SCIENTIFIC ARTICLE

Cold Intolerance in Surgically Treated Neuroma Patients: A Prospective Follow-Up Study

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Purpose Cold intolerance may impose great changes on patients' lifestyle, work, and leisure activities, and it is often severely disabling. This study aims to investigate the prevalence and severity of cold intolerance in patients with injury-related neuromas of the upper extremity and improvement of symptoms after surgical treatment. Furthermore, we try to find predictors for cold intolerance and correlations with other symptoms.

Methods Between January 2006 and February 2009, 34 consecutive patients with surgically treated neuroma-specific neuropathic pain of the upper extremities were sent a questionnaire composed of general questions concerning epidemiologic variables and several specific validated questionnaires, including the Visual Analog Scale for pain. To estimate the prevalence of cold intolerance objectively in neuroma patients, we used the validated CISS (Cold Intolerance Symptom Severity) questionnaire with a prespecified cutoff point.

Results The CISS questionnaire was filled out by 33 patients before and 30 after surgery for neuroma-specific neuropathic pain, with a mean follow-up time of 24 months. We found a prevalence of cold intolerance of 91% before surgery, with a mean CISS score above the cutoff point for abnormal cold intolerance. After surgery, the prevalence of cold intolerance and the mean CISS score were not significantly different, whereas the mean Visual Analog Scale score decreased significantly ($p < .01$). CISS scores were lower in patients with neuromas associated with sharp injury of the peripheral nerve ($p = .02$). A higher VAS score correlated significantly with a higher CISS score ($p = .01$).

Conclusions Cold intolerance is a difficult and persistent problem that has a high prevalence in patients with a painful injury-related neuroma. There seems to be a relationship between severity of cold intolerance as measured by CISS, pain as measured by the Visual Analog Scale, and type of injury. Cold intolerance may not disappear with time or surgical treatment.

Type of study/level of evidence Therapeutic IV.

Key words Cold intolerance, neuroma, neuralgia, peripheral nerves, thermal hyperalgesia.

Cold intolerance is defined as abnormal pain of the hand and fingers after exposure to mild or moderate cold, with or without discoloration, numbness, weakness, or stiffness. It is also known as thermal hyperalgesia or cold sensitivity, and it affects work and leisure activities taking place when the ambient temperature is low. Therefore, cold intolerance may seriously influence patients' daily life.[1,2] Cold intolerance is a common long-term consequence of upper-extremity nerve injury, with an estimated incidence of 42% to 100%.[3–7]

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When a peripheral nerve is damaged, it will try to regenerate itself toward the distal nerve end or target organ.[8] If a distal target is not found, axon sprouts may grow into the surrounding scar tissue, forming a neuroma.[9–11] Some neuromas cause intense pain and altered sensation in the distribution of the injured nerve.[12] Once a neuroma has formed, best results are obtained from surgical intervention, usually by relocation of the nerve end into muscle or bone.[12,13] Although a high incidence of cold intolerance is expected following neuroma formation, there are no data available on the prevalence of cold intolerance in patients with a painful injury-related neuroma.

Most studies focusing on peripheral nerve injuries have estimated the prevalence of cold intolerance using only subjective symptoms mentioned by patients,[3,14] and they do not specify the variable used to measure cold intolerance.[15] The use of a validated questionnaire can provide more consistent and reliable information. To estimate the prevalence of cold intolerance in neuroma patients, we used the validated Cold Intolerance Symptom Severity (CISS) questionnaire with a prespecified cutoff score defined as abnormal. In addition, we observed the surgically treated neuroma patients to see how their pain and cold intolerance symptoms changed postoperatively and investigated the relationship between these problems.

This study aimed to investigate the prevalence and severity of cold intolerance in patients with injury-related neuromas of the upper extremity and improvement of symptoms after surgical neuroma treatment. Furthermore, we tried to find predictors for cold intolerance and correlations with other symptoms.

MATERIALS AND METHODS

Study design

Between January 2006 and February 2009, we performed a prospective cohort study of surgically treated neuroma patients. Intake questionnaires were sent before surgery, including general questions concerning demographic variables and specific validated questionnaires about pain, loss of upper extremity function, symptoms of psychopathology, and cold intolerance. Follow-up questionnaires concerning cold intolerance and pain were sent in February 2009 to all subjects who responded preoperatively, with a follow-up period of at least 3 months.

Study population

Entry criteria were patients diagnosed with neuroma pain, planned for surgical neuroma treatment by author J.H.C. at our institution. We asked 34 consecutive patients with neuroma-specific neuropathic pain of the upper extremities to participate in our study.

The diagnosis of neuroma-specific neuropathic pain was made based on history and reports, presence of Tinel's sign, and reduction of pain after nerve blockade. The surgery entailed excision of the neuroma with relocation of the nerve end into muscle or bone. After we obtained patients' consent, we sent an initial questionnaire when they were scheduled for surgery and another questionnaire at least 3 months postoperatively. Nonresponders were contacted by telephone and asked to return the questionnaire. The medical ethics committee of our institution approved this study.

Scoring methods

The preoperative questionnaire contained questions concerning patient-specific factors such as age, gender, height, weight, smoking status, dominant hand affected, employment status, workers' compensation, pending litigation, type of injury, and number of previous operations.

The severity of posttraumatic cold intolerance was measured using the self-administered Blond McIndoe CISS questionnaire, which has been validated in both a peripheral nerve injury group and a normative control group.[6,16] The CISS questionnaire is used to measure self-reported symptoms of cold intolerance and consists of 6 questions (Table 1). The first question involves the occurrence of the following symptoms and signs: pain, numbness, stiffness, swelling, and change of skin color to white or blue. According to the official score guidelines, answers to this first question are not calculated toward the final CISS score. Questions 2 to 6 relate to the frequency, duration, severity, and impact of cold intolerance symptoms on activities of daily life. Question 5 consists of the earlier McCabe Cold Sensitivity Test.[4,17,18] The CISS questionnaire was translated into Dutch, following recommendations for the cross-cultural adaptation of health status measures supported by the American Academy of Orthopaedic Surgeons and the Institute for Work and Health.[16] The CISS questionnaire gives a minimum score of 4 and a maximum score of 100.

The Visual Analog Scale (VAS) consists of a 10-cm horizontal line anchored with the words "no pain at all" on the left side and "unbearable pain" on the right. The patient has to place an X on the line representing the amount of pain felt. The VAS score ranges from 0 to 10. In addition, we asked 4 questions concerning the severity of different types of pain: spontaneous pain, pain on pressure, pain on movement, and painful hyperesthesia on light skin touch. The severity of the pain was scored as severe, moderate, mild, or absent.