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Assessment and Nursing Management of Drain Placement Needs in Traumatic Wound Care

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Abstract

Assessing the need for drainage in traumatic wounds is critical in wound management, as it can help prevent complications and promote wound healing. Drainage methods can be classified as passive or active. Passive drainage methods are more suitable for wounds with minimal fluid accumulation, whereas active drainage methods, such as wound drains and negative pressure wound therapy, provide better drainage control and stimulate tissue granulation. Drainage tubes serve multiple functions in wound management, including facilitating the removal of excess fluid, helping to prevent complications, reducing the risk of infection, aiding in wound contraction, and simplifying dressing changes and wound assessment. Various types of drainage tubes, including Penrose drains, Jackson–Pratt drains, Hemovac® drains, and closed-suction drains, can be applied, each with specific advantages and suitability for different wound types or surgical procedures. Regular monitoring and timely dressing changes are essential for maintaining effective drainage. These measures help ensure that drainage systems continue to function properly over time. Ultimately, the use of tailored drainage techniques selected based on the specific characteristics of the wound and proper care of the drainage system play crucial roles in successful wound management. This comprehensive approach promotes optimal healing, enhances patient comfort, and supports faster recovery.

Keywords: Traumatic wound care, Wound drainage, Wound dressing, Wound healing

Introduction

Traumatic wounds, resulting from accidents, injuries, or surgical procedures, can pose significant challenges to the body's healing process. In the United States, approximately 12.2 million patients visit the emergency room for wound care each year.[1] In Thailand, tertiary hospital emergency departments report that, on average, 30.9% of emergency cases are accident-related cases[2], with 15,133 patients (or 44% of all emergency department visits) presenting with wounds. Traumatic wounds vary in type and can, include lacerations, abrasions, stab wounds, and avulsions. The majority of these injuries, about 73.5%, occur on the extremities.[4] Most of these wounds are contaminated and produce significant amounts of exudate, which complicates their management.

Effective wound management plays a crucial role in promoting optimal healing and preventing complications. One key aspect of wound management is wound assessment, particularly determination of the need for drainage. Drainage refers to removing fluid, such as blood, serum, or purulent discharge, from a wound or surgical site.[5] Traumatic wounds often accumulate excess fluid, which can impede the healing process.[6] Without proper drainage, these wound can form hematomas, seromas, and abscesses, which can delay healing, increase the risk of infection, and potentially lead to other complications.[7, 8]

Assessment of the need for drainage

Assessing the need for drainage in traumatic wounds is a critical step in wound management. Selecting the appropriate drainage method based on the wound type and fluid characteristics, is essential for promoting effective fluid removal and preventing complications such as infection, blockage, and delayed healing.[9] Healthcare professionals (i.e., physicians, nurses, and wound care specialists) must evaluate several key factors, such as the following, to determine the need for drainage.

Wound characteristics: The size, depth, and location of the wound influence the need for drainage. Deep or large wounds with potential dead spaces are more prone to fluid accumulation and may require drainage.[10]

Presence of fluid accumulation: Visible signs of fluid accumulation, such as swelling, bruising, or fluctuance, indicate the need for drainage. The type of fluid, (e.g., serous, sanguineous, or purulent), helps further determine the appropriate drainage technique.[7, 11]

Risk of infection: Traumatic wounds have a risk of infection due to the possible introduction of contaminants. If the wound shows signs of infection, such as increased redness, warmth, pain, or purulent discharge, drainage becomes crucial to prevent the infection from spreading.[9]

Impaired healing: Wounds that exhibit delayed healing or fail to progress through the normal stages of wound healing may require drainage. Excessive fluid accumulation can impede the formation of granulation tissue and negatively affect the wound's healing trajectory.[12]

Benefits of drainage

Assessing traumatic wounds and implementing appropriate drainage techniques can provide the following benefits:

Prevention of complications: Drainage facilitates the removal of excess fluid while reducing the risk of complications, such as hematomas, seromas, and abscesses. Hematomas and seromas are common complications of surgical procedures or traumatic wounds. Hematomas are localized collections of blood, while seromas are accumulations of serous fluid. Both can exert pressure on the surrounding tissues, impair wound healing, and increase the risk of infection. Drainage tubes help prevent the formation of hematomas and seromas by providing a route for the blood or serous fluid to drain, thereby reducing the risk of wound healing complications.[7, 13, 14]

Promotion of wound healing: Accumulated fluid can hinder the healing process by creating a moist environment that promotes bacterial growth, delays the formation of granulation tissue, and impedes wound contraction. Drainage tubes allow for the controlled and efficient removal of fluid, thereby helping to maintain an optimal wound environment for healing.[7] This drainage also helps remove inhibitory factors, such as inflammatory mediators and proteases, which can impede the progression of wound healing.[12] The tubes also help prevent the formation of biofilms, which can impede wound healing and increase susceptibility to infection.[12,15]

Facilitation of wound contraction and closure: Drainage can assist in wound contraction by preventing the accumulation of fluid that may hinder the surgical closure of the wound edges. Drainage helps promote the natural closure of the wound and reduces the need for extensive surgical intervention. In some cases, traumatic wounds may require closure techniques, such as suturing or wound dressing. In those cases, drainage aids in preparing the wound bed for closure, thereby ensuring a better approximation of wound edges and minimizing tension.[12]

Enhancement of visualization: Drainage provides healthcare professionals with better visualization of the woundbed, enabling an easier assessment of the wound's progress and the identification of any underlying issues that may hinder healing.[16]

Reduction of pain and discomfort: Accumulated fluid in traumatic wounds can cause pain and discomfort and place pressure on the surrounding tissues. By removing this fluid, drainage alleviates these symptoms, improving patient comfort and promoting faster recovery.[17]

Passive and active drainage methods

Wound drainage is accomplished using the two primary methods: passive drainage and active drainage. Passive drainage methods remove fluid from a wound based on cavity and capillary actions, and are generally suitable for wounds with minimal fluid accumulation and limited dead spaces, Conversely, active drainage methods use suction to create high or low negative pressure.[18] Active drainage is more effective for wounds with significant fluid accumulation, a complex anatomy, or a higher risk of complications.

The following section provide a comprehensive overview of these methods, including their characteristics, indications, potential applications, and importance in different clinical settings.

Passive drainage

Passive drainage methods, which depend on gravity or capillary action to facilitate the natural flow of fluid out of the wound, are characterized by their simplicity, cost-effectiveness, and ease of management. The principle underlying these methods is the establishment of a channel or pathway through which fluid can exit the wound without external intervention.[19] Passive methods are particularly suitable for wounds that possess the potential for spontaneous healing and demand minimal intervention. However, it is worth noting that passive methods may prove less effective when the wounds have significant fluid volumes or intricate anatomical structures.[20,21] Several common passive drainage methods are typically considered, including the following:

Gravity drainage: Gravity drainage utilizes the natural force of gravity to allow fluid to drain from the wound. This method involves positioning the wound in a dependent position to facilitate fluid flow.

Capillary action: Capillary action takes advantage of the natural tendency of fluids to move through small channels or absorbent materials. Dressings or wicks made of materials such as gauze or foam are placed in the wound cavity or tunnel to absorb and draw fluid away from the wound.[16]

Passive drainage can be categorized as open or closed, depending on the method of fluid collection from the wound. Open passive drainage allows wound fluid to exit the body through a corrugated rubber or plastic sheet, typically into a stoma bag or onto a gauze pad. This method is commonly used in trauma patients to facilitate the removal of contaminated fluids and reduce bacterial load at the wound site. However, it carries a risk of secondary infection due to exposure to the external environment.[18] Therefore, open passive drainage is generally recommended only for short-term use. Common examples of open passive drains include the Penrose drain and gauze drains.

Closed passive drainage involves the collection of wound fluid into a sealed container, such as a bottle or drainage bag, without exposure to outside air; thereby reducing the risk of infection. This method is also commonly used in trauma patients. Examples of closed passive drains include ventriculostomy drains and chest drains with one or two bottles.

Indications for passive drainage: Passive drainage methods are frequently employed in various situations, including: wounds exhibiting low-to-moderate levels of fluid accumulation, superficial wounds or those with limited dead spaces, non-infected wounds devoid of excessive debris, and wounds that necessitate minimal intervention and possess the potential for spontaneous healing.[22]

Benefits and considerations of passive drainage: Passive drainage methods are straightforward and cost-effective, while also easy to manage by the patients themselves or their caregivers.[20] These methods generally represent a less invasive approach and typically cause minimal discomfort. However, they

may prove less effective for wounds characterized by substantial fluid accumulation or complex anatomical structures. Regular monitoring and dressing changes are necessary to prevent dressing saturation and ensure that adequate drainage is maintained.[21]

Active drainage

Active drainage methods, such as suction drains or negative pressure wound therapy, play a crucial role in facilitating the controlled and efficient removal of excess fluid. These methods offer notable advantages, especially when dealing with wounds characterized by significant fluid accumulation, deep or complex structures, or a heightened risk of infection or impaired healing. Active drainage methods provide enhanced control over drainage levels and promote wound healing by reducing edema, stimulating tissue granulation, and preventing complications associated with fluid buildup.[12] Several common active drainage methods are typically considered, including the following:

Suction drains: Suction drains are tubes or other features placed into wounds or surgical sites to remove excess fluids. Typically, these drains are linked to a collection apparatus, which could be a suction bulb or a vacuum system. If only a tube drain is used without negative pressure, this is passive drainage. In trauma patients, various types of suction drains, such as Redivac drains, Hemovac® drains, and three-bottle chest drainage systems, are used to apply negative pressure, which enhances fluid removal and helps prevent fluid accumulation[18].

Negative pressure wound therapy (NPWT): NPWT, also known as vacuum-assisted closure, involves the application of controlled negative pressure to the wound bed using a specialized dressing and a vacuum pump. It uses control suction to create a vacuum-seal environment for active fluid removal. This method helps remove excess fluid, promotes wound contraction, and enhances granulation tissue formation.[16,23]

Indications: Active drainage methods are frequently utilized in various scenarios, including wounds characterized by large dead spaces or substantial fluid accumulation, complex or deep wounds arising from trauma or surgery, infected wounds or wounds with a heightened risk of infection, chronic wounds exhibiting slow or impaired healing, and wounds demanding frequent monitoring and controlled removal of fluid.[24]

Benefits and considerations: Active drainage methods have proven highly effective for removing excess fluid, thereby reducing the risk of complications.[25] They provide better control over drainage by enabling the precise adjustment of suction levels as needed. Moreover, active drainage has the potential to promote wound healing by stimulating tissue granulation and mitigating edema.[24] However, an essential point to note is that active drainage methods necessitate proper training for their application and maintenance. Close monitoring is imperative to ensure appropriate drainage levels and prevent complications, such as tube blockage or tissue trauma.[18,21]

Drainage tubes

Drainage tubes are medical devices designed to facilitate the removal of excess fluid from wounds or surgical sites. They play a critical role in wound management by preventing fluid accumulation, reducing the risk of complications, and promoting optimal wound healing.[5,25]

Drainage tubes are flexible hollow tubes made of various materials, such as silicone, latex, or polyurethane. They come in different sizes and shapes, depending on the specific wound characteristics and the intended purpose of the drainage. These tubes are typically inserted into the wound or its cavity during or after a surgical procedure to establish a pathway for fluid to exit the wound site.[22]

Selection of drainage tubes

The selection of an appropriate drainage tube depends on various factors, such as the characteristics of the wound, the amount of fluid accumulation, and the desired mode of drainage.[7] Whether through passive capillary action or active suction, drainage tubes provide an essential pathway for fluid to exit the wound, and create a conducive environment for healing. Healthcare professionals must assess the specific needs of the wound and select the most suitable drainage tube to optimize the wound-healing outcomes.[9,26]

Type of drainage tubes

Different types of drainage tubes are available, depending on the specific needs of the wound and the desired mode of drainage. Each type of drainage tube offers specific advantages and is suitable for different wound types or surgical procedures. The most common drainage tubes include the following:

Penrose drain: The Penrose drain is a soft, flexible tube made of latex or silicone. It functions through capillary action and relies on the surrounding tissues to absorb and wick fluid away from the wound.

Penrose drains are frequently employed in superficial wounds or in those with minimal fluid accumulation, as they establish a passage for fluid to drain passively through capillary action. They are especially beneficial in wounds characterized by limited dead spaces that necessitate minimal intervention. By averting fluid buildup, Penrose drains facilitate an ideal wound environment conducive to healing while mitigating the potential for complications.[22]

Jackson–Pratt® drain: The Jackson–Pratt® (JP) drain consists of a silicone or PVC tube connected to a bulb or reservoir. The bulb applies negative pressure, creating suction that draws fluid from the wound into the reservoir.

Jackson–Pratt® drains are frequently employed in surgical procedures to eliminate moderate to large volumes of fluid, as the negative pressure generated through the bulb or reservoir, facilitates the active drainage of fluid from the wound.[18] These drains are highly effective in preventing hematomas[27], seromas, and abscesses. JP drains play a pivotal role in maintaining a dry wound environment, thereby reducing the risk of infection and expediting the healing process.[25]

Hemovac® drain: The Hemovac® drain is a collapsible, spring-loaded drainage system that utilizes negative pressure. It consists of a silicone or PVC tube connected to a collection chamber, which collapses as the fluid is suctioned out.

Hemovac® drains are commonly employed in orthopedic and abdominal surgeries, because the spring-loaded design offers the advantage of active drainage via the collapsing of the collection chamber. These drains are beneficial for the removal of substantial quantities of fluid, including both blood and serous fluid. By preventing fluid accumulation, Hemovac® drains can effectively diminish the risk of infection, minimize tissue tension, and foster the healing process within the wound.[28]

Closed-suction drain: Closed-suction drains, such as the Blake drain® or the Redivac drain, are designed to provide continuous or intermittent suction to remove fluid from the wound. These drains consist of a flexible tube connected to a collection chamber, which is further connected to a vacuum source. The vacuum creates negative pressure, promoting the drainage of fluid from the wound.[16,29]

Closed-suction drains are frequently utilized in scenarios necessitating continuous or intermittent suction, proving especially valuable in deep or intricate wounds, such as those encountered in reconstructive or plastic surgeries. The application of continuous or intermittent negative pressure by the drain facilitates the effective elimination of fluid, thereby mitigating the potential for complications. In addition, closed-suction drains aid in preserving a clean wound bed, optimizing tissue approximation, and ultimately enhancing wound healing outcomes.[12,27]

Nursing roles in drain care

Nurses play a vital role in the management of wound drainage, from the immediate postoperative period until the drainage device is removed. Proper nursing care enhances the effectiveness of drainage and helps prevent complications such as slippage, blockage, and infection. One key nursing responsibilities is the regular monitoring and recording of the volume of collected fluid. The nurse, as the first-line medical professional responsible for monitoring the functioning of wound drains, must ensure that drainage bottles be emptied regularly to ensure continued function. The nurse must also remain alert for any kinks or bends in the drainage tubing.

Closed passive drains must always be positioned lower than the wound site to allow gravity to assist in drainage. Nurses must routinely check for any leakage from the drainage tube and ensure that the surrounding area remains clean. Signs of infection, such as swelling, redness, warmth, or pus at the

insertion site, must be closely monitored.

The position of the drain must also be regularly assessed to ensure it has not shifted. Any abnormalities must be promptly reported to the physician for further evaluation. Educating the patients on how to care for their drainage system can also significantly reduce the risk of complications and promote better outcomes.[9]

Conclusion

Effective wound management is crucial for promoting optimal healing and preventing complications in traumatic wounds. Assessing the need for drainage is a critical step in this process. Healthcare professionals must evaluate various factors, such as the wound characteristics, fluid accumulation, risk of infection, and impaired healing, to determine whether drainage is necessary. Proper drainage offers several benefits, including the prevention of complications, such as hematomas, seromas, and abscesses. It also promotes wound healing by creating an optimal healing environment and removing wound-bed factors that can inhibit wound healing.

Passive drainage methods, which rely on gravity or capillary action, are suitable for draining wounds that have minimal fluid accumulation and limited dead spaces. They are cost-effective and easily managed; however, they may be less effective for complex wounds with significant fluid accumulation. Active drainage methods, such as suction drains and negative pressure wound therapy, provide better control over drainage levels, while also stimulating tissue granulation, reducing edema, and preventing fluid-related complications. Various types of drainage tubes such as Penrose, Jackson–Pratt, and Hemovac® drains and other closed-suction systems offer distinct advantages that make them appropriate for different wound types and surgical procedures. Effective nursing care of drainage systems is essential to maximize drain efficiency prevent complications, and promote optimal wound healing.

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การอ้างอิง

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