Recent advances in the management of hemiplegic shoulder pain

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Abstract

Stroke is a debilitating neurological disorder with hemiplegia as most common presentation. Hemiplegic shoulder pain (HSP) affects a large number of stroke survivors and is associated with significant morbidity and low quality of life (QoL). The etiology is multifactorial and therefore the management is multipronged. Traditionally, oral analgesics have been advised with physical therapy and intra-articular steroid injections. This narrative review discusses emerging treatment strategies for HSP. It focuses on four key new treatments; electric stimulation, the use of robotics, intraarticular injections of novel anti-inflammatory agents, and pulsed radiofrequency treatment. Multiple studies have assessed the efficacy of these techniques and have found the efficacy and side effect profile to be comparable or superior to current management strategies for HSP. Integrating these interventions in the multidisciplinary rehabilitation programmes for stroke patients, can improve the management of HSP and reduce stroke related morbidity and disability.

Keywords: Stroke rehabilitation, hemiplegia, shoulder pain, electric stimulation, pulsed radiofrequency treatment, robotics, rotator cuff syndrome.

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Introduction

Stroke is a debilitating neurological disorder with an estimated incidence of 250/100000 population in Pakistan.[1] The most common impairment after stroke is hemiplegia, affecting a large number of stroke survivors and resulting in multiple life-long disabilities. One important disability related to post stroke hemiplegia is hemiplegic shoulder pain (HSP), affecting the shoulder on the hemiparetic side. The reported incidence is 10-22% and prevalence is 22-47%.[2] HSP is caused by a combination of local soft-tissue dysfunction (subacromial bursitis, bicipital and suprascapular tendinitis, adhesive capsulitis, shoulder subluxation), local neuropathic pain (impingement of articular nerves), central-mediated pain (central/thalamic post-stroke pain) and regional autonomic dysfunction like Complex Regional Pain Syndrome. HSP prolongs recovery and hospital stay, worsens arm function and reduces QoL, making it an important contributor to post-stroke morbidity. Many treatments are used in patients with HSP, with a combination of oral analgesics and physical therapy usually the first-line treatment. Analgesics may include acetaminophen, NSAIDs and opioids. Physical therapy includes use of physical modalities (hydrocollator packs, Transcutaneous Electric Nerve Stimulation-TENS, Shortwave Diathermy, therapeutic ultrasound, Continuous Passive Movement) and therapeutic exercises (passive and active range-of-motion, mobilization, positioning and anti-spasticity exercises).

In recent years, various interventional pain management techniques have been used as second line therapy for HSP. These include intra-articular steroid injections, suprascapular nerve blocks, botulinum toxin injections and complementary medicine techniques including acupuncture, dry needling, aromatherapy etc.[3] The success rate for these interventions is variable, and none is considered superior to others. Intra-articular steroids remain the most used intervention for HSP, however their side effects (skin discolouration, cartilage degeneration, tendon rupture, systemic absorption, suppression of hypothalamo-pituitary axis) limit their repeated use, especially in patients with coexisting diabetes mellitus or other metabolic disorders. The search for newer, more effective management techniques focuses on interventions with a safer side-effect profile and longer-lasting pain-relieving properties. We present a brief overview of the emerging techniques being used for the management of HSP, including mechanisms of action, efficacy, side effects, and comparisons with traditional interventions.

Recent Advances:

1. Electric Stimulation

TENS has long been used in the management of HSP. The analgesic mechanism is attributed to "Gate-control theory" by Melzack and Wall. Recent research is focused on comparing newer electric stimulation methods with TENS. Chuang et al[4] compared the efficacy of TENS with EMG-biofeedback activated Neuromuscular Electric Stimulation (NMES) of hemiplegic Deltoid and Supraspinatus muscles using implanted needle electrodes. Meimei Zhou et al[5] studied the efficacy of NMES of affected Deltoid and Supraspinatus muscles using surface electrodes without

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biofeedback and compared it with TENS and traditional rehabilitation techniques. In both studies, NMES showed greater improvement in the primary outcome measure of HSP relief on short and long-term follow-up as well as in secondary outcome measures of Shoulder ROM and Fugl-Meyer assessment of upper limb. Karaahmet et al[6] compared TENS with Functional Electric Stimulation (FES)-based upper-limb cycle ergometry which demonstrated greater efficacy of FES over TENS in HSP relief. The mechanisms for effectiveness of these techniques include improvement in spasticity, reduction in shoulder subluxation and improvement in local blood flow to the affected muscles. The absence of any significant side-effects and greater efficacy compared to traditional TENS makes NMES / FES an important treatment option for patients with HSP.

2. Intra-articular Injections

The efficacy of intra-articular injections in HSP management is based on their anti-inflammatory effects in reducing local bursitis and tendinitis in the hemiplegic shoulder. Traditionally, intra-articular steroid injections have been used for HSP, however their side-effect profile does not allow repeated use. Recent studies have evaluated alternatives to steroids. The efficacy of triamcinolone was compared with consecutive intraarticular injections of Polydeoxyribonucleotide (PDRN) in a recent RCT.[7] PDRN group showed reduction in HSP severity with efficacy comparable to intra-articular steroids. PDRN is a new anti-inflammatory agent that has shown efficacy in the management of rheumatoid arthritis, supraspinatus tendinitis and plantar fasciitis. It acts by stimulation of Adenosine A2A receptor, thereby decreasing local production of TNF-alpha and Interleukin-6. Huang et al[8] compared the efficacy of sub-deltoid bursa injections of Hyaluronic Acid, against placebo and reported statistically significant improvements in HSP as well as Fugl-Meyer assessment of Upper Limb scores. Hyaluronic Acid has long been used in patients with knee and shoulder osteoarthritis due to its chondroprotective and anti-inflammatory properties, but the results of this study indicate that it can be used as an effective treatment option in HSP.

3. Robotics

Combined with other rehabilitation techniques, Continuous Passive Movement (CPM) helps in management of HSP by reducing spasticity, enhancing local blood flow and improving ROM using a programmable machine that carries out cycles of passive movement across the shoulder joint at a predetermined range. The drawback is its ability to move the joint across only a single plane, and the requirement of the patient being in sitting position. Newer robotic devices address these limitations by allowing passive movement across multiple planes/joints in a single therapy session, as well as accommodating supine patients, which is especially helpful in the acute post-stroke phase and in patients with poor sitting balance. Kim et al[9] evaluated a robotic device that provided passive ROM to supine patients, with a friction plate under the scapula to prevent compensatory scapular movement during glenohumeral passive ROM. This was found to result in significantly higher improvements in HSP pain scores as well as joint ROM when compared to control group that received only traditional physical therapy, up-to 4 weeks after the cessation of treatment. Another robotic device evaluated by Serrezuela et al carried out multi-plane passive movements across shoulder, elbow and wrist joints in a sitting patient.[10] In this study, the robotics group showed significant improvements in pain severity, spasticity and motor strength when compared with the control group that underwent traditional physical therapy.

4. Pulsed Radiofrequency Treatment

Coagulative neurolysis by Continuous Radiofrequency ablation (CRF) is frequently used by pain management professionals for treating osteoarthritis,[11] neuralgia[12] and facet arthropathy.[13] Since sensory supply of the shoulder joint derives from articular branches of the suprascapular and axillary nerves, application of CRF to these nerves results in improvement in shoulder pain. However, these nerves also provide motor supply to the shoulder, and neurolytic coagulation via CRF can result in weakness of the shoulder girdle, therefore the newer technique of Pulsed Radiofrequency (PRF) provides a suitable alternative. PRF of mixed nerves results in analgesia due to its neuro-modulatory effect of reducing rates of synaptic transmission, as well as causing inhibition of Type C fibers and enhancing the activity of serotonergic and noradrenergic pain inhibitory pathways.[14] Compared to intraarticular steroids, PRF of Suprascapular nerve has shown lesser efficacy in improvement of HSP,[15] however when compared to patients receiving no treatment,[16] or undergoing suprascapular nerve block with local anaesthetic,[17] PRF has shown greater efficacy in HSP pain relief. Another study[18] compared PRF of suprascapular and axillary nerves with local anaesthetic-based nerve block of the same nerves in patients with HSP. PRF had similar efficacy as nerve block while resulting in greater improvements in shoulder range of motion.

Local Perspectives in Management of HSP

HSP is a frequently encountered problem in stroke patients in Pakistan. This is because stroke patients are not enrolled in rehabilitation programmes and are not taught preventive positioning and exercises. Lack of knowledge about this debilitating complication amongst patients,

caregivers and treating physicians, results in long-term morbidity and lower QoL for stroke patients. For patients who undergo timely stroke rehabilitation, the use of physical modalities, exercise and medications results in a lower incidence of HSP, better arm function and higher QoL. Multidisciplinary stroke rehabilitation is currently available only at few centres in Pakistan. Therefore, a large proportion of stroke survivors with hemiplegia have no access to stroke rehabilitation services.

Conclusion

HSP is an important post stroke complication which adversely affects patient outcomes. The management of HSP is evolving, with many new techniques undergoing clinical trials. Many of these new treatment options are better or at least similar in short and long-term efficacy when compared to the traditional treatment techniques, which augurs well for their adoption in local setups. While the use of robotics may face stumbling blocks due to high R&D costs, most other techniques are already being used in Pakistani multidisciplinary rehabilitation setups, and can be utilized in HSP cases at little to no extra cost. Research into the efficacy v/s cost effectiveness of these techniques in the local population will help in tailoring the use of recent advances to better serve the needs of Pakistani stroke patients with HSP, thereby reducing post-stroke morbidity and improving their quality of life.

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