III Annual International Conference
of the Baltic Society of Regional Anaesthesia

5th-6th of May 2017, Pärnu

Ultrasound guided symphatetic blocks for treatment of CRPS

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US guidance for treatment of CRPS

- Classification
- Symptoms
- Treatment
- US tecnique
  - stellate ganglion block
  - brachial plexus blocks
- Confirmation

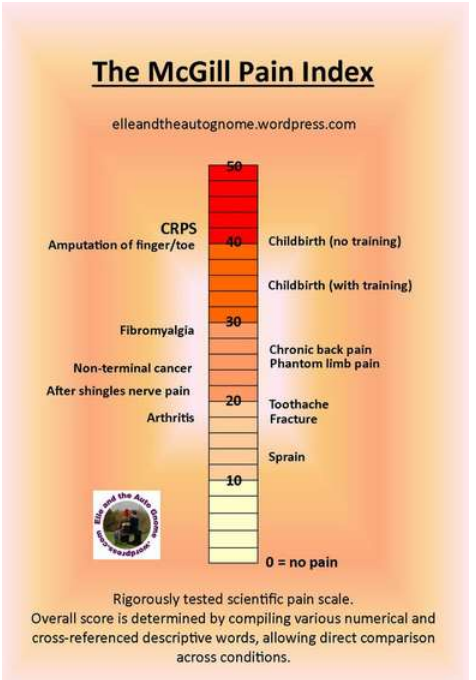
CRPS

- CRPS was originally described during the American Civil War (1861-1865) where it was called causalgia by Silas Weir Mitchell.

Mitchell, S.W. (1872). Injuries of Nerves and their Consequences. Philadelphia: JB Lippincott.[page needed]

- In 1993, a special consensus workshop held in Orlando, Florida, provided the umbrella term "complex regional pain syndrome", with causalgia and RSD as subtypes.

*Stanton-Hicks M, Jänig W, Hassenbusch S, Haddox JD, Boas R, Wilson P (October 1995). "Reflex sympathetic dystrophy: changing concepts and taxonomy". Pain. **63** (1): 127–33*



Complex Regional Pain Syndrome
CRPS
24 hours /7days a week every year

«For those who understand no explanation is needed. For those who do not understand no explanation is possible»

**1 Borrowed from Kristen Hensley' Pinterest*-RSD/CRPS Awareness

http://www.crps247.com/

CRPS – a Heterogeneous Condition

CRPS has been recognized by over 100 names

Common names are:

- reflex sympathetic dystrophy (RSD)
- causalgia
- Sudek's atrophy
- algodystrophy
- algoneurodystrophy
- shoulder-hand syndrome
- transient osteoporosis, etc.

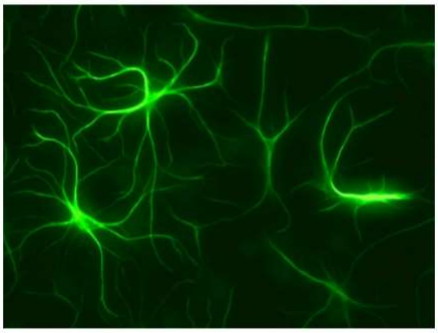
What exactly happend in CRPS?

Central Sensitization

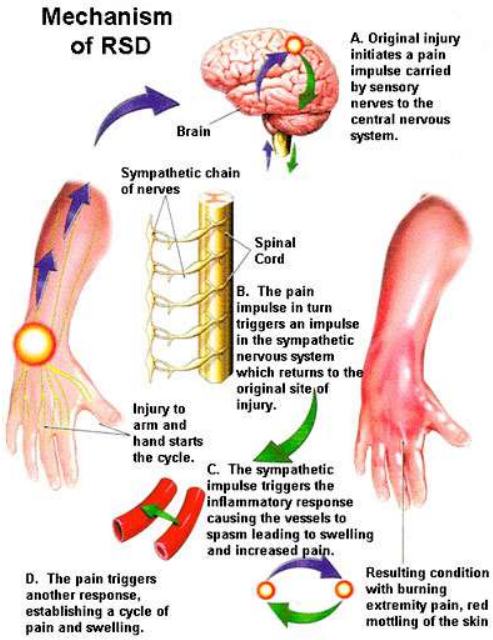
- Two things happen in Central Sensitization:
  1. Glial cells get activated
  2. NMDA receptors are activated

Pradeep Chopra, MD

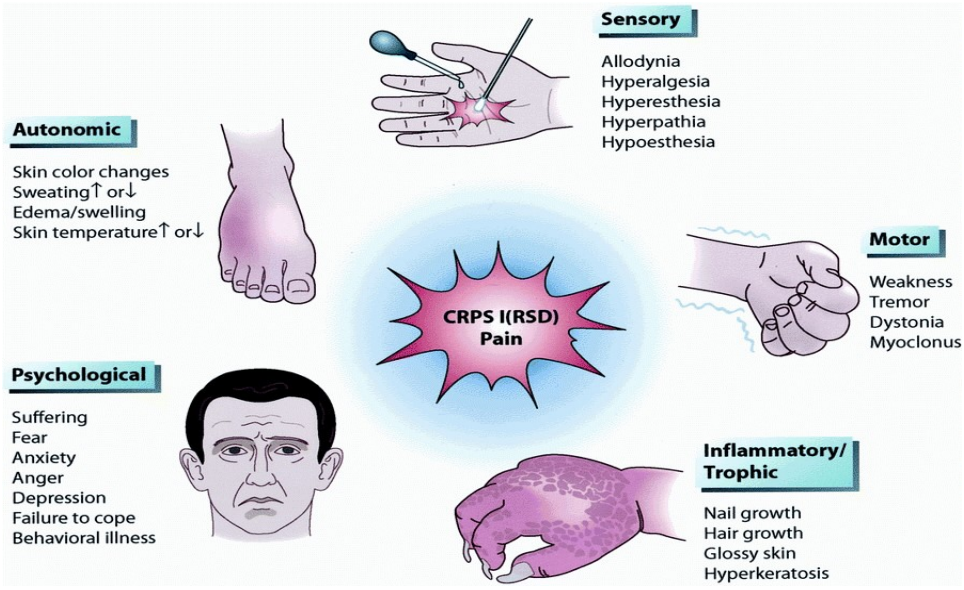
This is what glial cells look like



Courtesy Jarred Younger, PhD Pradeep Chopra, MD Sonja Paetau, University of Helsinki



Clinical Presentation: Signs and Symptoms



KF7028-01/02 - PSSV

CRPS classification

- CRPS Type I (CRPS-I), previously known as RSD (Reflex Sympathetic Dystrophy)
  - Typically follows a minor injury (usually of a hand or foot), most commonly a fracture, sprain, crush injury or surgery (may also occur after stroke acute MI)
  - No precipitating event is reported by up to 5-10% of patients
- CRPS Type II (CRPS-II), previously known as causalgia
  - Identical to CRPS-I but with evidence of overt "major" nerve damage

CRPS – a Heterogeneous Condition

- CRPS is also heterogeneous with respect to symptoms and time
  - Signs and symptoms (***hot*** CRPS [acute] versus ***cold*** CRPS [chronic]) vary with time
  - "Chronification" and centralization of pain – pain may persist for decades
- This heterogeneity has contributed to difficulty in diagnosis of CRPS

Signs and symptoms (for patients)

- Continuous **burning** or throbbing pain, usually in your arm, leg, hand or foot
- Sensitivity to touch or cold
- **Swelling** of the painful area
- Changes in **skin temperature** — at times your skin may be sweaty; at other times it may be cold
- Changes in **skin color**, which can range from white and mottled to red or blue
- Changes in **skin texture**, which may become tender, thin or shiny in the affected area
- Changes **in hair and nail** growth
- **Joint stiffness**, swelling and damage
- Muscle **spasms**, **weakness** and **loss** (atrophy)
- Decreased ability to move the affected body part

Early diagnosis and treatment are required to prevent a long-standing or permanent disability.

Clinical features such as spontaneous pain, edema, hyperalgesia, temperature or sudomotor changes, motor function abnormality, and autonomic changes are the hallmark of this disease.

The treatment of CRPS remains controversial, and includes medications, physical therapy, regional anesthesia, and neuromodulation.

- Thuan-Tzen Koh , MBBS, MedSci; Anne Daly , DClinPhysio; William Howard , MBBS, FANZCA; Chong Tan , MBBS, FANZCA; Andrew Hardidge , MBBS, FRACS (Orth), FAOrthA, PGDip(Mgmt)
- *JBJS Reviews*, 2014 Jul; 2 (7)

ANESTHESIOLOGY
The Journal of the American Society of Anesthesiologists, Inc.

From: Heart Rate Variability in Complex Regional Pain Syndrome during Rest and Mental and Orthostatic Stress
Anesthes. 2012;116(1):133-146. doi:10.1097/ALN.0b013e31823bbfb0

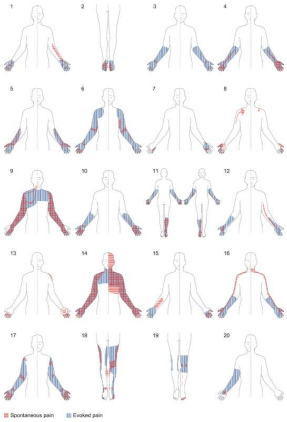


Figure Legend:

Fig. 1. Areas of spontaneous and evoked pain (pinprick hyperalgesia and brush allodynia) marked on a body chart (posterior and anterior dimensions) in patients with complex regional pain syndrome.

Color difference

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Nashvill, TN, 2017

Hair growth

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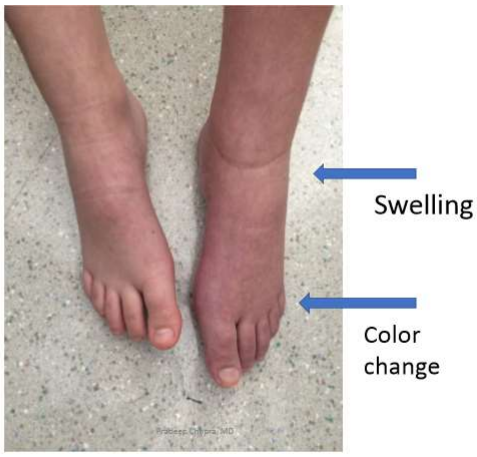

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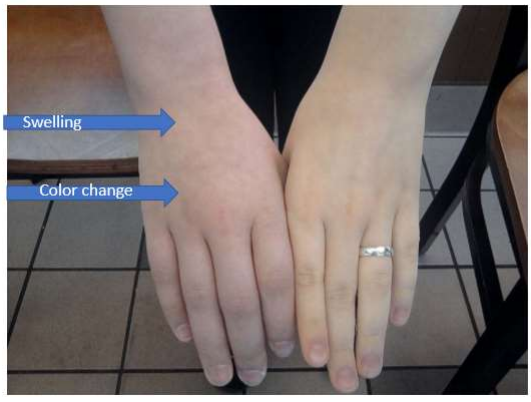

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Mast Cell Activation Syndrome (MCAS)

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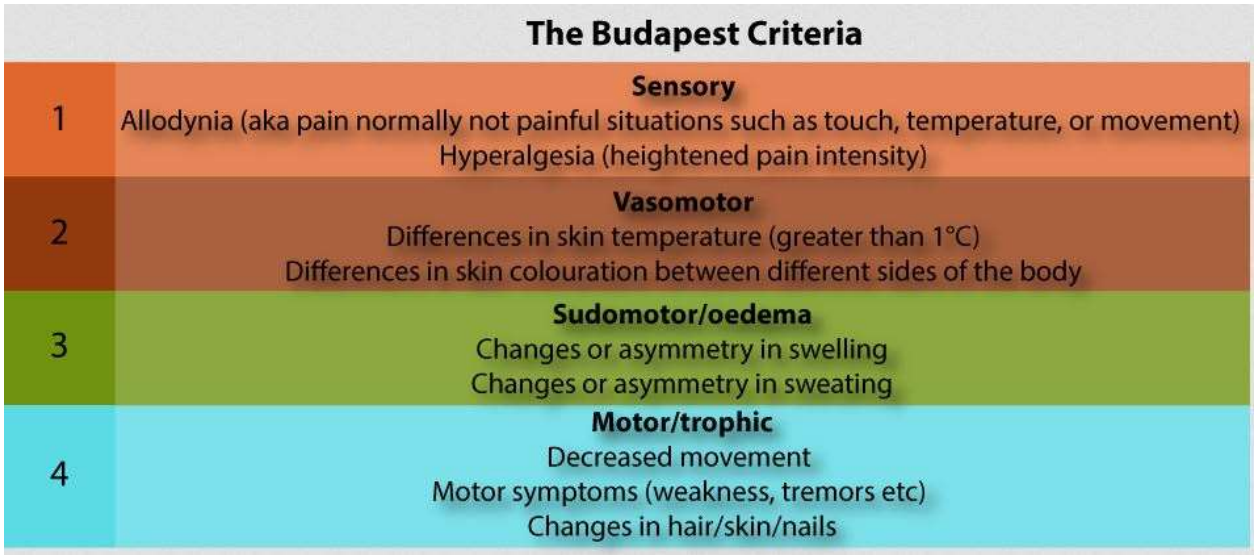
The Budapest Criteria

Diagnostic criteria	Sensitivity	Specificity
IASP	1.00	0.41
Budapest clinical	0.99	0.68
Budapest research	0.78	0.79

1 from 3 of 4



Medications

- Pain relievers-killers. (NSAIDs…)
- Opioids
- Antidepressants and anticonvulsants
- Corticosteroids
- I/V ketamine
- Bone-loss medications. lendronate (Fosamax) and calcitonin (Miacalcin).
- Sympathetic nerve-blocking medication. Injection of an anesthetic to block pain fibers in affected nerves

Harden et al.

Table 9 Pharmacotherapy guide. The following strategies are suggested for patients who have been diagnosed with CRPS but who cannot begin or progress in the functional restoration algorithm

Reason for Inability to Begin or Progress	Action
Mild-to-moderate pain	Simple analgesics and/or blocks (see interventional therapy section)
Excruciating, intractable pain	Opioids and/or blocks or later, more experimental interventions (see interventional therapy section)
Inflammation/swelling and edema	Steroids, systemic or targeted (acutely) or NSAIDs (chronically); immune modulators
Depression, anxiety, insomnia	Sedative, analgesic antidepressant/anxiolytics and/or psychotherapy (see pharmacotherapy section)
Significant allodynia/hyperalgesia	Anticonvulsants and/or other sodium channel blockers and/or NMDA receptor antagonists
Significant osteopenia, immobility and trophic changes*	Calcitonin or bisphosphonates
Profound vasomotor disturbance	Calcium channel blockers, sympatholytics, and/or blocks (see interventional therapy section)

It is important to remember that these suggestions are overruled by individual patient presentation.
* It is also important to note that certain drugs, such as calcitonin, may be associated with analgesia as well as the more primary action.
CRPS = complex regional pain syndrome; NMDA = N-methyl-D-aspartate; NSAID = nonsteroidal anti-inflammatory drug.

Complex regional pain syndrome: practical diagnostic and treatment guidelines, 4th edition.
Harden et all; Center for Pain Studies, Rehabilitation Institute of Chicago, Illinois 60611, USA. nharden@ric.org
Pain Med. 2013 Feb;14(2):180-229. doi: 10.1111/pme.12033. Epub 2013 Jan 17.

Harden et al.

Table 10 Studies examining psychological/behavioral interventions for complex regional pain syndrome

Author	Design and Sample	Psychological Intervention	Outcome
Blanchard [273]	Case report N = 1 adult	Thermal biofeedback	Complete resolution of symptoms
Alioto [272]	Case report N = 2 adult/adolescent	Autogenic and breathing relaxation, thermal and muscular biofeedback	75–100% reduction in pain
Barowsky et al. [271]	Case report N = 1 child	Thermal biofeedback	Complete resolution of symptoms
Kawano et al. [274]	Case report N = 1 adolescent	Autogenic relaxation, imagery	Complete resolution of symptoms
Wesdock et al. [279]	Case series N = 36 child/adolescent	Biofeedback	Helpful in some cases, particularly in CRPS of shorter duration
Gainer [275]	Case report N = 3 adult	Hypnotic imagery, relaxation training	Complete resolution of symptoms
Wilder et al. [278]	Case series N = 70 child/adolescent	Multidisciplinary treatment including relaxation training and CBT	Significantly improved pain and function in 57% of patients
Fialka et al. [270]	Randomized trial N = 18 adult	PT (N = 9), PT+ autogenics (N = 9)	Pain improved in both groups equally. Skin temperature more improved in autogenics group.
Sherry et al. [98]	Case series N = 103 child/adolescent	Multidisciplinary treatment including psychotherapy for 77% of sample	Complete symptom resolution in 92% of sample at end of treatment, 88% symptom-free at 2 year follow-up
Oerlemans et al. [65,276]*	Randomized trial N = 135 adult	PT including relaxation training and cognitive interventions (N = 44), OT (N = 44), Social Work Control (N = 47). All patients received standard medical care.	Significantly greater improvements at 1 year follow-up for PT group than Controls on pain, temperature, active range of motion, and overall impairment scores
Lee et al. [67]	Randomized trial N = 28 child/adolescent	PT 1× week + CBT (N = 14), PT 3× week + CBT (N = 14)	Pain and function improved significantly pre-post for both groups. Recurrence rate = 50%.
Singh et al. [277]	Prospective case series N = 12 adult	4-week outpatient interdisciplinary treatment program including group psychotherapy	Function improved significantly pre-post treatment without corresponding increases in anxiety
de Jong et al. [99]	Series of prospective single-subject experiments N = 8 adult	Intensive graded exposure therapy targeting pain-related fear	Pain-related fear was significantly reduced, with corresponding decreases in pain intensity, disability, and other CRPS symptoms

Studies are listed in order of date of publication.
* Both Oerlemans et al. studies were based on same sample.
CBT = cognitive-behavioral therapy; OT = occupational therapy; PT = physical therapy.

- Complex regional pain syndrome: practical diagnostic and treatment guidelines, 4th edition.
- Harden et all; Center for Pain Studies, Rehabilitation Institute of Chicago, Illinois 60611, USA. nharden@ric.org
- Pain Med. 2013 Feb;14(2):180-229. doi: 10.1111/pme.12033. Epub 2013 Jan 17.

Therapies

- Applying heat and cold
- Topical analgesics
- Biofeedback
- Physical therapy
- Transcutaneous electrical nerve stimulation (TENS)
- Puls radiofrequency (PRF DRG)
- Surgery
  - Spinal cord stimulation
  - Sympathectomy
  - Amputation

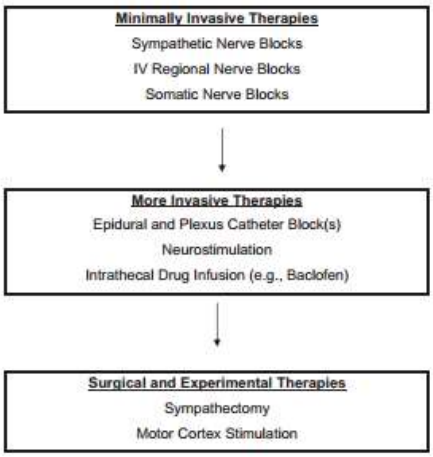


Figure 3 Interventional pain treatment algorithm for complex regional pain syndrome (modified from Stanton-Hicks et al. [53]). Inadequate or partial response to any given therapy should lead to a stepwise progression down through theses modalities (moving from less to more invasive) in conjunction with other noninterventional treatments. IV = intravenous.

Treatment

MILITARY MEDICINE, 179, 10:1133, 2014

Stellate Ganglion Block Used to Treat Symptoms Associated With Combat-Related Post-Traumatic Stress Disorder: A Case Series of 166 Patients

Sean W. Mulvaney, MD; James H. Lynch, MD†; Matthew J. Hickey, DO‡; Tabassum Rahman-Rawlins, PsyD‡; Matthew Schroeder, PhD*; Shawn Kane, MD§; Eugene Lipov, MD‖*

ABSTRACT Objective: Report the successful use of stellate ganglion blocks (SGBs) in 166 active duty service members with multiple combat deployments experiencing anxiety symptoms associated with post-traumatic stress disorder (PTSD). Background: Successful treatment of PTSD symptoms with SGB has been reported previously. This is the largest published case series evaluating SGB with a minimum of 3 months follow-up. Methods: Following clinical interview including administration of the PTSD Checklist (PCL), 166 service members with symptoms of PTSD elected to receive a SGB. All patients received a SGB on the right side at the level of the sixth cervical vertebrae (C6). The PCL was administered the day before treatment to establish a baseline, repeated 1 week later, and then monthly out to 3 months. A positive response was considered to be an improvement in the PCL score by 10 or greater points. Follow-up PCL scores from 3 to 6 months were obtained and analyzed for 166 patients. Results: In a military population with multiple combat deployments, over 70% of the patients treated had a clinically significant improvement in their PCL score which persisted beyond 3 to 6 months postprocedure. Conclusion: Selective blockade of the right cervical sympathetic chain at the C6 level is a safe and minimally invasive procedure that may provide durable relief from anxiety symptoms associated with PTSD.

evidence

Cochrane Database Syst Rev. 2016 Jul 28;7:CD004598. doi: 10.1002/14651858.CD004598.pub4.

Local anaesthetic sympathetic blockade for complex regional pain syndrome.

O'Connell NE[1], Wand BM, Gibson W, Carr DB, Birklein F, Stanton TR.

Author information

1 Department of Clinical Sciences/Health Economics Research Group, Institute of Environment, Health and Societies, Brunel University, Kingston Lane, Uxbridge, Middlesex, UK, UB8 3PH.

Abstract

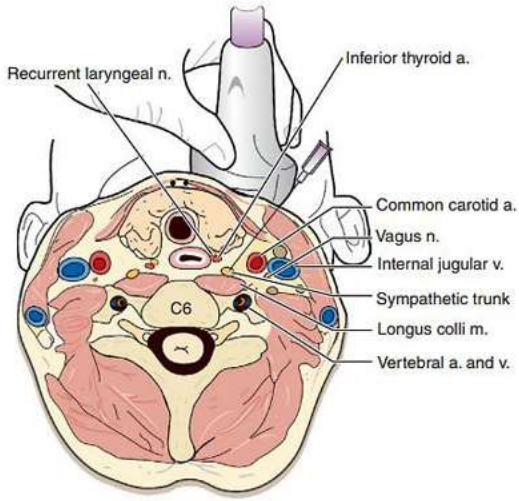
BACKGROUND: This review is an update of a previously published review in the Cochrane Database of Systematic Reviews, 2005, Issue 4 (and last updated in the Cochrane Database of Systematic Reviews, 2013 issue 8), on local anaesthetic blockade (LASB) of the sympathetic chain to treat people with complex regional pain syndrome (CRPS).

AUTHORS' CONCLUSIONS: This update's results are similar to the previous versions of this systematic review, and the main conclusions are unchanged. There remains a scarcity of published evidence and a lack of high quality evidence to support or refute the use of local anaesthetic sympathetic blockade for CRPS. From the existing evidence, it is not possible to draw firm conclusions regarding the efficacy or safety of this intervention, but the limited data available do not suggest that LASB is effective for reducing pain in CRPS.

Management of CRPS – possible causes of CRPS I

- Unknown
- Autoimmune dysfunction
- Gastrointestinal (?)

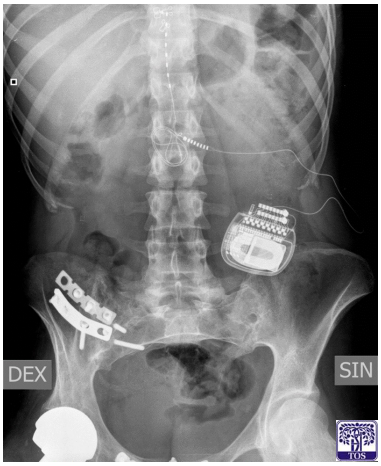
Treatment or CRPS II



A successful stellate ganglion block may result in a Horner's Syndrome on the involved side. This consists of: pupil constriction(decrease in size), hot red face, anihidrosis, red eye and drooping eyelid. The Horner's syndrome will normally dissipate in four to six hours after the block.

The stellate ganglion lies medial to the scalene muscles, lateral to the longus colli muscle, anterior to the transverse processes and prevertebral fascia, and superior to the subclavian artery and the posterior aspect of the pleura. The initial portion of the vertebral artery lies anterior to the stellate ganglion

X ray alternative or support ? Ultrasound



Point-of-Care Ultrasound for the Regional Anesthesiologist and Pain Specialist
A Series Introduction

Stephen C. Haskins, MD, Jan Boublik, MD, PhD,† and Christopher L. Wu, MD‡*

Point-of-care ultrasound (PoCUS) refers to ultrasonography that is "performed and interpreted by the clinician at the bedside."[1] Recent technological advances have allowed for the creation of small handheld ultrasound machines that produce similar or better images than laptop-sized machines made only 5 to 10 years ago. With the growing availability, portability, and affordability of ultrasound machines, many other medical specialties have started to incorporate PoCUS into their clinical practice.[2] In addition, some medical schools now provide their students with handheld ultrasound units for use during clinical rotations.[1]

In some sense, PoCUS can be thought of as the "stethoscope of the 21st century."[3] By providing

Regional Anesthesia and Pain Medicine • Volume 42, Number 3, May-June 2017

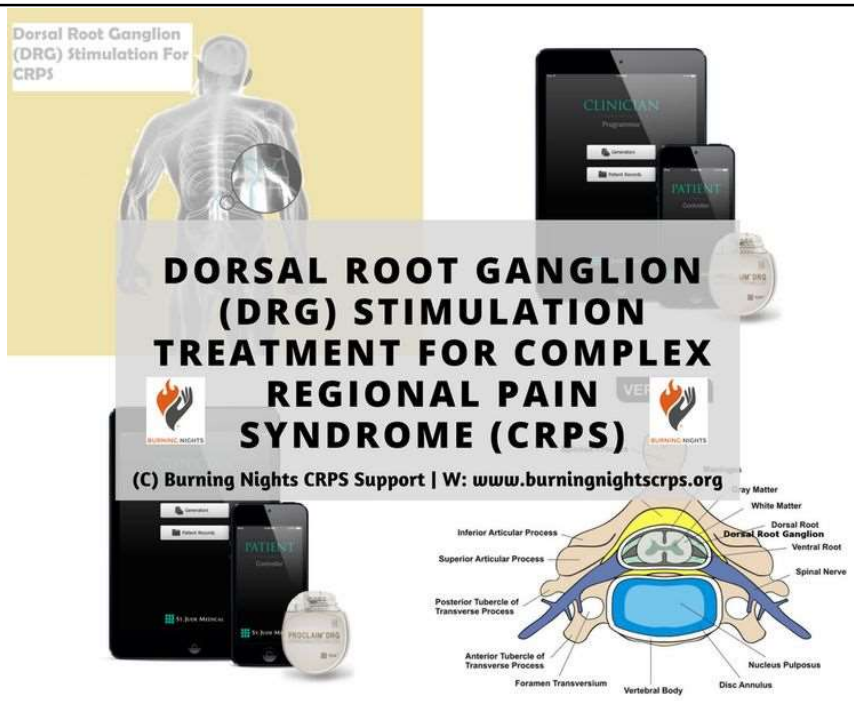


Figure 1

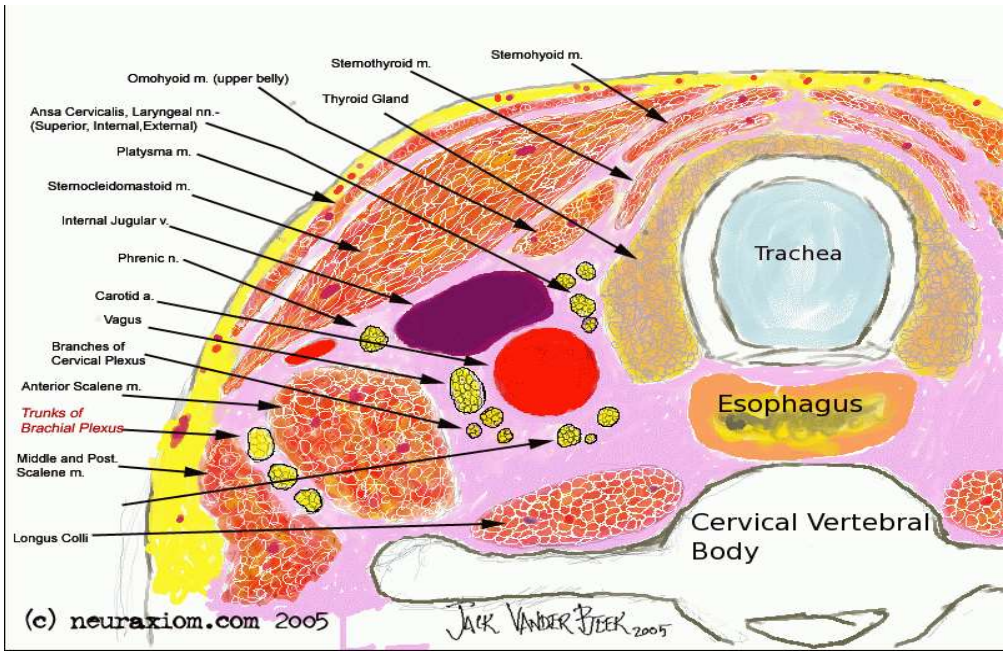
Review of Sympathetic Blocks: Anatomy, Sonoanatomy, Evidence, and Techniques

Baig, Samir; Moon, Jee Youn; Shankar, Hariharan

Regional Anesthesia and Pain Medicine. 42(3):377-391, May/June 2017.

doi: 10.1097/AAP.0000000000000591

FIGURE 1. Cross-sectional view of structures at the C6 vertebral body level. ESO indicates esophagus; Th, thyroid; C6, cervical 6 vertebral body.



A Convenient Pocket-Sized Map of the Neck as Seen with Ultrasound

Table 1

Publication	Target	Imaging	Study Design	N	Findings	Complications
Malmqvist et al[9]	SGB	None	Prospective study	54	15/54 met criteria for sympathectomy	None
Ackerman and Zhang[11]	SGB	Fluoroscopy	Prospective study	25	10/25 had complete symptom relief	None
Forouzaner et al[12]	SGB	Fluoroscopy	Retrospective study	86	40.7% noted a >50% reduction of pain, 54.7% reported no effect on pain, and 4.7% showed worsening of pain	None
Price et al[13]	SGB	None	Randomized, blind-controlled trial	4	No difference in pain reduction between SBG and placebo for CRPS	None
Milligan and Nash[14]	SGB	None	Retrospective study	77	40% SGB patients were pain-free	4 ataxia and diplopia, 1 urine retention
Erickson and Hogan[15]	SGB	CT	Case series	7	Successful block achieved in all cases	2 brachial plexus blockade 1 headache and nausea; 1 warm face, fullness in the ear, and stuffy nose; 1 shoulder, neck, and jaw soreness with facial hot flashes; 1 subpleural hemorrhage
Choi et al[16]	SGB	US	Randomized, blind-controlled trial	40	No benefit to SGB over traditional pain management	Not quantified
Kumar et al[17]	SGB	US	Randomized, double-blind, placebo-controlled trial	30	Less tramadol consumption for those with SGB	None
Kapral et al[18]	SGB	US	Prospective study	12	12/12 patients with US blocked successfully, 10/12 with landmark-based blocked successfully	3 hematomas in landmark-based group
Shibata et al[19]	SGB	US	Prospective study	11	Subfascial technique has more reliable onset, less hoarseness than suprafascial	2 subfascial injections paresthesias, 4 suprafascial injections hoarseness
Bhatia et al[20]	SGB	US	Prospective study	100	Lateral approach may confer greater safety than anterior approach	None
Siegenthaler et al[22]	SBG	US	Observational study	20	19/20 blocks were located at or near the stellate ganglion	None

REGIONAL ANESTHESIA AND PAIN MEDICINE

Review of Sympathetic Blocks: Anatomy, Sonoanatomy, Evidence, and Techniques

Baig, Samir; Moon, Jee Youn; Shankar, Hariharan

Regional Anesthesia and Pain Medicine. 42(3):377-391, May/June 2017.

doi: 10.1097/AAP.0000000000000591

TABLE 1 Selected Studies on Stellate Ganglion Block

Wolters Kluwer

complications

- pneumothorax
- bleeding
- infection
- allergic reaction
- intravascular injection and its consequences
- phrenic nerve or recurrent laryngeal nerve palsy
- hypotension
- injury to adjacent vascular structures (particularly the vertebral artery) and bradycardia

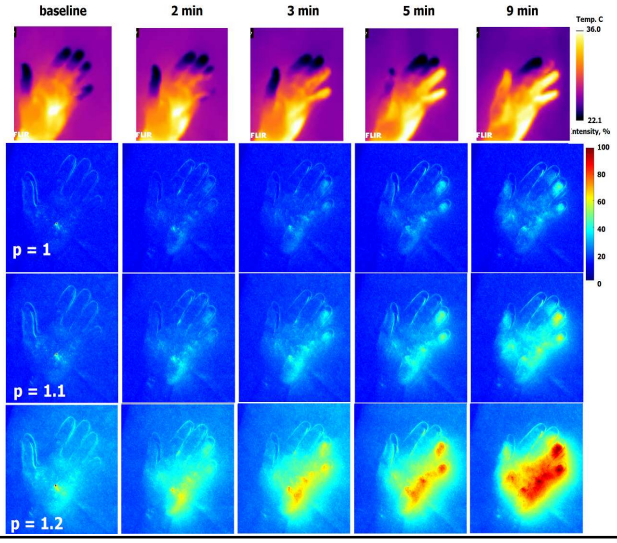
confirmation

A successful stellate ganglion block may result in a Horner's Syndrome on the involved side. This consists of: pupil constriction(decrease in size), hot red face, anihidrosis, red eye and drooping eyelid. The Horner's syndrome will normally dissipate in four to six hours after the block.

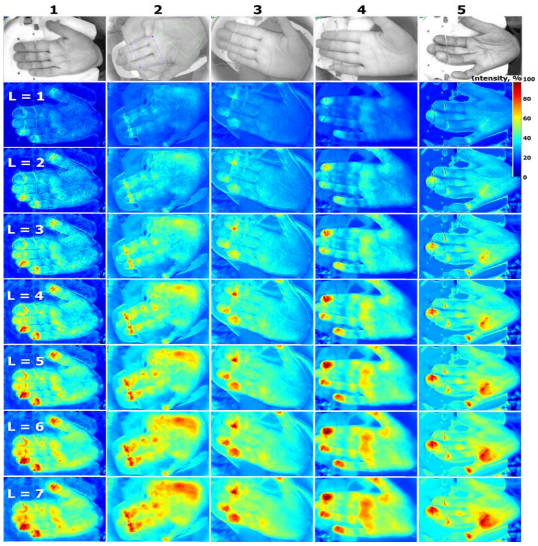
Clinical measurements and results

Contactless PPG system and armrest has been successfully tested in the Hospital of Traumatology and Orthopaedics , Riga, Latvia

thermography



photoplethysmography



Simple and convenient remote photoplethysmography system for monitoring of regional anesthesia effectiveness

U. Rubins[1], A. Miscuks[2] and M. Lange[1]

[1]University of Latvia, Institute of Atomic physics and Spectroscopy, Riga, Latvia
[2]Hospital of Traumatology and Orthopaedics, Riga, Latvia

Abstract— **Compact remote photoplethysmography device was developed, software was developed, for continuous monitoring of effectiveness of regional anesthesia using surgical lamp as light source. Data from six patients were processed and amplitude dynamics was calculated as well as amplitude maps at different time moments. Results showed that the surgical operational lamp can be successfully used for illumination of palm skin for monitoring of regional anesthesia effectiveness.**

Keywords— **Remote photoplethysmography, photoplethysmography imaging, regional anesthesia, blood flow, skin perfusion.**

in any surgical room and it is conveniently located in the room.

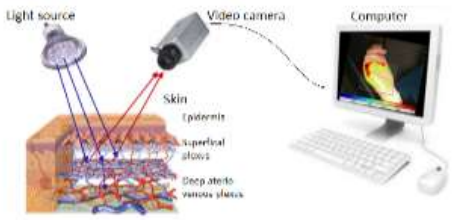


Fig. 1 The principle of rPPG technique.