Post-stroke shoulder subluxation: A concern for neuroscience nurses

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Abstract
Approximately 84% of all stroke patients with hemiplegia will experience shoulder injury and pain. The importance of maintaining proper posture while positioning and transferring a stroke patient is key to decreasing risk for shoulder injury. Shoulder subluxation injury post-stroke is a consequence of sustained hemiplegia and spasticity. Current research evidence suggests that using therapies such as gentle range of motion and functional electrical stimulation may reduce and prevent shoulder subluxation and hemiplegic shoulder pain. However, physiotherapists are currently the only professionals who can implement such therapies. Considering that stroke care provided by neuroscience nurses includes transferring, positioning and assisting in activities of daily living, it is clear that nurses are an important part of the therapy process. Therefore, the question is: "What is the role of the neuroscience nurse in the reduction and prevention of shoulder pain post-stroke?" The purposes of this paper are to i) discuss the causes of shoulder subluxation and related pain post-stroke, ii) review current best practice in prevention and treatment of shoulder subluxation, and iii) explore ways in which the acute neuroscience nurse can prevent or reduce shoulder subluxation in the hemiplegic stroke patient.

Stroke is the primary cause of long-term adult disability in Canada (Canadian Stroke Network, 2004). Hemiplegia is a common disability experienced post-stroke. As many as 84% of stroke survivors with hemiplegia will develop shoulder subluxation and related shoulder pain (Teasell, Bhogal, Foley, & Speechley, 2004). Currently, there is much clinical discussion by physiatrists, nurses and therapists who work in the area of stroke rehabilitation about shoulder pain and subluxation post-stroke. Clinical discussions range from proper positioning and proper range of motion to the use of electrical stimulation therapy to strengthen shoulder muscles as an adjunct to physiotherapy exercises. Most stroke rehabilitation discussion and research papers examine and explore treatment of shoulder pain, management of shoulder subluxation through consistent range-of-motion exercises and the efficacy of electrical stimulation as a preventive therapy (Ada & Foongchomcheay, 2002; Gilmore, Spaulding, & Vandervoort, 2004; Price & Pandyan, 2001; Rathfon, 1994; Spaulding, 1999; Teasell et al., 2004; Turner-Stokes & Jackson, 2002; Vuagnat & Charnaine, 2003; Walsh, 2001). In addition, therapists and nurses have multiple definitions of what causes post-stroke subluxation and shoulder pain, which has led to uncertainty around each disciplines’ role in prevention of this injury (Pomeroy, Niven, Barrow, Faragher, & Tallis, 2001). Nurses not only have multiple definitions about the cause, but also are generally unaware of interventions to treat and champion the prevention of shoulder subluxation and shoulder pain post-stroke.

However, physiotherapists are currently the only professionals who are consistently implementing such therapies. Stroke care provided by neuroscience nurses includes range-of-motion exercises, transferring, positioning and assisting in activities of daily living. These nursing interventions are rehabilitative in nature, which clearly indicates that neuroscience nurses are an important part of an interdisciplinary team and must champion best practices in stroke rehabilitation (Goulding, Thompson, & Beech, 2004). The purposes of this paper are to discuss the causes of shoulder subluxation and related pain post-stroke, review current best practice in prevention and treatment of shoulder subluxation and explore ways in which the acute neuroscience nurse can prevent or reduce shoulder subluxation in the hemiplegic stroke patient.

Post-stroke shoulder subluxation
Stroke patients who have upper extremity hemiplegia as a lingering deficit are at risk for shoulder injury and related pain. Possible causes of shoulder pain are spasticity of shoulder, which occurs after an initial stage of flaccidity, restricted shoulder range of motion and contractures, sustained hemiplegic posture and shoulder (glenohumeral) subluxation (Ada & Foongchomcheay, 2002; Moskowitz, Goodman, Smith, Balthazar, & Mellins, 1969; Teasell et al., 2004; Tobis, 1957). However, controversy exists regarding whether shoulder
subluxation causes post-stroke shoulder pain. Tobis (1957) suggested because of flaccidity in the hemiplegic shoulder joint, subluxation and pain occurs as the weight of the unsupported arm pulls and stretches the shoulder capsule and ligaments. However, researchers have not been able to determine a relationship between shoulder subluxation and pain (Bohannon & Andrews, 1990; Zorowitz, Idank, Ikai, Hughes, & Johnston, 1995). Nevertheless, Ada and Foongchomcheay (2002) suggested severe untreated post-stroke shoulder subluxation might eventually lead to chronic hemiplegic shoulder pain and other shoulder injuries due to immobility of the shoulder joint.

The shoulder joint consists of a complex series of joints: the acromioclavicular, sternoclavicular and the glenohumeral joints. These joints have a wide range of motion that allows extreme mobility in the shoulder. The glenohumeral joint is supported by the rotator cuff (supraspinatus muscle and tendon), which keeps the humeral head in position and moveable in the joint. In order for such mobility to occur, stability of the joint is sacrificed, thereby exposing the glenohumeral joint, in particular, to sprains, disease processes, dislocation or subluxation (Porth, 2005). Shoulder subluxation is defined by Teasell et al. (2004) as “changes in the mechanical integrity of the glenohumeral joint causing a palpable gap between the acromion and humeral head” (p. 6). Subluxation of a joint is a partial dislocation wherein the joint and the humeral bone end remain in partial contact via the connecting muscle or ligament (Porth, 2005). In the initial phase of upper arm hemiplegia, the supraspinatus muscle that supports the humeral head into the glenohumeral joint is flaccid. Due to flaccidity of this muscle, the arm is unsupported and is pulled or stretched causing the humeral head to sublux downward out of the shoulder joint (Teasell et al., 2004). If a hemiplegic arm is not supported properly during the flaccid stage of hemiplegia and subluxation occurs, the subsequent contracture will create permanent shoulder pain, hinder movement and, ultimately, halt the patient’s rehabilitation.

**Prevention and treatment**

In the clinical setting, it is common to observe stroke patients with their hemiplegic arm hanging lower than their unaffected arm while in a seated position. The unsupported arm hanging at the side of the patient or their wheelchair, especially in the critical flaccid stage of the hemiplegic arm, typically leads to shoulder subluxation. According to Teasell et al. (2004) “improper positioning in bed, lack of support while the patient is in the upright position or pulling on the hemiplegic arm when transferring the patient all contribute to glenohumeral subluxation” (p. 6). All of these contributing factors are preventable and are factors that all disciplines, including nurses, can control by championing best practice when transferring and positioning patients in the bed or wheelchair. Management of stroke patients with shoulder subluxation and shoulder pain is the most ideal when it is prevented from occurring in the first place (Walsh, 2001). Strategies and/or interventions that neuroscience nurses can employ to aid in preventing shoulder subluxation and shoulder pain will be discussed in the nursing implications section of the paper.

Post-stroke shoulder subluxation is a preventable injury but, when it does occur, treatments are available that can aid in strengthening the shoulder joint and decreasing pain (Teasell et al., 2004; Walsh, 2001). The following is a review of some strategies that have been shown to be effective in treating shoulder subluxation and shoulder pain.

**Shoulder supports**

The use of shoulder supports is common early after stroke to decrease glenohumeral subluxation and support the shoulder joint. Examples of shoulder supports are the Henderson shoulder ring, Bobath role, Harris hemi-sling, Rolyan humeral cuff sling, Cavalier shoulder support, arm trough or lapboard and shoulder strapping (Brooke, de Lateur, Diana-Rigby, & Questad, 1991; Morin & Bravo, 1997; Spaulding, 1999; Williams, Taffs, & Minuk, 1988; Zorowitz et al., 1995). Conclusions about which shoulder sling or supports are most beneficial are mixed and controversial (Spaulding, 1999; Teasell et al., 2004). Some researchers support the use of the hemi-sling and Henderson shoulder ring as they are the easiest of the supports to apply, thereby ensuring that the shoulder is in proper alignment and increasing prevention of shoulder subluxation (Brooke et al., 1991; Morin & Bravo, 1997). Other authors recommended the use of all supports including the Bobath roll and shoulder strapping as long as health care professionals properly assess individual patient needs in order to ensure the correct choice regarding which shoulder support will benefit the stroke patient (Williams et al., 1988; Zorowitz et al., 1995). Also, Zorowitz et al. (1995) noted that health care professionals should know how to apply and use shoulder supports properly and should ensure that the patient and their family are also adequately educated. In contrast, there are disadvantages to using shoulder supports to prevent or reduce shoulder subluxation. Shoulder supports can “encourage flexor synergies, inhibit arm swing, contribute to contracture formation and decrease body image causing the patient to further avoid using [their] arm” (Teasell et al., 2004). When a stroke patient wears a shoulder support, movement of the arm is not only inhibited, but a decreased body image may deter the patient from engaging in any rehabilitative exercises. This, in turn, may delay and alter the rehabilitation experience for the stroke patient. In addition, shoulder supports in combination with adhesive shoulder strapping can cause skin irritation (Morin & Bravo, 1997; Walsh, 2001). Nevertheless, most researchers agree that despite such disadvantages, shoulder supports are the best method of supporting a flaccid hemiplegic arm when a stroke patient is standing or transferring (Spaulding, 1999; Teasell et al., 2004). All research studies examined for this paper suggested that more research is required as there is a paucity of research evidence to support the use of shoulder supports or slings.
Electrical stimulation

Electrical stimulation (ES) as a treatment for shoulder pain and subluxation can be administered through different electrical devices, two of which are: transcutaneous electrical nerve stimulation (TENS) and functional electrical stimulation (FES). First, TENS units provide pain relief by transmitting electrical energy through the skin to peripheral nerve fibres in the muscle (Porth, 2005). In a randomized controlled trial conducted by Leandri et al. (1990), high and low intensity TENS stimulation versus placebo was evaluated in decreasing shoulder pain. The researchers concluded that high intensity TENS was effective in decreasing shoulder pain and was effective in improving passive range of motion of the shoulder joint. Second, FES was used to stimulate paralyzed or flaccid muscles in the hemiplegic arm in order to prevent shoulder subluxation (Teasell et al., 2004). FES is administered using electrodes on the surface of the skin or by implanted electrodes. Researchers have demonstrated that FES is effective in preventing shoulder subluxation, and determined that it is also effective in improving pain, range of motion and arm function (Chantarne, Baribeault, Uebelhart, & Gremion, 1999; Faghri et al., 1994).

Additionally, Ada and Foongchomchey (2002) conducted a systematic review of the effect of ES on the prevention and reduction of shoulder subluxation and pain post-stroke. The outcome of this review indicated that ES administered to a stroke patient could aid in the prevention of shoulder subluxation. The key point in this review was that ES, when added to conventional therapy, should be administered early in the patient’s recovery process rather than late. Conventional therapy was defined as regular physiotherapy sessions. As well, a systematic review conducted by Price and Pandyan (2001) sought to determine “the efficacy of any form of surface ES when used after stroke to prevent or treat shoulder pain and increase passive humeral lateral rotation” (p. 6). The outcome of this review revealed that randomized controlled trials have yet to confirm or refute the positive effect of ES on reports of pain in the shoulder after stroke. However, reduction in passive humeral lateral rotation does appear to be a result of ES. According to Teasell et al. (2004), ES, specifically functional electrical stimulation (FES), can improve hemiplegic shoulder outcomes such as tone, subluxation, pain and range of motion. Given such improvements, ES is an important treatment for shoulder pain and shoulder subluxation.

Gentle/passive range of motion

As discussed earlier, chronic shoulder subluxation in a stroke patient can eventually lead to shoulder pain due to contracture formation and spasticity. Teasell et al. (2004) states, “The association of spasticity, muscle imbalance and a frozen shoulder with shoulder pain suggests that a therapeutic approach designed to improve range of motion of the hemiplegic shoulder will improve pain” (p. 20). In fact, an immobile joint ravaged with contractures and spasticity would benefit from passive range-of-motion exercises to reduce pain. In a randomized controlled trial conducted by Partridge, Edwards, Mee, and Van Langenberghhe (1990), shoulder pain was reduced after initiation of a regimen of passive range of motion based on the Bobath (1970/1990) method. Partridge et al. (1990) found that, compared to cryotherapy or local cold therapy, the Bobath method of encouraging normal positioning and neutral postures during passive range of motion improved pain. In addition, using a quasi-randomized controlled trial design, Kumar, Metter, Mehta, and Chew (1990) explored the incidence of shoulder pain in patients after receiving three distinct rehabilitation exercise regimens. Patients were randomized to use an overhead pulley system, a shoulder rest on wheels (skateboard) or receive range of motion with the therapist. The researchers found that aggressive use of the pulley system or skateboard increased shoulder pain significantly as compared to passive range of motion. The researchers concluded that a stroke patient who suffers from hemiplegic shoulder pain could benefit from passive or gentle range of motion in order to decrease intensity and frequency of pain.

Shoulder supports, electrical stimulation, and passive or gentle range of motion are treatments that can be used to prevent and decrease the incidence of shoulder subluxation and shoulder pain. Knowledge of individual patient needs regarding body image, and education about how to incorporate such treatments into their rehabilitative plan are also important issues for health care professionals to consider when caring for a stroke patient with shoulder subluxation and pain. A collaborative approach is required by all health care professionals to ensure that such treatments are implemented properly and to ensure knowledge about the potential for this injury is known and, therefore, prevented.

Implications for neuroscience nursing

The role of neuroscience nurses in the prevention and treatment of shoulder subluxation and shoulder pain has been discussed minimally in the literature. According to Rowat (2001), because of a lack of research to guide nursing practices such as active range of motion, proper positioning and transfers, nursing practice varies from unit to unit and from hospital to hospital. Such diverse practices and understandings of specialized stroke care can lead to further injury for patients who have and are at risk for shoulder subluxation and shoulder pain. The following is a discussion of ways in which neuroscience nurses can prevent, treat, and reduce shoulder subluxation and pain in stroke patients early in their rehabilitation program.

Range of motion exercises

Given evidence that passive range of motion early in the care of stroke patients can prevent shoulder subluxation (Kumar et al., 1990; Teasell et al., 2004), it is crucial that neuroscience nurses incorporate range of motion as part of care provided to stroke patients with upper extremity hemiplegia. In nursing programs across Canada, nursing
students are taught the fundamentals of active and passive range-of-motion exercises. Lab and clinical instructors on neuroscience units teach nursing students how to perform range-of-motion exercises and encourage students to use these exercises when caring for stroke patients with hemiplegia. Neuroscience nurses use range-of-motion exercises to facilitate movement and use of the affected arm. However, neuroscience nurses can also aid in preventing shoulder subluxation simply by employing range-of-motion exercises specific to the affected shoulder. Range-of-motion exercises for the shoulder joint include flexion-extension, abduction-adduction, as well as external and internal rotation (Alexander, Hiduke, & Stevens, 1999; Hoeman, 2002). Such range-of-motion exercises should be implemented using proper shoulder and arm movement in order to encourage normal posture alignment (Bobath 1970/90). Proper positioning of the arm is critical during the early stage of hemiplegia post-stroke because of flaccidity and related instability of the arm (Teasell et al., 2004). Even using basic range-of-motion exercises improperly can cause injury to the shoulder and increase the stroke patient’s risk for shoulder subluxation. Therefore, care must be taken when using range-of-motion exercises in the shoulder area and nurses should be aware of proper alignment and positioning of the joint.

Positioning and transfers
Neuroscience nurses continually position, reposition and transfer stroke patients over a 24-hour period. Not unlike range-of-motion exercises, positioning and transfers are nursing interventions that neuroscience nurses employ for reasons such as comfort, pain relief and for mobility. In order to be mobile, stroke patients depend greatly on the assistance and interventions provided by nurses, therapists, other professionals and family (Walsh, 2001). Walsh suggested that “handling, positioning, and transferring on a day-to-day basis can exert great stress on the vulnerable shoulder” (p. 645). During times when a stroke patient is transferred to and from a wheelchair, chair or bed, and is positioned in bed, they are at risk for shoulder injury. Thus, proper positioning plays an important role in reducing the risk of shoulder subluxation and subsequent chronic pain.

However, nurses’ and other health care professionals’ views regarding proper positioning vary. Carr and Kenney (1992), during their review of proper positioning of the stroke patient, found general agreement that post-stroke shoulder joint should be protracted with the arm slightly forward and in proper spinal alignment. As well, in a study conducted by Dean, Mackey, and Katrak (2000), stroke patients were exposed to extended positioning of the affected arm in order to improve shoulder range of motion and pain. However, results were inconclusive. That being said, the main finding of reviews of proper positioning suggested the affected arm must always be supported when positioned and during transfers (Carr & Kenney, 1995; Teasell et al., 2004).

In addition, proper positioning of a stroke patient remains undefined due to a lack of consensus of best practice (Goulding et al., 2004). Research conducted by Rowat (2001) using mailed questionnaires examined beliefs held about proper positioning of stroke patients by nurses and therapists who worked on either a stroke unit, neurological unit or general medical unit. Results indicated a lack of consensus. However, an important conclusion from the study was that specialization in an area increased awareness, understanding and knowledge of the importance of positioning of stroke patients (Rowat, 2001). In another study, Pomeroy et al. (2001) examined interventions used by nurses and therapists to position stroke patients. More than 175 different types of interventions were reported and, in addition, reports varied between nurses and therapists. It is clear that further research is indicated in the area of positioning and transferring stroke patients due to a lack of consensus and lack of research studies (Teasell et al., 2004).

None of the aforementioned nursing interventions should be performed or implemented without collaboration between nurses, therapists and other health care professionals. Due to the fact that therapists work and care for stroke patients mainly during one-hour therapy sessions, collaboration is a key factor in order to ensure around-the-clock rehabilitation for stroke patients (Seneviratne & Reimer, 2004). If a stroke patient has been diagnosed with shoulder subluxation, the sharing of skills and knowledge between therapists and nurses should enhance treatment of subluxation beyond set therapy sessions. According to Goulding et al. (2004) “…it is important that care management plans should be multidisciplinary and there should be shared learning within the multidisciplinary team of each profession’s skills and knowledge” (p. 538). That is, education between nurses and therapists can occur through collaborative practice and can ultimately enhance care provided to stroke patients. Furthermore, education for families about different interventions used by health care professionals to prevent and treat shoulder subluxation and shoulder pain is essential (Zorowitz et al., 1995).

Discussion
In an atmosphere of interdisciplinary collaboration, neuroscience nurses can be champions of best practice. This can be achieved, for example, through collegial discussion of current research evidence regarding prevention and treatment of shoulder subluxation. Health care organizations and managers encourage nurses to utilize best practice and research outcomes to inform their clinical practice. Instead of repeating customary practices, nurses can evolve, change and adapt their practice to incorporate quality research findings into practice. Hynes (2000) asserts that to combine research, patient choices and clinical decisions together, a “new level of evidence” is created that informs nursing practice (p. 453). Citiska, Pinelli, DiCenso, and Cullum (2001) suggested that, in addition to research, evidence-based practice is informed

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practice environment is critical. Open discussions with managers, nurses, and therapists would only begin to break down such barriers. As well, encouraging early adopters or nursing practice innovators such as nurse scientists to educate others in the importance of research evidence will begin to foster the formation of a community of evidence-based practice (Estabrooks, 2003).

However, barriers do exist that can hinder development and implementation of best practices regarding shoulder subluxation and shoulder pain on a neuroscience or specialized stroke unit. The first barrier is that it may be difficult to find nurses and therapists who share a common interest in shoulder supports, passive range of motion, electrical stimulation and ‘simple’ positioning strategies as collaborative therapies to prevent and treat shoulder pain. Nurses do not agree that it is their ‘job’ to implement stroke rehabilitation therapies such as electrical stimulation into their acute neuroscience practice. In addition, therapists have suggested that nurses have a role in stroke rehabilitation that does not include using designated physiotherapy or occupational therapy techniques. Nevertheless, other therapists and nurses have stated the opposite, noting the need for collaborative efforts in order to improve patient outcomes.

Secondly, finding nurses to join a literature review group or best practice in stroke rehabilitation committee, for example, may be a challenge. According to DiCenso, Cullum, and Ciliska (1998), barriers to the use of research to inform practice are: lack of time, limited access to literature, lack of training regarding literature searches and critical appraisal, a closed work environment that does not promote literature searches and a focus on practical skill rather than intellectual knowledge. This may, in fact, prove to be the greatest barrier because nurses do not readily jump at opportunities for incorporating research into practice.

Thirdly, according to Graham and Logan (2004), issues such as decision-making practices, rules, regulations and local organizational politics may be barriers to change. In order to overcome this barrier, assessment of the practice environment is critical. Open discussions with managers, nurses, and therapists would only begin to break down such barriers. As well, encouraging early adopters or nursing practice innovators such as nurse scientists to educate others in the importance of research evidence will begin to foster the formation of a community of evidence-based practice (Estabrooks, 2003).

Conclusion

Shoulder subluxation and shoulder pain are important and critical issues for stroke patients who have upper extremity hemiplegia. Conclusions regarding shoulder supports, electrical stimulation and passive range of motion as interventions to prevent and treat shoulder subluxation and related pain are controversial. Nevertheless, consensus does exist regarding the need to support the affected arm when positioning and transferring stroke patients in order to decrease risk for shoulder subluxation. Nurses and therapists who provide range-of-motion exercises, position and transfer stroke patients’ need to collaborate in order to enhance the care provided to stroke patients. As stroke rehabilitation is a 24-hour process, nurses should collaborate with therapists and other health care professionals in order to increase understanding of potential complications related to post-stroke hemiplegia, and to promote evidence-based neuroscience practice beyond one-hour therapy sessions. Neuroscience nurses are well-positioned, due to the comprehensive care they negotiate with stroke patients and their families, to champion collaborative practice and the incorporation of current research into stroke care by being open to and facilitating education between disciplines.

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