate pharmacological agents. For instance, managing chronic pain necessitates a different approach than treating anxiety or depression [35].
2. **Evidence-Based Selection:** The choice of pharmacological treatment is informed by scientific evidence and clinical guidelines. Healthcare providers should consider the efficacy, safety, potential side effects, and

interactions of medications. For example, nonsteroidal anti-inflammatory drugs (NSAIDs) are commonly employed for pain and inflammation, while selective serotonin reuptake inhibitors (SSRIs) may be prescribed for managing symptoms of depression and anxiety [36].

3. **Individualized Treatment:** Each patient's context is unique, thus requiring tailored approaches to pharmacological management. Factors such as age, sex, genetic predispositions, coexisting medical conditions, and personal preferences must be considered. Personalized medicine has gained prominence in recent years, emphasizing the need to adjust treatment protocols to optimize outcomes [37].
4. **Monitoring and Evaluation:** Continuous assessment of treatment efficacy and side effects is critical. Regular follow-ups enable healthcare providers to make necessary adjustments to medication regimens, ensuring that the therapeutic goals are met without compromising patient safety [38].

Common Classes of Medications for Symptom Management

Pharmacological treatment modalities can broadly be categorized into several classes based on the symptoms they target:

1. **Analgesics:** Pain management is one of the primary applications of pharmacological intervention. Analgesics, ranging from over-the-counter options like acetaminophen and NSAIDs to prescription opioids, are frequently used to alleviate acute and chronic pain. The choice of analgesic depends on the severity of pain, its origin, and patient-specific factors [39].
2. **Antipyretics:** To manage fever, antipyretic agents such as acetaminophen and ibuprofen are utilized. These medications work by acting on the hypothalamus to regulate body temperature and provide symptomatic relief [40].

3. **Antiemetics:** Nausea and vomiting can result from various stimuli, including chemotherapy, gastrointestinal disorders, and neurological conditions. Antiemetics, including ondansetron and metoclopramide, help mitigate these symptoms, allowing patients to maintain their nutritional intake and overall quality of life [41].
4. **Anxiolytics and Antidepressants:** For symptoms of anxiety and depression, pharmacological interventions include anxiolytics (such as benzodiazepines) and antidepressants (such as SSRIs, SNRIs, and atypical antidepressants). These medications aim to restore emotional balance, reducing anxiety and depressive symptoms [42].
5. **Corticosteroids:** When inflammation is a significant symptom, corticosteroids may be prescribed to reduce swelling and immune response, particularly in conditions such as asthma, rheumatoid arthritis, and autoimmune diseases [42].
6. **Sedatives and Hypnotics:** Insomnia and sleep disorders can severely disrupt a patient's daily life. Medications such as benzodiazepines, Z-drugs, and melatonin agonists are frequently used to manage sleep disturbances, providing symptomatic relief [43].

Challenges and Considerations in Pharmacological Management

Despite the significant advancements in pharmacological management of symptoms, several challenges persist.

- **Adverse Effects:** All medications come with the potential for side effects. For instance, long-term use of opioids can lead to tolerance, dependence, and addiction. Similarly, SSRIs can cause gastrointestinal disturbances and sexual dysfunction. It is critical for healthcare providers to weigh the benefits against the risks and to engage in thorough patient counseling [44].
- **Drug Interactions:** Patients often present with multiple comorbidities requiring

polypharmacy, which heightens the risk of drug-drug interactions. These interactions can diminish the efficacy of medications or exacerbate adverse reactions, necessitating careful management and patient education [45].

- **Patient Adherence:** Even the most effective pharmacological treatments can fail if patients do not adhere to prescribed regimens. Factors influencing adherence include the complexity of medication schedules, side effects, and the individual's understanding of the treatment's importance [46].
- **Access and Affordability:** In many regions, healthcare disparities can limit access to necessary medications. Socioeconomic factors often dictate whether patients receive appropriate pharmacological treatment, emphasizing the need for health equity initiatives [47].

Future Directions

As the understanding of pharmacology and pathophysiology advances, the future of pharmacological symptom management appears promising. The rise of precision medicine, biotechnology, and advancements in drug development heralds new opportunities to enhance symptom management through targeted therapies. Furthermore, integrative approaches incorporating non-pharmacological interventions, such as cognitive-behavioral therapy, physical therapy, or mindfulness techniques, can complement pharmacological strategies, potentially leading to improved outcomes [48].

Moreover, ongoing research is focused on understanding the genetic and molecular basis of diseases, paving the way for innovative treatments tailored to individual patient needs. The integration of digital health technologies—such as mobile health applications and telemedicine—can also streamline symptom management, promote monitoring, and enhance patient engagement [49].

Patient Education and Prevention Strategies:

In recent years, the prevalence of steam inhalation injuries has emerged as a significant public health concern, particularly among vulnerable populations

such as children and the elderly. Steam inhalation, often touted as a home remedy for alleviating congestion, is increasingly recognized as a potential cause of serious respiratory injury. This essay delves into the significance of patient education and the implementation of prevention strategies tailored to mitigate the risks associated with steam inhalation injuries. Understanding the mechanisms through which these injuries occur, recognizing the symptoms, and adopting preventive measures are vital components of safeguarding health and enhancing overall well-being [50].

Steam inhalation injuries arise when individuals accidentally or intentionally inhale water vapor at high temperatures, leading to thermal injury of the mucosal surfaces of the respiratory tract. The human respiratory tract, particularly the trachea and bronchi, is lined with sensitive mucosal tissue designed to resist infection and foreign invaders. When exposed to high-temperature steam, typically exceeding 60 degrees Celsius (140 degrees Fahrenheit), this mucosal tissue can become severely damaged, leading to acute inflammation, swelling, and potential airway compromise [51].

The mechanisms of steam inhalation injuries primarily involve direct thermal effects and the production of inflammatory mediators in response to the heat exposure. Symptoms include coughing, wheezing, shortness of breath, and in severe cases, the development of respiratory distress or failure. Depending on the severity of the inhalation injury, treatment may range from simple symptomatic management to advanced interventions, including bronchoscopy and airway management [52].

Patient education plays a pivotal role in the prevention of steam inhalation injuries. Proper education can empower individuals with knowledge about the risks associated with steam inhalation, enabling them to make informed choices regarding their health. Educational programs must be tailored to address various demographics, as patients from different age groups and backgrounds may exhibit diverse levels of understanding and awareness regarding the hazards involved [53].

Effective patient education should encompass several key areas:

1. **Understanding Risks:** Educating patients about the dangers of steam inhalation is

fundamental. This includes clear information about the temperature thresholds that can cause injury, the symptoms of potential injuries, and the scenarios where steam inhalation may occur—such as home remedies, steam showers, or sauna usage [53].

2. **Proper Techniques:** If steam inhalation is deemed necessary for therapeutic purposes, teaching proper techniques is critical. Patients should be informed about maintaining a safe distance from the source of steam, using cool mist vaporizers instead, or utilizing products specifically designed for inhalation therapy that minimize risks.
3. **Recognizing Symptoms:** Patients should be familiar with the signs and symptoms of steam inhalation injuries. Early recognition can lead to prompt medical evaluation and intervention, thus improving outcomes [53].
4. **Encouraging Safe Practices:** Moving beyond mere information dissemination, patient education must promote safe practices in the home environment. This includes avoiding the use of boiling water or uncontrolled steam sources near children, ensuring that the elderly or ill do not misuse steam therapy, and employing safer alternatives like nebulizers and saline solutions [53].

Prevention Strategies

The strategy for preventing steam inhalation injuries can be multifaceted, involving community engagement, public health initiatives, and safe practices within individual households. Below are some recommended prevention strategies:

1. **Awareness Campaigns:** Community-based awareness campaigns can significantly improve knowledge regarding the dangers of steam inhalation. Distributing educational materials in healthcare settings, schools, and community centers can ensure that families recognize the inherent risks and how to avoid them [53].

2. **Skill Development Workshops:** Local health organizations can facilitate workshops designed to educate individuals on safe inhalation practices. These workshops would cover effective home remedies for respiratory issues, alternatives to boiling water for steam, and hands-on demonstrations of safe techniques.
3. **Parental Guidance:** Special focus should be placed on educating parents about the risks steam inhalation poses to children. Specific strategies, such as using vapor rubs or humidifiers that work safely without producing steam, should be promoted instead of traditional steam therapies [53].
4. **Healthcare Provider Training:** Training healthcare providers to recognize and manage steam inhalation injuries effectively can enhance prevention. Providers can serve as critical points of contact for educating patients about the risks and safe practices [54].
5. **Legislation and Standards:** The establishment of health regulations surrounding the marketing and sale of products associated with steam therapy could enhance safety. Stricter guidelines could regulate the permissible temperature of vaporizers marketed to the public, ensuring they are designed with safety features.

Collaborative Care and Multidisciplinary Approach:

Steam inhalation injuries, while often underestimated, present significant risks, particularly in domestic settings where individuals, especially children, may inadvertently expose themselves to scalding steam. The management of these injuries requires a comprehensive and coordinated response that encompasses a variety of healthcare professionals, a model known as collaborative care. This approach not only improves patient outcomes but also enhances the recovery experience through the integration of diverse expert insights [54].

Steam inhalation injuries primarily occur due to the inhalation of hot steam produced from boiling water or heated substances. These injuries can result in thermal damage to the airways, leading to airway edema, inflammation, and in severe cases, respiratory distress. Clinical manifestations can vary from mild coughing and throat irritation to more severe outcomes, including airway obstruction and respiratory failure. The management of these injuries requires prompt assessment and intervention to minimize long-term complications, making the role of an interdisciplinary team crucial [54].

The Importance of Collaborative Care

Collaborative care refers to a model where healthcare professionals from different disciplines work together towards shared goals. In the context of steam inhalation injuries, this involves a variety of specialists including emergency medicine providers, respiratory therapists, nurses, pain management specialists, and social workers. Each of these professionals contributes unique skills and perspectives that enhance patient care [55].

1. **Emergency Medicine Perspective:** The immediate management of steam inhalation injuries often falls to emergency medicine practitioners. They play a critical role in the initial assessment and stabilization of the patient. This may involve administering oxygen, securing the airway, and providing intravenous fluids. Quick recognition of severity is vital, as this can dictate the course of treatment and referral needs [55].
2. **Respiratory Therapy:** Respiratory therapists are essential in the ongoing management of patients with significant airway involvement. They assess respiratory function, provide nebulized medications, and support mechanical ventilation if required. Their expertise ensures that patients receive appropriate care to optimize lung function during recovery.
3. **Nursing Care:** Nurses are often the primary caregiver in the hospital setting and are responsible for monitoring vitals and managing symptoms. They ensure comprehensive care, focusing on pain management, infection control, and emotional

support for both the patient and family. Their ongoing assessments are pivotal in identifying any changes in the patient's condition that may require immediate attention [55].

4. **Pain Management Specialists:** Severe injuries can lead to intense discomfort. Including pain management specialists in the team ensures that patients receive tailored analgesics and, where appropriate, interventions such as nerve blocks or alternative therapies, contributing not only to comfort but also to the overall effectiveness of the rehabilitation process [56].
5. **Social Work and Mental Health:** The psychological impact of experiencing a steam inhalation injury, especially in children, should not be overlooked. Social workers and mental health professionals can provide counseling and support to help patients and their families cope with trauma. This holistic approach acknowledges the emotional and psychological aspects, reinforcing the importance of emotional wellbeing in recovery.

The Multidisciplinary Approach

The collaborative approach in the management of steam inhalation injuries translates into a multidisciplinary management plan. This plan is characterized by:

- **Comprehensive Assessment:** Each professional conducts a thorough evaluation, leading to a multifaceted understanding of the injury's implications on respiratory health, physical comfort, and psychological state [57].
- **Individualized Treatment Plans:** Based on the consensus of the team, customized management strategies are devised, ensuring that every aspect of the patient's condition is addressed. This may include a combination of medical management, respiratory therapy, and psychological support.
- **Ongoing Communication:** Regular interdisciplinary meetings are essential for discussing the progress of patients, facilitating adjustments to treatment plans based on real-time observations, and ensuring all team members are informed about the patient's status [57].

- **Transition of Care:** Upon discharge, the collaborative care team continues to play a role in the follow-up phase, including education on potential complications, strategies to prevent future injuries, and connections to community resources for ongoing support [57].

Conclusion:

In conclusion, effective nursing management of vapor inhalation injuries is critical to improving patient outcomes and promoting recovery. Nurses play a pivotal role in the early identification and assessment of respiratory impairments, implementing timely interventions to ensure airway protection and adequate oxygenation. Through a combination of immediate care strategies, ongoing monitoring, and symptom management, nurses can address the complex needs of patients affected by such injuries. Additionally, providing education on the risks of vapor exposure and facilitating preventative measures is essential in minimizing future incidents. Collaborative efforts with interdisciplinary teams further enhance care delivery, ensuring a comprehensive approach to treatment and rehabilitation. By emphasizing both the physical and emotional aspects of patient care, nursing professionals contribute significantly to the healing process and the overall well-being of individuals recovering from vapor inhalation injuries.

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