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Postoperative Seroma Management

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Continuing Education Activity

Seroma is the abnormal accumulation of serous fluid in a dead space containing plasma and lymphatic fluid. It is a common postoperative complication, particularly in breast cancer and plastic surgery. They are a potential source of pain and anxiety for patients in the postoperative period and can lead to further complications such as infection or wound dehiscence. Current research trends focus on postoperative prevention; however, repeated aspiration remains the mainstay of postoperative seroma management once this fluid collection develops. This activity reviews the postoperative evaluation and management of seromas and highlights the role of the interprofessional team in managing this condition.

Objectives:

- Describe the pathophysiology of seroma formation.
- Review the treatment considerations for patients with a post-operative seroma.
- Outline the technique of seroma aspiration.
- Describe the role of the interprofessional team in the post-operative management of seroma in improving patient care and outcomes.

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Introduction

Seroma is the abnormal accumulation of serous fluid in a dead space containing plasma and lymphatic fluid.[1][2][3] It is a common complication of breast cancer surgery, plastic surgery, and abdominal wall hernia repair, with rates ranging between 15 to 85% following mastectomy and a global prevalence of 10.9% following abdominoplasty.[4][5][6]

The etiology of seroma formation remains unclear but is thought to be due to disruption of lymphatic and vascular drainage through extensive soft tissue dissection with an accumulation of serum, and possibly inflammatory exudate, in a dead space.[7][8]

These fluid collections can cause pain and anxiety for the patient necessitating further outpatient and hospital visits, leading to increased cost of care. Local wound complications can occur, such as wound dehiscence and flap necrosis, requiring further surgical intervention.[9] They are also associated with an increased risk of wound infection and possible abscess formation.[10]

Although current research trends are focussed on prevention, the mainstay of postoperative management of seroma includes conservative measures and fine needle aspirations.[11]

Anatomy and Physiology

Surgical wounds will heal through primary intention in the presence of well-approximated tissues and the absence of infection. This occurs over three overlapping phases: hemostasis/inflammation, proliferation, and maturation. Disruption of this process through infection, hypoxia, or dehiscence will lead to secondary wound healing. This occurs through the formation of granulation tissue (consisting of fibroblasts, new blood vessels, and type III collagen) with overlying epithelialization and extensive remodeling. Decelerated angiogenesis and epithelialization make this a slower mode of healing and more likely to result in chronic wounds or infection without good wound care.[12][13] It is thought this delayed form of healing plays a role in the formation of seroma due to a prolonged phase of the first phase of wound repair.

The exact pathophysiology of seroma formation is not yet fully understood. Current hypotheses from different studies indicate a likely multifactorial origin of this fluid collection. Surgical procedures with extensive soft tissue dissection are more likely to transect blood and lymphatic vessels and lead to a transudative fluid collection. Cases that have undergone significant resection of tissue result in a large potential dead space, making it more difficult for flaps to adhere and creating shearing forces between tissue surfaces. This is thought to contribute to an inflammatory process with exudative fluid from tissues adding to seroma formation.[7][11]

Multiple studies have analyzed fluid aspirated from seromas to investigate its chemical and cellular components, with conflicting findings suggestive of both a lymph-like fluid and fluid similar to inflammatory exudate.[8][14][15]

Chronic, unsuccessfully treated seromas may rarely lead to pseudocyst formation, lined by a dense capsule consisting of fibrous tissue and hyaline degenerated collagen. The incidence and pathophysiology of this encapsulated seroma remain poorly understood, with current evidence limited to case reports.[16][17][18][19]

Indications

Seromas that are minimal in volume and do not cause any pain, functional deficit, or strain on the wound closure can be managed conservatively with observation. In most cases, these will reabsorb without the need for further intervention.

Large volume seromas greater than 75 to 100 ml are often associated with pain, infection, and reduced function of the associated area, such as shoulder movement in axillary seromas.[20] Aspiration may be carried out in these cases to treat the patient's symptoms. In instances where recollection occurs, multiple aspirations may be required.

Ultrasound-guided aspiration is indicated in patients with periprosthetic seroma, such as in patients with breast implants, due to the risk of rupture.[21]

Open surgical drainage and debridement are rarely required and reserved for chronic cases with encapsulated pseudocyst formation or in cases where there is superimposed infection.[20]

Contraindications

Contraindications to seroma aspiration include:

- Small volume seromas that are not causing pain, functional deficit, or compromise to wound closure
- Presence of a pulsatile mass

Equipment

- Clean trolley
- Dressing pack
- Skin disinfectant wipe/device
- 18G needle or cannula
- Sterile syringe 20, 30, or 50 ml
- Universal container for specimen collection
- Disposable gloves and apron
- Sterile gauze
- Sharps container
- Disposable absorbent pad
- Disposable waste bag
- Sterile dressing

For potentially complex or periprosthetic seromas, consider radiologically guided aspiration.

Personnel

Seroma aspiration can routinely be carried out by an individual clinician at the patient's bedside or clinic setting. An appropriately trained nurse may carry out the procedure, although any concerns regarding possible infection, hematoma, or wound dehiscence warrant review by a physician.^[22]

In cases where ultrasound-guided aspiration is required, this can be referred to a radiologist if the clinician is not appropriately trained.

Preparation

Following correct patient identification, assessment should begin with history and examination to ascertain indications for intervention. Informed consent must be obtained following a discussion of the risks and benefits of aspiration. Significant risks include pain, infection, the need for future procedures, and damage to surrounding structures.^[20]

Other than possible damage to nerves, blood vessels, and tendons, this includes implant damage in periprosthetic seromas and pneumothorax in chest wall seromas.^[23]

A clean trolley should be used, and a sterile field should be set up with the equipment required. The aseptic non-touch technique must be adhered to throughout the procedure to minimize the risk of introducing infection. The clinician should use personal protective equipment, including gloves, an apron, a mask, and a visor, to minimize exposure to bodily fluids.

Technique or Treatment

After the patient has been appropriately positioned, the seroma should be examined to plan the aspiration point. This reduces the need for further palpation after skin preparation and minimizes the risk of introducing infection. An entry point through the surgical scar can be used to minimize the pain if feasible. If there is suspicion of infection, the clinician should be prepared to collect a sample for microscopy and culture.

The skin is prepared with a disinfectant wipe/device. A sterile drape with a central gap can be placed to isolate the aspiration site from surrounding unprepared skin. The needle entry point should be in the central aspect of the collection, and the needle advanced at a 45-degree angle to the skin and parallel to underlying structures. Once through the skin, the needle is gently advanced while aspirating on the syringe until there is a reduction in resistance and fluid is aspirated. If the seroma has not fully resolved but fluid stops withdrawing, the needle can be carefully repositioned as there may be locations. If a repeated attempt is required, a new needle should be used, but multiple attempts should be limited to reduce the risk of infection.[22]

Once the seroma has resolved, the needle can be removed and gentle pressure applied with gauze to the injection site until hemostasis is achieved. A sterile dressing can then be applied. Seroma fluid should be clear in nature; if the collected sample is cloudy or purulent, the sample should be sent for analysis, and broad-spectrum antibiotics may be considered if an infection is suspected.

Following the procedure, arrangements should be made for an early follow-up to review for resolution or need for further aspiration.

Complications

Although seroma aspiration is generally considered a safe procedure, there are recognized complications that may occur:

- Bleeding
- Neurovascular damage
- Infection: All invasive procedures carry a risk of infection. The need for multiple aspirations increases this risk. It should be noted that evidence in the literature suggests large untreated seromas are associated with infection, and therefore a decision to aspirate should be based on a risk assessment by the clinician.[6][10]
- Implant damage: In periprosthetic seromas, such as following breast implant surgery, there is a risk of implant puncture and rupture during aspiration. This is a significant complication that may necessitate a return to theatre. This risk can be mitigated using ultrasound guidance and an intravenous cannula or blunt needle.[21][24]
- Pneumothorax: Aspiration of chest wall seromas carry the risk of damage to the underlying pleura, which may cause a pneumothorax. Any symptoms of acute shortness of breath or difficulty breathing during or immediately after aspiration warrant emergency assessment and consideration of obtaining a chest radiograph.

Clinical Significance

Seromas can form in any surgical wound where extensive soft tissue dissection and dead space creation occur. Patients often present 7 to 10 days following wound closure or wound drain removal with a fluctuant collection near the operative site. This can be asymptomatic or associated with pain, a functional deficit of the affected area, and/or wound dehiscence.

Common Differentials

- Hematoma: An abnormal collection of blood; this is often associated with bruising.
- Abscess: A collection of pus in a cavity surrounded by epithelium. This is associated with overlying erythema and a warm surface. The patient may become systemically unwell with pyrexia and raised inflammatory markers. Definitive management includes incision and drainage and antibiotic administration.

- **Lymphedema:** Tissue swelling caused by disruption to the lymphatic systems. It can occur following procedures where significant lymphatic resection occurs, such as axillary node clearance for breast cancer with nodal disease. Swelling can be localized or generalized to an entire limb.

Patients presenting with suspected seroma in the early postoperative period should be thoroughly evaluated with history and examination to rule out other differentials. Blood tests, including a complete blood count and c-reactive protein (CRP), may also aid in the diagnostic process, but results should be considered in the clinical context of the patient's presentation.

Ultrasonography is indicated in patients whose diagnosis is uncertain or whose multiple aspirations have failed to resolve the collection to investigate for pseudocyst formation.[18]

As previously discussed, aspiration provides therapeutic relief for large-volume, symptomatic seromas. Moreover, examining the appearance of the fluid aspirated can be useful in confirming the diagnosis. This would be clear/straw-colored fluid in a seroma, blood in a hematoma, and pus in an abscess.

Breast Cancer Surgery

Due to its high incidence following mastectomy and axillary surgery, in the literature, seroma is occasionally regarded as an adverse effect of the surgery as opposed to a complication. Current research focuses on prevention through different flap fixation techniques, using chemical agents, and intra-operative drain insertion, with conflicting evidence in different patient groups.[25]

However, in the context of breast reconstruction, the management of seroma can become more difficult due to the risk of implant loss and skin flap ischemia. Implant loss rates due to seroma formation have been reported to be between 2 to 8%.[26][27] This can occur through wound dehiscence or superimposed bacterial infection. Using a mesh for reconstruction has also increased seroma formation rates. Studies comparing the incidence of seroma in synthetic and biological meshes have found conflicting results.[26][28]

The decision to drain a seroma in the context of breast reconstructive surgery can be difficult for the surgeon, and the risks of introducing infection with subsequent implant loss must be weighed up against the patient's symptoms, risk of skin dehiscence/necrosis, and the degree of aesthetic effect on the reconstruction.[29][30]

Hernia Repair

Seroma formation is common following hernia repair surgery, with an incidence between 8 to 12.5% for open hernia repair and 5.4% for laparoscopic repair.[31] Other than the possible complications already associated with seroma formation, in this patient group, they can be incorrectly perceived as a recurrence of the hernia by the patient or their clinician, potentially leading to unnecessary operative intervention.[32][33][34] Careful clinical examination is required to differentiate these pathologies, and adjunct imaging (USS or CT) may be used in cases with diagnostic uncertainty.

Studies have been performed to investigate the role of mesh repair on the incidence of seroma formation. A Cochrane review found that repair with mesh is more likely to be complicated by seroma compared to the non-mesh repair, likely due to a more significant local reaction to the prosthesis. A meta-analysis by Fang et al. found higher rates of seroma formation with biologic mesh compared to those made of synthetic materials.[35]

The decision to aspirate seromas in patients following hernia repair with mesh should be carefully considered as it carries a risk of introducing infection to the underlying prosthesis. This significant complication is likely to require further revision surgery to remove the infected implant.[36]

Seroma following laparoscopic hernia repair should be considered an expected outcome rather than a complication, with studies showing 95 to 100% of patients having early postoperative seroma formation on USS/CT imaging. The

seroma did not resolve spontaneously in only 3 or 4% of patients.[37]

Abdominoplasty

Abdominoplasty is one of the most common plastic surgery procedures, with seroma being the most common complication post-operatively; however, their incidence is decreasing, likely due to the wider use of successful intra-operative preventative measures.[6] These include quilting sutures, closed suction drainage, and Scarpa's fascia preservation.[6]

The use of tissue adhesives does not seem to reduce the incidence of seroma but rather reduces their volume.[9] [38] Following the formation of seroma, aspiration remains the treatment modality for large and symptomatic collections. There is little evidence in the literature on the volume of fluid after which aspiration is recommended. Di Martino et al. used a cut-off of 20ml and found that 23.8% of patients undergoing abdominoplasty (without quilting sutures) required aspiration.

Enhancing Healthcare Team Outcomes

A multidisciplinary and interprofessional approach is essential in managing postoperative seroma to ensure positive patient outcomes and minimize risks of complications. Clinical nurse specialists (CNS) play a key role in postoperative follow-up and monitoring. In breast cancer surgery, on-demand nurse-led follow-up in suitable patients has shown to be safe and effective with high patient satisfaction. A CNS follow-up service provides a more accessible, consistent means for patients to be reviewed and educated in the postoperative period.[39] [Level 1]

Protocols have been developed for trained CNS-led aspiration of seromas with appropriate escalation for medical input when required.[22] [Level 5]

This allows for improved reallocation of time for the surgeon to focus on diagnosing and treating the underlying condition and reviewing complicated seromas. Symptomatic seromas refractory to aspiration or complicated by infection or wound dehiscence will be reviewed by the physician as different management strategies are likely to be required. This includes incision & drainage with antibiotics for abscess formation and surgical excision of pseudocysts.[16][17][18][19] [Level 5]

The radiologist can aid the diagnostic process by interpreting ultrasound or computed tomography (CT) imaging. They can also offer ultrasound-guided aspiration for periprosthetic breast seromas.

Review Questions

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