

Therapy after thoracic outlet release

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Although much has been written regarding conservative management of thoracic outlet syndrome (TOS), few protocols have been published for postoperative management of TOS [1,2]. This article presents the authors' postoperative care of patients who had thoracic outlet release with scalenectomy and neurolysis.

Conservative treatment consists of postural education, stretching/strengthening of postural muscles, nerve gliding, and modalities. Postoperative treatment initially varies from conservative care with an emphasis on wound care, edema control, and scar management while incorporating range of motion and nerve gliding techniques. Typically patients undergoing surgery have had a longer duration of symptoms resulting in longer time out of work and a severe impact in their ability to complete their activities of daily living. As a result they usually have seen more physicians and have tried more medications. All of these factors have affected the patient physically and emotionally. Addressing psychosocial issues for many of these patients is of primary importance.

Common symptoms in these patients include severe neck and shoulder pain, occipital headaches, muscle weakness, and loss of cervical or upper extremity range of motion [3]. They describe certain positions that aggravate their symptoms, such as lying prone and any overhead activity. Therapy is catered to each individual and adjustments are made to accommodate changes in symptoms and function. This protocol would need to be modified if the patient's surgery included a rib resection. Most patients have been treated conservatively for several months before

surgery and are familiar with the exercises and symptom management.

Early care

Patients are seen in therapy 1 day postoperatively upon discharge from the hospital. The first area of focus is wound care. A Jackson-Pratt or Penrose drain may be found in the wound and is covered with Tegaderm (3M Health Care; St. Paul, Minnesota) to prevent dislodgement and infection (Fig. 1). Patients are instructed to keep a log measuring the amount of drainage in the reservoir. This measurement is taken while the bulb is uncapped, and the bulb is emptied if it contains more than 50 ml of fluid or every 8 hours. The drain is removed when drainage is less than 10 ml per 8 hours or 25 ml per 24 hours.

After the drain is removed, patients are instructed to keep the drain site covered with Betadine (Purdue Frederick Co.; Stamford, Connecticut), gauze, and pressure pad held in place by Microfoam tape (3M Health Care). The dressing should be kept in place for 24–48 hours. At this time, patients are instructed to monitor any drainage from the wound. If it continues to drain, a bandage is applied. If there is no drainage and the drain openings have closed, the patients are instructed to keep the sutures clean and dry. Showering while sutures are in place is permitted once drain sites are closed. Swimming is permitted if wound has not drained for a few days.

A pressure bandage is applied over the dressing: a foam pressure pad is placed over the incision with Microfoam tape to maintain pressure to the area and decrease edema (Fig. 2). The pad is worn full time for the first 7–10 days. The pad can be removed temporarily if it interferes with cervical range of motion. Patients also are instructed in monitoring the incision and drain

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Fig. 1. Postoperative dressings with Jackson-Pratt drain still in place (note lymphatic milky fluid in drain reservoir).

site for infection at this time. Sutures are removed 7–10 days postoperatively. After the sutures have been removed, a scar pad can be made to be worn at night, secured by Microfoam tape to prevent hypertrophic scarring [4]. Ice also can be used as tolerated for 10-minute periods, on and off for the first 3–4 days [5].

Patients are educated in edema control techniques. They are instructed to keep their hand elevated above the level of their heart for the first 7–10 days if they are not comfortable using their hand normally. Retrograde massage for the involved upper extremity also can be performed as necessary.

An arm sling may be worn during the first 2 weeks when walking in crowded areas or riding in a car, but patients are encouraged to keep their arm out of the sling and elevated on pillows when sitting or sleeping to prevent elbow and shoulder stiffness. Preferred sleeping positions include lying on the unaffected side with a pillow supporting the affected upper extremity or lying in a semirecumbent position to minimize edema and allow ease of breathing. The affected arm may be placed on additional pillows or on the patient's abdomen for support. Patients are advised against riding in a car for extended periods of time; they also should stay home as much as possible so that they can lie down if they develop aching or fatigue in the involved upper extremity, to alleviate traction from the weight of the limb.

Range of motion exercises begin on the first visit. Nerve gliding is essential to prevent adhesions after the release, to improve the microcirculation, and to prevent long-lasting edema within the nerve that can lead to scar and chronic nerve



Fig. 2. Pressure bandage and TENS unit in place.

compression [2,6]. The first visit usually consists of a review/education of cervical range of motion, shoulder pendulum exercises, and hand tendon gliding exercises [7]. Patients are encouraged to use the affected side with activities of daily living as much as possible early in the rehabilitation process, avoiding activities that cause strain or pain. Gentle shoulder range of motion is started as tolerated. Patients are instructed to perform cervical and shoulder range of motion, holding the position (5 seconds) just before the point that pain or strain is felt, thus protecting the sternocleidomastoid muscle that is often divided during surgery. Patients are instructed to perform the exercises three to four times daily. Active assistive exercises, including cane, pulleys, or therapist-assisted motion, are used as needed to maintain full shoulder range of motion.

Scar management begins 24–48 hours after sutures have been removed. The authors' patients are educated on the theory of scarring [8] from the beginning of treatment to help them understand the importance of scar control and the home exercise program. Massage across the scar with lanolin begins 3 weeks postoperatively, with the patient also performing scar massage twice daily at home. Phonophoresis with triamcinolone gel (0.3%) begins at 3 weeks over the scar site and brachial plexus. Phonophoresis also can extend to the upper trapezius in the event muscle tightness is noted from protracted shoulder muscle guarding and cocontraction [9]. Pain and tenderness around the scar is normal for a few months (peaking at approximately 6 weeks) and can last up to a year [8]. Scar control also may include scar desensitization. Massaging the scar with lotion and light pressure using a thick creme (lanolin) and a scar stick can help desensitize the scar. The authors

also use various textures of increasing roughness, from moleskin to Velcro hook, rubbing over the scar until the uncomfortable sensation subsides. The authors progress the program, starting with the least uncomfortable texture to the most uncomfortable. Patients are encouraged to perform the desensitization program as often as possible during the day to eliminate hypersensitivity of the scar.

Patients usually report lower pain levels immediately after surgery, although a slight increase may occur once the strengthening program is initiated. Patients often complain of soreness in the axilla or over the surgical site. An effective way to monitor the areas of pain is to have the patient fill out a subjective body pain diagram to be completed initially before surgery, then after, and then every 4 weeks [10]. Modalities such as transcutaneous electrical nerve stimulation (TENS) can be used for pain management. The TENS pads can be placed along the affected nerve pathways of the injured extremity. Patients also have expressed relief of pain with TENS pad placement over the upper trapezius of the affected side (Fig. 2). Patients are instructed to use ice the first few days. Heat is recommended before exercises (after initial inflammatory period) and ice after the exercise program [5]. Biofeedback can be incorporated into the program for retraining of postural muscles and to encourage relaxation. A formal relaxation program also can be useful to decrease pain and muscle tension.

Intermediate care

Weights are added to the program at 3–4 weeks postoperatively [1]. Many patients have lead sedentary lifestyles preoperatively, because of pain and weakness, and get further deconditioned from the healing process of the surgery. The authors take this into account when starting them on an exercise program including therapy activities to strengthen the entire upper body. This part of the treatment is extremely individualized, depending largely on the patient's preoperative activity level. Increases are applied to the program at least weekly and patients are instructed to monitor pain levels before, during, and post-exercise session, so the authors can accommodate the program to a level that fits the patient.

Hobbies and work duties and demands are taken into consideration when developing the patient's work therapy program. A detailed job description needs to be obtained to formulate the

patient's individualized treatment plan. In some cases a job site visit may be beneficial to the patient and his or her employer in preparing for return to work. The authors' work therapy program includes a work simulator (Baltimore Therapeutic Equipment Company; Baltimore, Maryland), Thera-Band exercises (The Hygienic Corporation; Akron, Ohio), free weights, and workshop projects such as woodworking and macramé. These are selected by the therapist based on the limitations of the individual patient. A functional capacity evaluation may be indicated once the authors start planning for the patient's return to work.

Patients planning to return to high demand jobs, such as construction or factory work, are encouraged to re-evaluate their plans for the future. Although surgery alleviates the symptoms they were having, the chances of the patients re-injuring themselves are greater. Ergonomics and body mechanics training together with adequate strengthening are of utmost importance if they are to return to this type of job.

Typically therapy lasts approximately 3 months, with patients attending 2–3 times per week. A home exercise program is encouraged from day one. It is important to begin early gliding exercises to avoid nerve scarring [7,8]. Patients then are encouraged to perform a stretching program on a daily basis for at least 2 years, because scar contraction can continue to this time.

Occasionally patients return in 6–12 months complaining of pain in and around the scar. Patients tend to stop their daily exercise programs after a few months because they are feeling fine. The authors generally would start another course of therapy, which includes phonophoresis treatments to reduce the inflammation and scar [9]. A thorough review of proper posture, stretching, and strengthening exercises is completed at this time.

A general guideline for treatment after surgery for thoracic outlet syndrome

Postoperative Day 1 (week 1): gentle range of motion, active and active-assisted range of motion; drain removal at approximately 3–5 days

Postoperative Day 8 (week 2): suture removal; continue gliding exercises for neck and upper extremity

Postoperative Day 15 (week 3): scar massage, scar desensitization

Postoperative Day 22 (week 4): phonophoresis to scar site, brachial plexus massage, start strengthening exercises

Postoperative Day 29 (week 5): upgrade-strengthening exercises

Postoperative Day 36 (week 6): ergonomic training, work-simulated activities

Postoperative Days 43–83 (weeks 7–12): work hardening

Late care

Very little literature exists on the postoperative care of patients with thoracic outlet surgery. Dating back more than 25 years [11], the trend has been for conservative treatment for TOS.

Anthony [1] recommends cervical range of motion exercises every 1–2 hours after surgery and gentle range of motion to shoulder 1–2 weeks postoperatively, but full use of the extremity is limited for 8–10 weeks postoperatively. The authors start patients the day after surgery with cervical range of motion and include pendulum exercises for the shoulder joint. Depending on the patient's condition, the authors educate them on shoulder range of motion the first day or next visit. The authors believe the quicker we get our patients moving, the better results we get [12].

The authors have found that if we encourage our patients to perform most of their activities of daily living (eating, dressing, bathing, light meal preparation) early on after surgery, they are more likely to have successful outcomes from the surgery. The authors advise patients to avoid *only* activities that cause strain or pain.

Exercises should be of low repetition and should be performed in the position that causes the least discomfort, whether that is supine, sitting, or standing. Exercises are to be done in a slow, controlled fashion. Symptoms lasting longer than 2 hours would indicate a need on the therapist's part to modify the exercise program.

Most investigators who have written on postoperative therapy for TOS agree that therapy has an equally important role after surgery in achieving successful outcomes. Current recommendations in the literature, however, are not actually based on any reliably measured scientific data [2].

The Feldenkrais method is a treatment protocol that has been used to treat patients with

TOS. This method is based on mental awareness of movement and was not designed specifically for TOS [13]. It claims superior control of pain over conventional physical therapy. Some features included in that method are, however, widely used in most therapy protocols, including bio-feedback, behavior modification, and postural exercises.

Postoperative care for patients with TOS varies a great deal from one center to another and extends through the spectrum of no therapy at all to an intensive course lasting many months. It is an area that needs to be studied further.

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