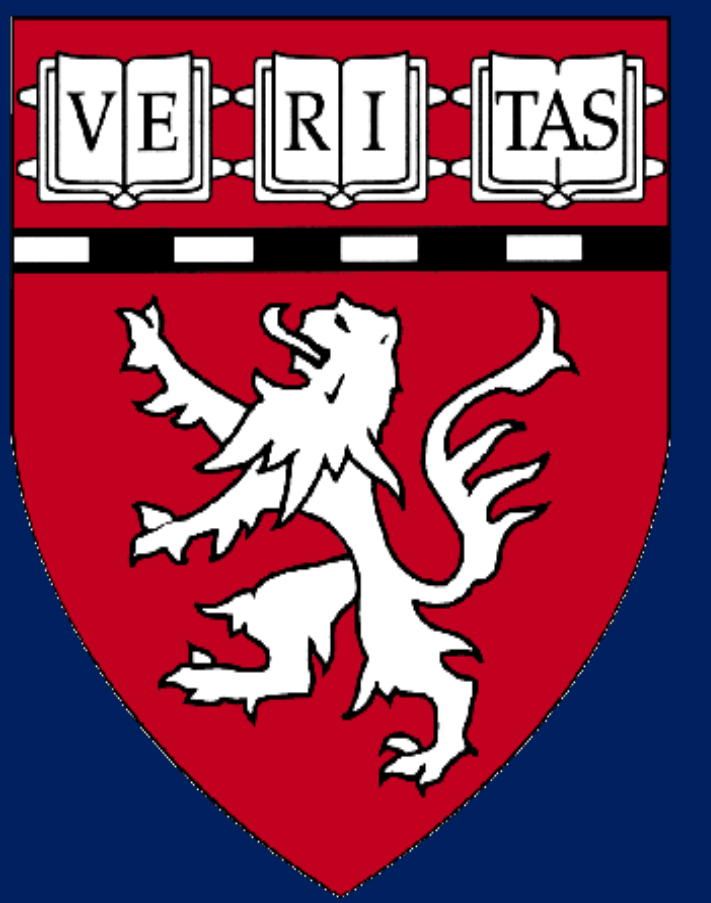




Diagnostic Criteria for Symptomatic Neuroma

Denise MJ Arnold, MD; Suzanne C Wilkens, MD; Neal C Chen, MD; Ivica Ducic, MD, PhD; Kyle R Eberlin, MD
Orthopaedic Hand and Upper Extremity Service, Massachusetts General Hospital, Harvard Medical School



Aim

To review existing literature on the diagnostic criteria for symptomatic neuroma, and develop criteria for the clinical diagnosis of symptomatic neuroma.

Conclusion

The diagnosis of symptomatic neuroma is based on a history of (suspected) nerve injury, symptoms in a defined neural anatomic distribution and most importantly pain. In combination with a positive Tinel sign, positive response to a diagnostic local anesthetic injection, or US or MRI confirmation of neuroma, these criteria form the basis of diagnosis of symptomatic neuroma.

1. Introduction

2. Methods

3. Results

- Neuromas occur in 5-10% of patients sustaining a nerve injury, especially after amputation. They are often difficult to treat and may cause significant morbidity.
- Diagnosis has traditionally been made based on patient history, symptoms, physical examination, and location and distribution of pain, sometimes supported by a Tinel sign, imaging, and response to a nerve block.
- There are no established or formally accepted diagnostic criteria for symptomatic neuroma.

- Design:**
- Systematic review following the 2009 PRISMA guidelines
 - Pubmed, Embase, Cochrane Library
 - Screening by title and abstract
 - Eligibility assessed by full article
- Inclusion:**
- All articles addressing neuroma after nerve injury and amputation
 - Languages: English, Dutch, German
- Exclusion:**
- Duplicates
 - Non-human studies
 - Non-extremity neuromas
 - Morton's neuroma, bowler's thumb

Diagnostic Criteria for Symptomatic Neuroma

Must have all 3:

- Pain with at least 3 of the following characteristics: burning, sharp, shooting, electric, paresthesias, numbness, cold intolerance
- Symptoms in a defined neural anatomic distribution
- History of nerve injury or suspected nerve injury

Must have at least 1:

- Positive Tinel sign (for cutaneous nerve)
- Positive response to local anesthetic injection
- US or MRI confirmation of neuroma

| Year | Authors | Type of article | No. Pts/Studies | Body part | Type of injury | Anamnesis | Mentioned diagnostics |
|------|------------------------|--|-----------------|---------------------------|--|--|---|
| 2018 | Lu et al. | Literature review | - | NS | NS | Allodynia, hyperesthesia | Tinel sign, histology |
| 2017 | Dahlin et al. | Literature review | - | Upper extremity and hand | Traumatic | Localized pain, sensory disturbances, allodynia, hyper-/dysesthesia, cold sensitivity | Tinel sign, US/MRI |
| 2017 | Vlot et al. | Retrospective cohort | 1083 | Fingers | Amputation | Sharp/burning pain, cold intolerance | Shooting, electrical sensation elicited by direct pressure |
| 2017 | Poyntz et al. | Systematic review | 22 | Lower extremity | Amputation | Localized tenderness, electric pain, mechanical and chemosensitivity | Sensitive palpable lump, Tinel sign, diagnostic lidocaine nerve block, US, histology |
| 2017 | Decrouy-Duruz et al. | Retrospective cohort | 231 | Whole body | Surgical | Burning/tingling/sharp/ stabbing pain, anesthesia, hypesthesia, allodynia, hyperalgesia, dysesthesia | Tinel sign, diagnostic nerve block |
| 2017 | Schwarz et al. | Review of current concepts | - | Brachial plexus | Traumatic | - | Tinel sign, US |
| 2017 | Aydemir et al. | Retrospective chart review | 147 | Lower extremity | Amputation | - | Tinel sign, US |
| 2016 | O'Reilly et al. | Retrospective review | 80 | Upper and lower extremity | Amputation | Localized pain, altered sensation | Tinel sign, US |
| 2016 | Toia et al. | Retrospective cohort | 108 | Upper and lower extremity | Entrapment, tumoral, traumatic, surgical | - | Tinel sign, US |
| 2015 | Duzcu et al. | Case report | 1 | Lower extremity | Amputation | Pain | Soft tissue mass, Tinel sign, CT/US/MRI, histology |
| 2015 | Wojtkiewicz et al. | Retrospective cohort | 490 | Upper and lower extremity | NS | Stabbing/throbbing/ shooting pain, QoL scores | - |
| 2015 | Martins et al. | Case series | 7 | Fingers | Amputation | Allodynia, paresthesia, dysesthesia, chronic pain spontaneous pain | Local tenderness, Tinel sign, diagnostic lidocaine nerve block |
| 2014 | Jung et al. | Prospective randomized experiment and control | 2x15 | Upper and lower extremity | Amputation | Neuropathic pain, hyperalgesia, allodynia | Tinel sign, US |
| 2014 | Chabra et al. | Review of current concepts | - | NS | NS | - | Tinel Sign, MRI |
| 2014 | Abraham et al. | Case report | 1 | Finger | Amputation | Sharp, unremitting pain | Tender soft tissue mass, Tinel sign |
| 2014 | Pet et al. | Retrospective case control | 35 | Upper and lower extremity | Amputation | - | Local tenderness, Tinel sign |
| 2014 | Souza et al. | Retrospective cohort | 26 | Upper extremity | Amputation | Localized nerve pain | Physical findings consistent with localized nerve pain (NS) |
| 2013 | Brogan et al. | Literature review | - | Upper extremity | Traumatic | Pain related to a single peripheral nerve distribution, hypoesthesia | Tinel, diagnostic nerve block, US/MRI |
| 2013 | Daniilidis et al. | Case report | 1 | Lower extremity | Amputation | Localized burning pain | Local pressure pain, diagnostic bupivacaine nerve block, MRI |
| 2013 | O'Reilly et al. | Retrospective review | 133 | Upper and lower extremity | Amputation | - | Local tenderness, US, Tinel sign |
| 2013 | Van der Avoort et al. | Retrospective cohort | 583 | Fingers | Amputation, neuroorrhaphy | Burning/shooting/electrical/rather deep/aching/throbbing pain, tight feeling | Tinel sign, histology |
| 2013 | Hsu et al. | Literature review | - | NS | Amputation | Mechanical sensitivity, pain, abnormal sensation, cold intolerance | Tinel sign |
| 2013 | Abreu et al. | Review of current concepts | - | NS | Traumatic | Pain | Tinel sign, firm soft tissue mass, histology, CT/US/MRI |
| 2012 | Lim et al. | Case series | 2 | Lower extremity | Amputation | Analgesic-resistant pain, hyperalgesia, hyperpathia, | US, biopsy/fine needle aspiration, pressure triggering test (Tinel) |
| 2012 | Rajput et al. | Literature review | 100 | NS | NS | Stabbing/throbbing/burning/ cramping pain, hyperalgesia, allodynia, hypoesthesia, hyperalgesia, anesthesia | Tinel sign, US/CT/MRI |
| 2011 | Ducic et al. | Literature review | 38 | Upper and lower extremity | Surgical | Medication-resistant pain | Tinel sign, diagnostic nerve block |
| 2011 | Zhu et al. | Prospective cohort | 202 | Upper and lower extremity | Traumatic | - | Neurological examination and electrodiagnostic tests, US |
| 2011 | Restrepo-Garces et al. | Case report | 1 | Lower extremity | - | Throbbing/burning/squeezing/stabbing/electrical pain | Tinel sign, US, diagnostic levo-bupivacaine nerve block |
| 2011 | Stokvis et al. | Review of current concepts | - | NS | Traumatic or iatrogenic | Spontaneous electric/shooting/burning pain, allodynia, hyperalgesia, hypoesthesia, paresthesia, cold intolerance | Tinel sign, diagnostic lidocaine nerve block, monofilament and 2-point discrimination tests, US |
| 2010 | Watson et al. | Review of current concepts | - | Hand and upper extremity | Traumatic or iatrogenic | Substantial stabbing/ throbbing/burning/cramping pain, altered sensation, hypoesthesia, hyperalgesia, anesthesia | Tinel sign |
| 2010 | Chhabra et al. | Review of current concepts, case series | 8 | Upper and lower extremity | Surgical, amputation, traumatic | Disabling pain, sensory changes | Tinel sign, denervation atrophy of the muscles, MRI |
| 2010 | Nikolajsen et al. | Randomized controlled blinded prospective case series | 6 | Hands | Amputation, surgical | Medication-resistant pain, allodynia, hyperalgesia, cold/heat intolerance | Tinel sign, quantitative sensory testing: brush-evoked allodynia, tactile/pressure pain/ thermal thresholds |
| 2010 | Stokvis et al. | Prospective cohort | 34 | Upper extremity | Traumatic, iatrogenic | Spontaneous electrical spike/burning pain, allodynia, hyperalgesia | Tinel sign, diagnostic lidocaine nerve block, DASH, CISS (cold intolerance) |
| 2009 | Stokvis et al. | Prospective cohort (sub analysis focusing on cold intolerance) | 34 | Upper extremity | Traumatic, iatrogenic | Intense pain, altered sensation, mechanical hyperalgesia, cold intolerance | Tinel sign, diagnostic lidocaine nerve block, DASH, CISS (cold intolerance) |
| 2009 | Shankar | Case report | 1 | Lower extremity | Amputation | Sharp, intermittent, lancinating, sometimes radiating pain | Tinel sign, diagnostic lidocaine nerve block, US |
| 2009 | Sehirlioglu et al. | Retrospective cohort | 75 | Lower extremity | Landmine explosion amputation | - | Soft tissue mass, Tinel sign, diagnostic lidocaine nerve block, US/MRI |
| 2008 | Ducic et al. | Retrospective chart review | 21 | Upper and lower extremity | Amputation | Pain, paresthesia | Tinel sign, diagnostic nerve block |
| 2008 | Gruber et al. | Prospective cohort | 82 | Upper and lower extremity | Amputation | Dull aching pain, paroxysmal sharp flashing staccato-like pain | Tinel sign, diagnostic lidocaine nerve block, US |
| 2007 | Cokluk et al. | Prospective case series | 36 | Upper extremity | Traumatic | - | US |
| 2006 | Lin et al. | Prospective single blinded cohort | 20 | Upper and lower extremity | Amputation | Throbbing/burning/squeezing pain, pins and needles, cold intolerance | Local tenderness, Tinel sign, pain elicited by local administration of norepinephrine |
| 2006 | Zhang et al. | Case report | 1 | Finger | Amputation | Chronic pain, cold intolerance, hypersensitivity | Tinel sign, histology |
| 2004 | Cokluk et al. | Prospective case series (subset of 2007 study) | 14 | Upper and lower extremity | Traumatic | - | US |
| 2004 | Koch et al. | Case series (subset of 2003 study) | 8 | Lower extremity | Amputation, surgical | - | Tinel sign, diagnostic lidocaine nerve block |
| 2003 | Koch et al. | Case series | 23 | Upper and lower extremity | Amputation, surgical | - | Tinel sign, diagnostic lidocaine nerve block |
| 1999 | Thomas et al. | Prospective case series | 10 | Upper and lower extremity | Amputation | - | US, diagnostic nerve block, histology |
| 1996 | Geraghty et al. | Retrospective cohort | 32 | Upper extremity | Amputation | Localized sharp/shooting /electric/shock-like pain | Tinel sign |
| 1990 | Singson et al. | Prospective case series | 20 | Lower extremity | Amputation | - | Tinel sign, MRI, histology |
| 1990 | Schmitt et al. | Case series | 3 | Lower extremity | Amputation | - | US/CT |
| 1985 | Badalamente et al. | Prospective case series | 20 | Upper extremity | NS | - | Electron microscopy, biochemical analysis |
| 1983 | Fisher et al. | Retrospective cohort | 100 | Fingers | Amputation | Dysesthesia, hyperesthesia, cold intolerance | US |

Identification

Screening

Eligibility

Included

