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Ultrasound-Guided Pectoral Hydrodissection for the Treatment of Chronic Breast Pain Post Surgery and Radiotherapy: A Case Report

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Abstract

Chronic chest wall and upper limb pain is a common complication following breast cancer surgery and radiotherapy, affecting up to 60% of patients and significantly impacting their quality of life. We present the case of an 83-year-old woman with significant right-sided chest wall pain persisting several years after lumpectomy and radiotherapy. Her symptoms included burning and shooting pain, radiating from the breast to the axilla and fingers, not responding to conservative management. She underwent ultrasound-guided hydrodissection of the pectoral muscles using 10 mls of 5% dextrose. The procedure was well tolerated and resulted in a complete resolution of her symptoms at two-month follow-up, with self-reported improvements in function, mood, sleep, and mobility. To our knowledge, this is the first reported case of pectoral muscle hydrodissection for chronic breast pain post-breast cancer surgery. This technique can offer a minimally invasive, non-pharmacological alternative that may reduce the need for oral analgesics and improve patient outcomes. Further research is warranted to explore its broader clinical application.

Keywords

Hydrodissection, Chronic, Pain, Breast

1. Introduction

Breast cancer is the most commonly diagnosed cancer type among women. Early diagnosis and management have led to a 5-year survival of above 80% [1]. Chest wall pain is a common complaint in patients who undergo breast surgery and radiotherapy after being diagnosed with breast cancer [2]. Persistent pain post

breast cancer treatment affects up to 60% of patients [3]. Pain can vary in duration, from weeks to months, and in certain occasions can persist for years following the intervention. Persistent post-surgical pain has been recognised to cause significant physical and psychological effects for these patients [4], leading to decreased quality of life [3], higher stress levels, anxiety and features of depression [3]. Pain can be experienced in multiple regions ranging from the breast and chest, to the arm and upper back. The most common source of pain is believed to be secondary to nerve injury due to either the surgery itself, or scar tissue formation following wound healing [5]. However, chemotherapy and radiotherapy alone have been linked to nerve injury.

Musculoskeletal pain and upper limb impairment is a common complication post-breast cancer surgery and radiotherapy. It can present as shoulder and arm pain, restricted motion and upper limb weakness [6]. Surgical intervention and radiation can lead to scar tissue formation, with shortening of the muscles of the anterior chest wall and changes in stability of the shoulder girdle, which can lead to shoulder pain and stiffness [6]. Pre-existing joint symptoms can interfere and worsen in patients who receive radiation therapy, as they are required to raise their arms above their head to spare their limbs from the radiation [7]. This position can also be uncomfortable for patients who have undergone axillary node clearance. Other causes of patient discomfort post-breast cancer surgery include lymphoedema, while pain coming from the removed nipple or breast is referred to as phantom pain [8]. Risk factors for ongoing pain post breast surgery involve patients who underwent lymph node removal, pain at the site before surgery, exposure to radiotherapy, chemotherapy, or being overweight [9].

Hydrodissection is a minimally invasive technique involving injection of fluid, usually 5% dextrose or 0.9% NaCl, to separate fascial layers, releasing adhesions and scar tissue, and free entrapped nerves [10]. Hydrodissection is regarded as a safe technique for treating chronic pain in a variety of situations and patient cohorts. It is used in a variety of settings ranging from neuropathic to musculoskeletal pain [11]. It requires advanced knowledge in the use of ultrasound to identify the correct anatomy and visualisation of the needle tip throughout the procedure. Hydrodissection is a growing field of research and can be useful to avoid pharmacological treatment of chronic pain and the adverse side-effects of such treatment.

2. Case Report

An 83-year-old female was referred to the Department of Pain Medicine in University Hospital Limerick. The patient had a history of right sided breast cancer which was treated in 2016 with a lumpectomy and radiotherapy. The patient's presenting complaint was tenderness on the sternum radiating from the right breast to the axilla and down to the fingers. The nature of the pain ranged from sharp, shooting and burning pain, to increased sensitivity to cold. The pain at its maximal intensity was 10/10 in severity, causing much discomfort to the patient, particularly due to the direct contact of garments. This pain was not present prior

to her diagnosis of breast cancer.

The patient was experiencing extreme discomfort and pain leading to a significant negative impact by self-report on her mood, sleep, mobility and quality of life. The Douleur Neuropathique 4 (DN4) questionnaire was used which the patient scored 7/10, indicating a high likelihood of the patient experiencing neuropathic pain [12]. The patient had a Patient-Reported Outcomes Measurement Information System (PROMIS) score of 3/10, and when the quality of life scale from the American Chronic Pain Association was used, the patient scored 5/10. This score indicates a struggle with, but ability to fulfill daily home responsibilities, however with no outside activity, and the patient not being able to work or volunteer [13]. The patient was currently on oral analgesics, namely paracetamol, pregabalin and tramadol, undergoing qutenza patch treatment, was applying hot and cold compresses intermittently, and engaging in physiotherapy with minimal effect. The decision was made to perform a procedure to diagnose and treat her pain. The patient underwent a right-sided pectoral muscle hydrodissection under ultrasound guidance with a linear transducer. Prior to the procedure, a consent process was carried out. In the operating theatre, the patient was positioned supine with the right shoulder abducted to 90 degrees. The linear ultrasound probe was positioned over the coracoid process in the paramedian sagittal plane. The procedure was done under aseptic technique. Personal protective equipment was used including a surgical mask, gown, hat and gloves. Chlorhexidine solution was applied to the skin. The injection site was infiltrated with 1 ml of 1% lidocaine using a 25 g needle. A 25 g Whitacre needle was inserted medial to lateral into the fascial plane separating pectoralis major and pectoralis minor. The anatomy was visualised on the ultrasound screen, with the needle tip identified. Once the needle was properly positioned, 10 mls of 5% dextrose was injected using an aseptic technique. No immediate complications occurred at this time. The patient was counselled regarding post-nerve block care, and was discharged to home (**Figure 1**).

The patient was referred to the Pain Medicine Outpatients Department for follow-up. At this clinic, she was assessed two months later and was found to have complete resolution of her symptoms on self-report. The patient had improved function and mobility of her right arm, decreased pain, improved mood, sleep and quality of life.

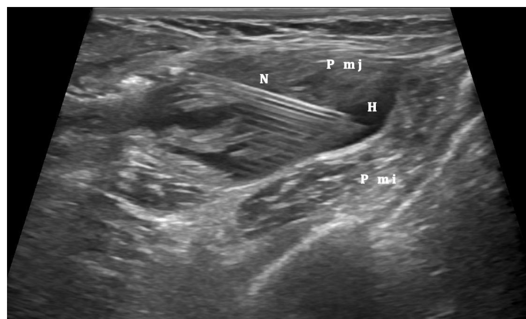

Figure 1. Ultrasound view of Intervention. N = needle; H = Hydrodissection; P mj = Pectoralis Major; P mi = Pectoralis Minor.

3. Discussion

To our knowledge, this is the first documented case report of pectoral muscle hydrodissection to relieve chronic breast pain in patients who have undergone breast surgery and radiotherapy for breast cancer. Hydrodissection is a growing field of research with regards to pain medicine. The exact mechanism of action of dextrose in treating chronic pain has not fully been established, but has been hypothesised through multiple theories. One such theory is that the separation of the fascia layers by 5% dextrose is thought to relieve the pressure on the associated nerves and relieve pain. Specifically, 5% dextrose is thought to trigger inflammation and cause the body to regenerate itself, promoting healing and the relief of pain [14] [15]. Dextrose 5% promotes cell proliferation in the musculoskeletal system, affects amino acid transport, and protein synthesis, which may reduce chronic pain [14] [15]. Other theories include the action of dextrose on the transient receptor potential vanilloid receptor-1 (TRPV1) ion channel [16] [17]. Perineural glycopaenia is another mechanism suspected to cause chronic pain due to hyperexcitability of nociceptive nerve fibres due to reduced firing of the ATPase pump which is dependent on ATP production from dextrose. The injection of dextrose 5% in theory restores low energy stores, treating this mechanism of chronic pain [18]-[21].

Ultrasound guided hydrodissection, when performed by a skilled operator, is a minimally invasive and safe treatment for patients to undergo, that is well tolerated. Numerous patients have reported significant improvement to their symptoms and quality of life after hydrodissection therapy, such as in this case report of a patient having improvement to her self-reported symptoms of chest wall pain.

Pectoral muscle hydrodissection provides a novel approach to the management of chronic breast pain post lumpectomy and radiotherapy. It provides a non-pharmacological solution that can greatly benefit a patient's quality of life. Currently, the treatment of chronic breast pain post lumpectomy and radiotherapy focuses on oral analgesics, ranging from paracetamol, NSAIDs, neuropathic agents (gabapentin, amitriptyline) and even opiates. These oral analgesics can provide varying degrees of relief, with undesirable side-effects such as opioid dependence, peptic ulcers from NSAIDs and dizziness from neuropathic agents. These side-effects can be particularly undesirable in an elderly cohort. More aggressive treatment options include surgical removal of the intercostal nerves causing the chronic pain, however this often leaves the patient with numbness over the area [22]. Trigger point injections, using commonly dexamethasone and bupivacaine, is another anaesthetic technique used to treat chronic post-mastectomy pain syndrome. The mechanism by which this works is explained by nerve damage to the sensory branches of the cutaneous nerves during surgery leading to neuroma formation, which continually fires pain signals. By identifying a "trigger point" which is a reproducible site of pain on palpation, this likely is the site of a neuroma, and perineural injection of dexamethasone and local anaesthetic can help alleviate this pain [23]. Local anaesthetic in this mixture provides short term relief which can

be a helpful diagnostic test, whilst the addition of dexamethasone can help to inhibit the persistent firing of the neuromas by disabling their pacemaker activity [23]. Extensive physiotherapy is an important, non-pharmacological and non-invasive therapy for the treatment of post-mastectomy pain syndrome. Other options include transcutaneous electrical nerve stimulations (TENS), acupuncture, massage, cryotherapy and heat therapy [24].

Interventional pain procedures have a well-documented, beneficial effect on patients experiencing post-mastectomy pain syndrome, as they have been shown to decrease pain scores by 56% in patients experiencing chronic pain, already being treated by oral agents [25]. Injections such as pectoral blocks with local anaesthetic are primarily used in the acute management of surgical pain, such as preoperatively in order to prevent severe pain, and reduce the potential for post-mastectomy pain syndrome [26]. Pulsed radiofrequency is another invasive method with a growing evidence base for the use for post-mastectomy pain. This is a treatment using pulsed radiofrequency stimuli to change the nerve tissue due to the heat around the electrode placed on the nerve, blocking the nerve stimulus causing the pain. This has been used to treat post-mastectomy pain syndrome by localising the specific nerve believed to be at fault, and targeting this nerve and its root [27].

When comparing the roles of invasive treatments such as pectoral blocks, pulsed radiofrequency and hydrodissection, important distinctions should be noted. Pectoral blocks with local anaesthetic have a greater foundation of research in the treatment of acute surgical pain, compared to chronic pain where 5% dextrose is commonly used due to its beneficial, long lasting effects. Pulsed radiofrequency requires the targeting of the individual nerve or nerves believed to be the cause of the chronic pain. This requires a greater degree of diagnosis and accuracy during the procedure to perform compared to hydrodissection, which separates the pectoralis major and minor muscles. Any inaccuracy in either diagnosing the specific nerve responsible for the post-mastectomy pain syndrome, or inaccuracy in performing pulsed radiofrequency to this nerve, can lead to failure of the procedure. We believe that pectoralis hydrodissection has an advantage in this regard, by targeting multiple nerves which may be responsible for causing the pain, and allowing the technician a greater degree of certainty of performing the procedure correctly, due to being able to identify on the ultrasound the anatomy, needle tip and visualise the spread of the 5% dextrose in the fascia between pectoralis major and pectoralis minor muscles.

Hydrodissection can reduce the need for oral analgesics, and avoid the associated side-effects, which is of particular benefit in elderly, comorbid patients. This new intervention may play a growing role in aiding some of the 60% of patients who experience persistent pain post breast cancer treatment, and is a growing field of research [3].

4. Conclusion

Pectoral muscle hydrodissection can be an effective treatment option for patients

suffering from breast or chest wall pain post breast-cancer surgery or radiotherapy. It offers an alternative to more invasive interventions and warrants further investigation in the management of post-surgical breast cancer pain. Hydrodissection can be an alternative to oral analgesics, which has numerous benefits especially in patients with multiple comorbidities. Ultrasound guided hydrodissection is a growing field of research, and has numerous examples of patient benefit in the field of chronic pain. Long-term follow-up is necessary to determine the durability of the treatment effect, and is an area requiring future research.

Availability of Data and Material/Data Transparency

This case report is an accurate account of the case described. No impertinent data has been omitted from this case report. All queries should be directed to the corresponding author via email. Requests for reprints should also be addressed to the corresponding author.

Ethical Approval

This study is fully compliant with the ethical guidelines of the Research Ethics and Clinical Trials Committee in the University of Limerick Hospitals Group.

Consent to Participate

The patient described in this case report consented to for their information to be provided anonymously in this case report, and for the publication of this case report.

Conflicts of Interest

There are no conflicts of interest to report in this study.

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