

Evaluation of Pain Measurement Practices and Opinions of Peripheral Nerve Surgeons

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Abstract The purpose of this study was to evaluate the opinions and practices of peripheral nerve surgeons regarding assessment and treatment of pain in patients following nerve injury. Surgeons with expertise in upper extremity peripheral nerve injuries and members of an international peripheral nerve society were sent an introductory letter and electronic survey by email ($n=133$). Seventy members responded to the survey (49%) and 59 surgeons completed the survey (44%). For patients referred for motor or sensory dysfunction, 31 surgeons (52%) indicated that they always formally assess pain. In patients referred for pain, 44 surgeons (75%) quantitatively assess pain using a verbal scale ($n=24$) or verbal numeric scale ($n=36$). The most frequent factors considered very important in the development of chronic neuropathic pain were psychosocial factors

(64%), mechanism of injury (59%), workers' compensation or litigation (54%), and iatrogenic injury (48%). In patients more than 6 months following injury, surgeons frequently see: cold sensitivity (54%), decreased motor function (42%), paraesthesia or numbness (41%), fear of returning to work (22%), neuropathic pain (20%), and emotional or psychological distress (17%). Only 52% of surgeons who responded to the survey always evaluate pain in patients referred for motor or sensory dysfunction. Pain assessment most frequently includes verbal patient response, and assessment of psychosocial factors is rarely included. Predominately, patient-related factors were considered important in the development of chronic neuropathic pain.

Keywords Peripheral nerve injury · Pain · Survey

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Introduction

Pain can negatively affect outcome and health-related quality-of-life [18]. In patients following nerve injury, neuropathic pain can contribute to significant disability and has been reported following peripheral nerve injury, particularly in patients with brachial plexus injuries [5, 8, 18, 28, 31, 42]. Many outcome studies of nerve-injured patients present motor and sensory functional outcomes but do not report information regarding the absence or presence of pain [1, 7, 16, 17, 30, 35, 36, 38, 41, 44]. In the surgical literature, many studies that report pain in nerve-injured patients generally use unidimensional measures (verbal ratings or visual analog scales of pain intensity) and do not include assessment of the psychosocial factors that may be associated with pain [5, 8, 28, 32, 34, 40, 42].

The purpose of this study was to evaluate peripheral nerve surgeons' opinions and practices regarding pain assessment and treatment in patients following nerve injury.

Methods

A survey was developed to include questions related to the assessment and treatment of pain in patients following nerve injury. A physical therapist, hand surgeon, psychologist, and clinical epidemiologist developed the preliminary questionnaire. To examine the survey questions for content, clinical relevance, clarity, flow, and wording, three different surgeons who operate on patients with upper extremity nerve injuries reviewed the questionnaire. Based on their feedback, the survey was modified and pilot tested on three different surgeons to ensure that the questions were understandable and clinically relevant.

The opinions of surgeons with expertise in the treatment of patients with upper extremity peripheral nerve injuries were sought for this study. Following approval by our institutional and university Research Ethics Boards, the active surgeons from an international peripheral nerve society who had a registered email address were invited to participate ($n=133$). An introductory letter and anonymous electronic survey were sent by email. The nonrespondents were sent two subsequent reminders by email at 2 weeks following the initial email and then 3 weeks following the first reminder. In total, 70 members responded to the survey (49%): after first mailing, $n=39$, after second mailing, $n=19$, after third mailing, $n=16$. There were six surgeons who declined to participate and five who indicated that they do not operate on patients with nerve injuries. In total, the sample consisted of 59 surgeons who completed the questionnaire (44%).

There were 49 men and ten women with a mean age of 50 years (standard deviation (SD) 9 years) and mean years in practice of 16 (SD 10 years). The majority of the surgeons

were from plastic surgery ($n=37$) followed by orthopedic surgery ($n=12$), neurosurgery ($n=8$), general surgery ($n=1$), and one respondent indicated both plastic and orthopedic surgery. Thirty-nine surgeons (66%) reported that they operate on patients with brachial plexus injuries.

Data Analysis

Data analyses were performed using Statistical Package for the Social Sciences (version 15.0 for Windows, SPSS Inc., Chicago, IL, USA). Using Chi square analyses for the categorical data and t tests for the continuous data, comparisons were made of the demographics and survey responses between: (1) those surgeons who operate on brachial plexus injuries and those that do not operate on brachial plexus injuries; (2) those surgeons who quantitatively assess pain and those that do not; (3) those surgeons who "always" assess pain in patients with motor or sensory dysfunction and those that do not; (4) those surgeons who responded after the first mailing compared to the late responders (surgeons that responded to the subsequent mailings).

Results

Comparisons between the surgeons who responded to the survey early (after the first email) or late (to subsequent emails) revealed no significant differences in the demographics; male vs. female ($p=.736$), age ($p=.483$), surgical specialty ($p=.588$), years in practice ($p=.787$), or surgeons who operate on brachial plexus patients compared to those that do not ($p=.409$).

Questionnaire Responses to Pain Assessment and Treatment

In patients referred for pain resulting from a nerve injury, 44 surgeons (75%) indicated that they "quantitatively assess pain" using a verbal scale ($n=24$), verbal numeric scale ($n=36$), visual analog scale ($n=14$), or pain questionnaire ($n=7$). The specific "pain questionnaires" identified were the McGill pain questionnaire, the Disability Arm Shoulder Hand, the SF-36, and pain questionnaires developed by the surgeon. There were no significant differences in the demographics between surgeons who do or do not quantitatively assess pain (male vs. female, $p=.306$; age, $p=.174$; years in practice, $p=.281$; surgical specialty, $p=.346$; early vs. late mailing response, $p=.796$). There was a lower frequency of pain assessment in patients referred for motor or sensory dysfunction resulting from nerve injury; 31 surgeons (52%) reported that they "always formally assess pain" in these patients.

In this survey, neuropathic pain was defined as "pain resulting from a nerve injury." When asked "when neuropathic pain becomes chronic?", 6 months was the most frequent response ($n=23$); however, the responses ranged from 3 days to 1 year (less than 6 months, $n=23$; greater than 6 months, $n=9$; no answer, $n=4$). The factors that were considered very important in the development of chronic neuropathic pain included psychosocial factors (64%), mechanism of injury (59%), involvement of workers' compensation or litigation (54%), and iatrogenic lesions from a previous surgery (48%; Table 1). Surgeons who quantitatively assess pain selected "mechanism of injury" more frequently ($p=.01$) as an important factor in the development of neuropathic pain and an injury proximal to the dorsal root ganglion was selected more frequently by surgeons who operate on patients with brachial plexus injuries compared to those that do not ($p=.028$). There was no difference in the selection of these factors between the early and late responders to the survey.

For the treatment of patients with chronic neuropathic pain, the most frequent nonoperative interventions were "refer to physical or occupational therapy" (64%) and "refer to pain management" (63%; Table 2). Surgeons who "always" assess pain in patients referred with motor and/or sensory dysfunction more frequently selected "prescribe anticonvulsants" ($p=.03$) and less frequently "refer to physical or occupational therapy" ($p=.03$). There were no statistical differences between surgeons who "quantitatively assess pain" and those that do not; between those surgeons who operate on brachial plexus injuries and those that do not; between early versus late responders.

In patients more than 6 months following nerve injury and repair, surgeons reported that they frequently see patients with cold sensitivity (54%), decreased motor

Table 1 Factors important in the development of chronic neuropathic pain.

Factors	Percentage of responses
Psychosocial factors	64
Mechanism of injury	59*
Involvement of workers' compensation or litigation	54
Iatrogenic injury from previous surgery	48
Injury proximal to the dorsal root ganglion	37**
Surgical repair	34
Brachial plexus injury distal to the dorsal root ganglion	29
Age of patient	19
Gender	7

* $p=.01$ (significantly more surgeons who "quantitatively assess pain"), ** $p=.028$ (significantly more surgeons who operate on brachial plexus injuries)

Table 2 First non-operative interventions used for patients with chronic neuropathic pain.

Nonoperative intervention	Percentage of responses
Refer to physical or occupational therapy	64*
Refer to pain management	63
Prescribe anti-convulsants	58**
Prescribe anti-depressants	37
Prescribe topical Creams	20
Prescribe opioids	20
Refer to psychologist &/or psychiatrist	17
Refer for naturopathic treatments	2

** $p=.03$ (the subcategory of surgeons who "always" assess pain more frequently "prescribe anti-convulsants"), * $p=.03$ (less often "refer to physical or occupational therapy")

function (42%), and paraesthesia or numbness (41%; Table 3). Surgeons who operate on patients with brachial plexus injuries did select "decreased motor function" more frequently compared to surgeons who do not operate on the brachial plexus ($p=.024$). Surgeons who responded later to the survey compared to the early respondents selected "fear of using the extremity" ($p=.006$) and "fear of returning to work" ($p=.045$) more frequently. There were no statistical differences between those surgeons who quantitatively assess pain and those that do not.

Discussion

Neuropathic pain is defined by the International Association for the Study of Pain as pain resulting from dysfunction or a lesion in the peripheral or central nervous system [21, 39]. Chronic neuropathic pain is usually defined as pain after 6 months from onset, and in our survey, many surgeons (39%) defined the onset of "chronic" at 6 months following

Table 3 Patient characteristics frequently seen more than 6 months following nerve injury.

Factors	Percentage of responses
Cold sensitivity	54
Decreased motor function	42*
Paraesthesia or numbness	41
Fear of using extremity	22**
Fear of returning to work	22**
Neuropathic pain	20
Emotional or psychological distress	17

* $p=.02$ (significantly, more surgeons who operate on brachial plexus injuries selected decreased motor function), ** $p=.006$ and $p=.045$ ("fear of using the extremity" and "fear of returning to work," respectively, selected by surgeons who responded later to the survey compared to the early respondents)

nerve injury. However, there were more surgeons who defined it by periods of time more than or less than 6 months following injury which points to inconsistency in the definition of "chronic neuropathic pain" among peripheral nerve surgeons. In the surgeons' general comments submitted in the survey, "chronic neuropathic pain" was often attributed to neuropathic pain, which was uncontrolled and nonresponsive to treatment.

Neuropathic pain and cold sensitivity are frequently reported as contributing to poor outcome following nerve injury [6, 12, 19, 20, 25, 27–29, 32]. However, few outcome studies provide details regarding these patient symptoms, and most studies of nerve injured patients report only motor and sensory function. Graham and Schofield reported the prevalence of cold intolerance symptoms in patients greater than 2 years following hand injuries [27]. The questionnaire was returned by 25% of patients, and cold intolerance was reported by most of these patients (90% in trauma cases). Only 9% of patients with cold intolerance reported an improvement over time. Collins et al. evaluated 85 patients who were at least 5 years following nerve injury and 76% reported cold intolerance, which did not appear to decrease over time [19]. In our survey, 54% of surgeons reported that 6 months following nerve injury, cold intolerance was a frequent symptom. However, there was no indication of a specific outcome measure used to quantify the degree of pain or disability related to cold intolerance. Many of the respondents of our survey indicated that referral to pain management and/or physical or occupational therapy is one of the first nonoperative interventions utilized for patients with neuropathic pain. Therefore, many of the surgeons may assume that these facets of outcome regarding pain and disability are assessed and addressed by other subspecialties.

Many questionnaires, which evaluate pain, disability, cold sensitivity, and psychosocial factors, are time consuming to complete and analyze and, therefore, may be difficult to include in clinical practice. The European Federation of Neurological Societies recently outlined their neuropathic pain assessment guidelines [21]. Visual analog scales, numerical rating scales, or verbal rating scales, which are simple to use, can provide a quantitative assessment of pain intensity and may be used to provide a baseline assessment [21]. Others have advocated assessment of pain intensity in addition to sensory descriptors, temporal variation, and functional impact [26]. Based upon simple assessment, patients who indicate the presence of neuropathic pain can be referred to pain specialists for more in-depth evaluation and prompt treatment of the pain and associated sequelae.

The response rate for our survey was 49%. To minimize the likelihood of nonresponse bias and to increase the generalizability, a higher response rate is desirable, but when compared to the response rate for physician ques-

tionnaires, this rate is similar to those previously reported [4, 11, 22–24, 33]. Many of the studies that have evaluated physician survey response rates used postal mail surveys, and in a study comparing electronic and postal mail surveys, there was a shorter response time with electronic surveys but no difference in response rate or data quality [3]. We utilized several of the methods recommended to increase the response rate, which included a short questionnaire, personalized email, survey began with the demographic data and each subsequent email to nonrespondents had a link to the questionnaire [3, 11, 24, 33]. Monetary and non-monetary incentives have been used to increase response rates and in a recent systematic review, VanGeest et al. found that monetary incentives improved the response rate [45]. In our study, no incentives were given to complete the survey.

The most significant limitation associated with a low response rate is the presence of nonresponse bias. The comparison of early and late respondents to the survey has been introduced as one method to address this issue. Previous studies have suggested that respondents of later mailings may be classified as "proxies" for the nonrespondents, and these late responders may represent qualities similar to the nonrespondents [33, 43]. The validity of this conclusion has been challenged. Blalock and Dial hypothesized that these similarities may not be present in the unevaluated responses or demographics [10]. In our survey, there were no differences in the demographics between the early and late responders, but the late responders did more frequently report patients with "fear of using the extremity" and "fear of returning to work." There were no differences in the factors considered important in the development of chronic neuropathic pain.

Leslie [37] proposed that individuals with a group identity share similar traits concerning attitudes and opinions towards group issues; therefore, response bias is less likely in studies that use a homogeneous group. Peripheral nerve surgeons represent a relatively homogeneous group regarding knowledge and training compared to other physicians or the general population. Therefore, the differences between respondents and nonrespondents in surveys involving peripheral nerve surgeons may have less significance in the attitude towards pain following nerve injury. However, the relatively low response rate in our study does limit the assumptions that one can make regarding the practices and beliefs of the nonrespondents. Based on the 44% of surgeons who did complete our survey and the results reported in outcome studies, there appears to be many surgeons who do not quantitatively assess pain or the associated factors in patients following nerve injury and yet many recognize the presence of cold sensitivity, pain, and psychological sequelae following nerve injury.

Significant disability, related to cold intolerance and/or neuropathic pain, may result following nerve injury, and early treatment is advocated [2, 9, 13, 14, 19, 20, 28, 29, 32]. However, in our study, few surgeons reported using valid, reliable questionnaires to assess pain, cold intolerance, or disability following nerve injury, and in those patients not specifically referred for a pain problem only 52%, of surgeons "formally assess pain." Therefore, these symptoms with respect to frequency, intensity, and disability may be under represented in the reports of outcome in patients following nerve injury. Early recognition of neuropathic pain and prompt intervention may provide the opportunity for more efficacious treatment.

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