



# **Cervical Sympathetic Blocks Modulation of PTSD symptoms and suicidal ideation**

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# Learning Objectives

1. **Obtain understanding of utility of Cervical Sympathetic Blocks (CSB) for treatment of PTSD and possible effect on suicidal ideation**
2. **Review the history of CSB use for PTSD .**
3. **Review Evolution of protocol CSB and PTSD**
4. **Review relevant cervical sympathetic and vascular anatomy**
5. **Review current known neuroscience of the CSB effect on PTSD**
6. **Review effect of SGB on suicidal ideation**



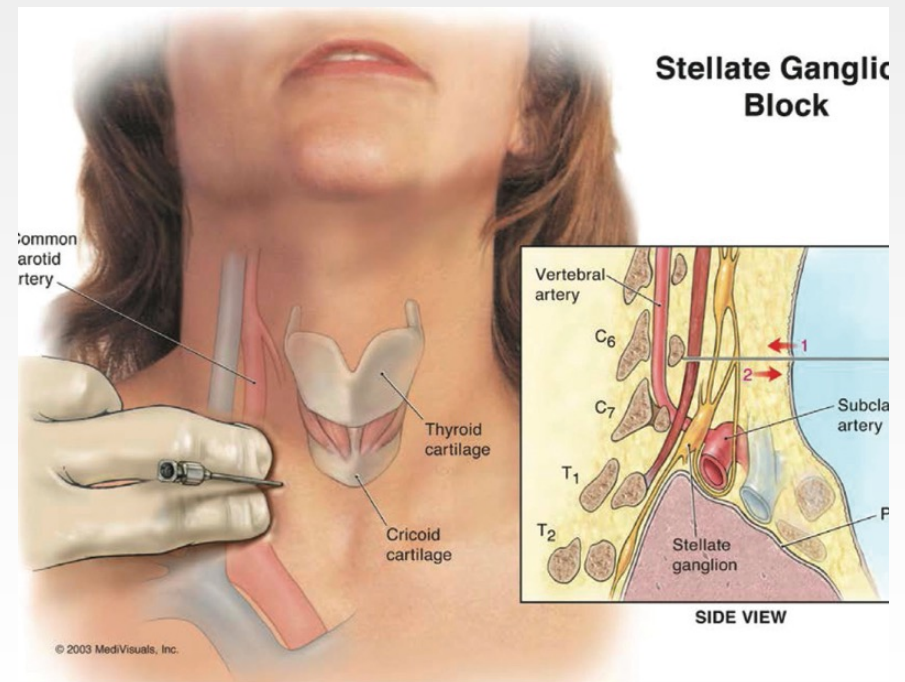
# Stellate Ganglion Block

Techniques

Blind

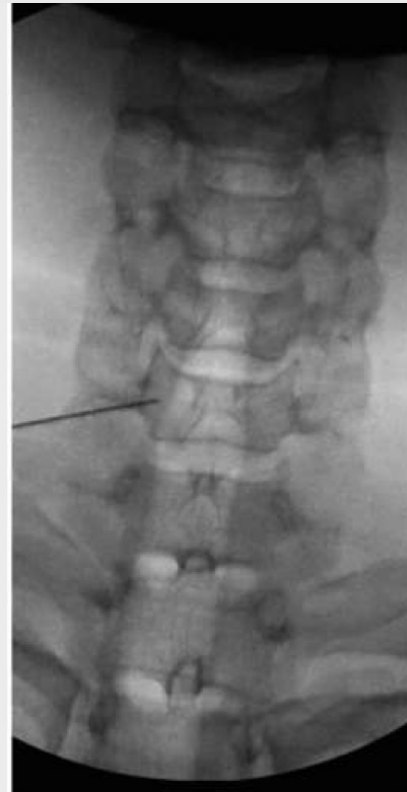
C-arm

Ultra sound





# SGB/ C-6



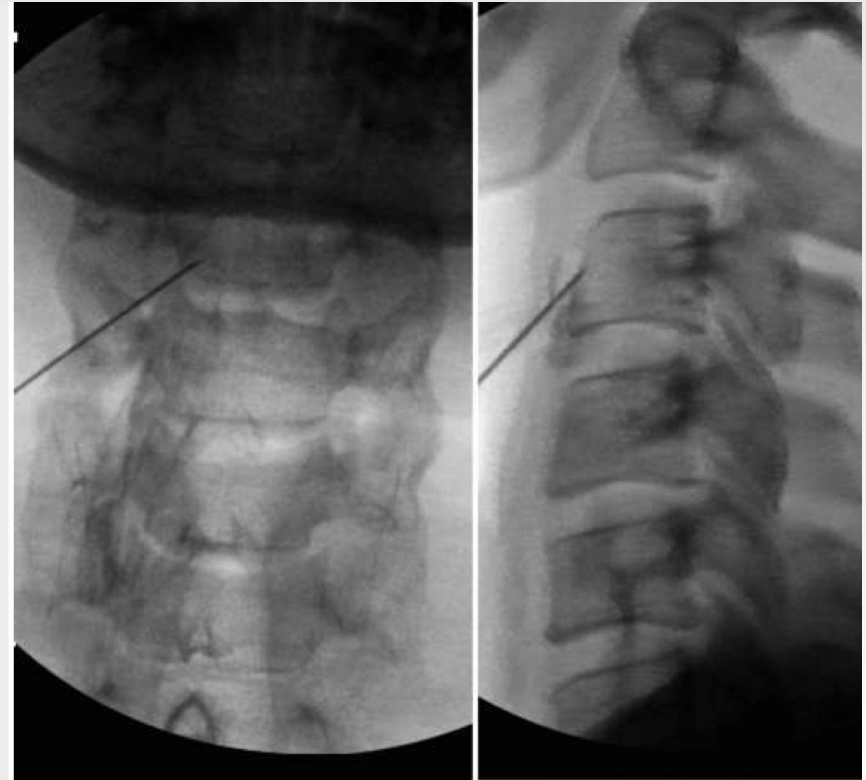
**Figure #1 A**

**Figure #1 B**

Needle placement during Stellate Ganglion Block



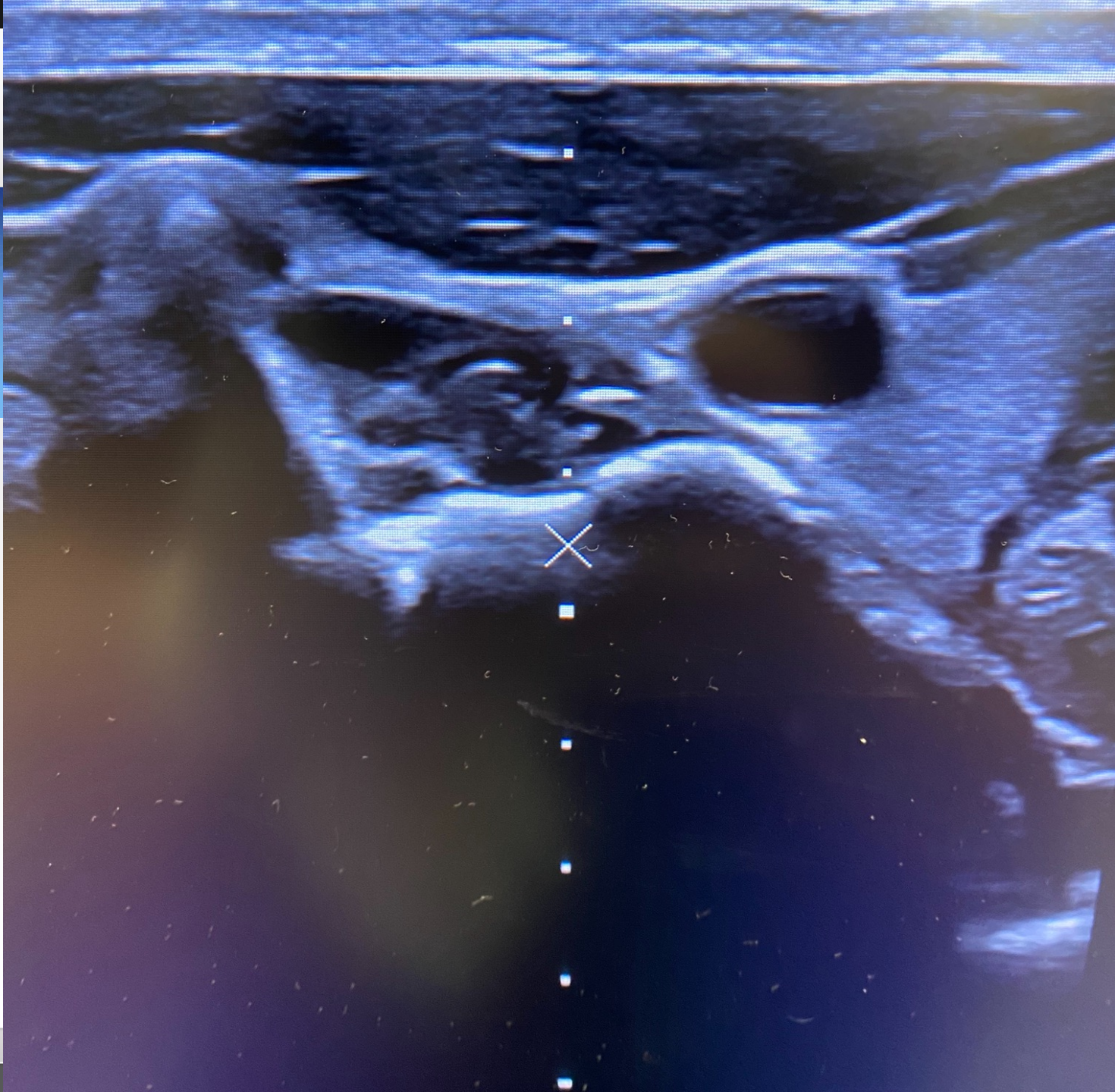
# Superior Cervical Block

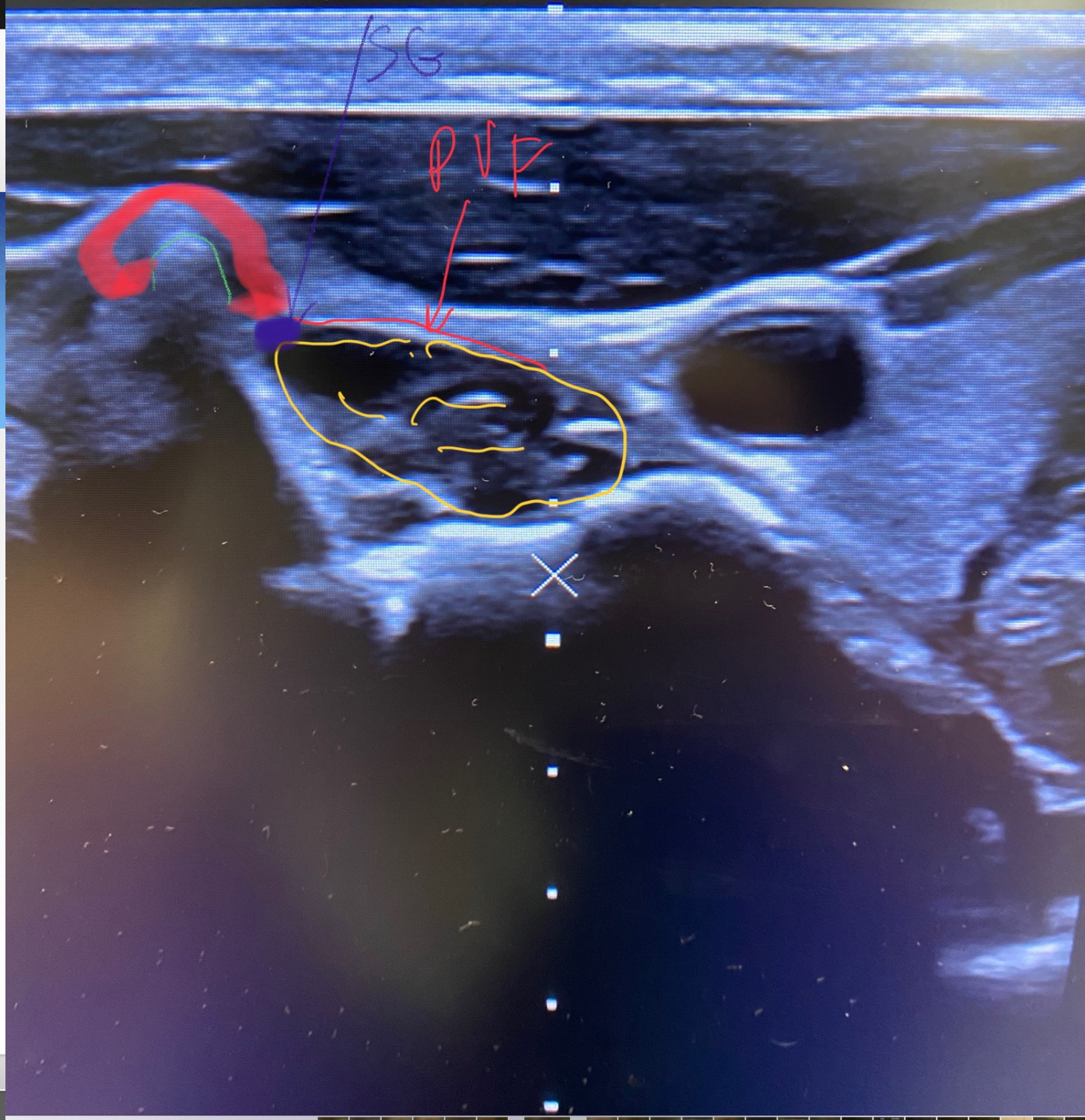


**Figure #2 A**

**Figure #2 B**

Needle placement during superior cervical sympathetic ganglion injection

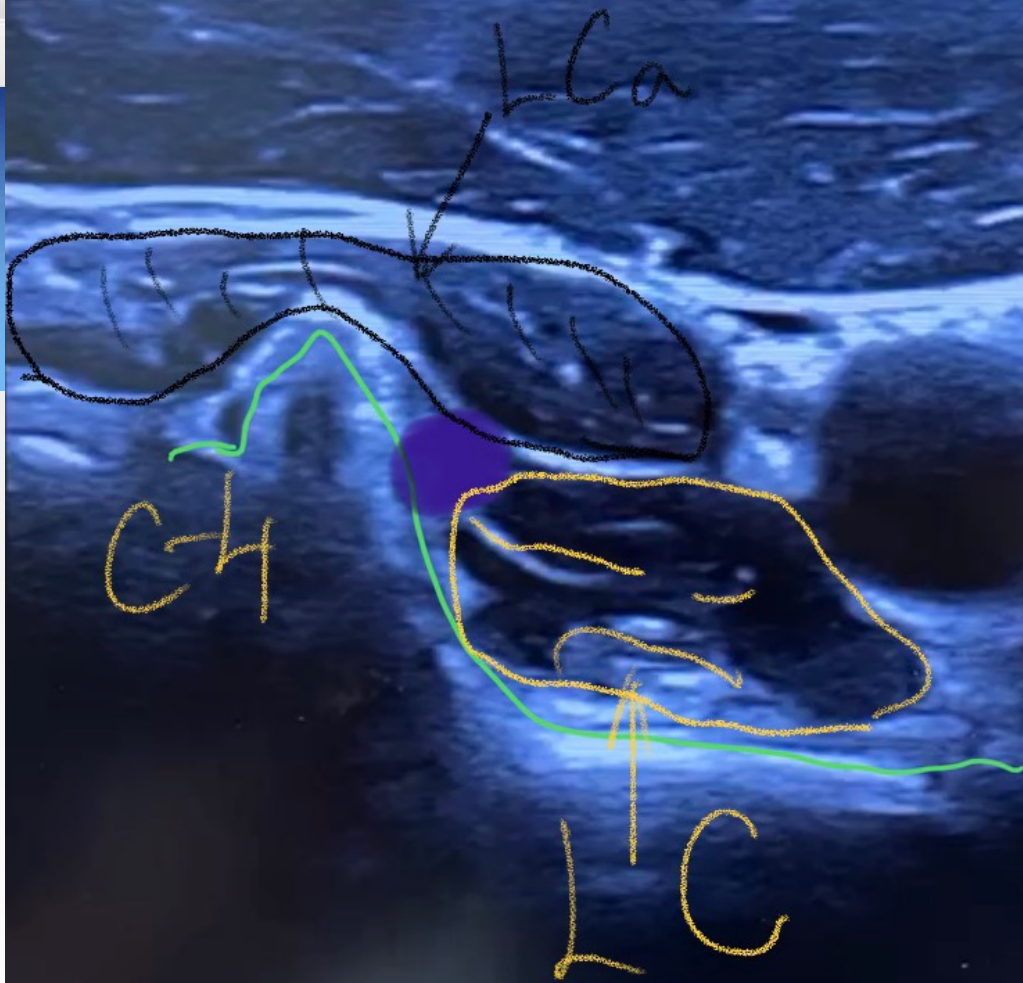






Return





Return



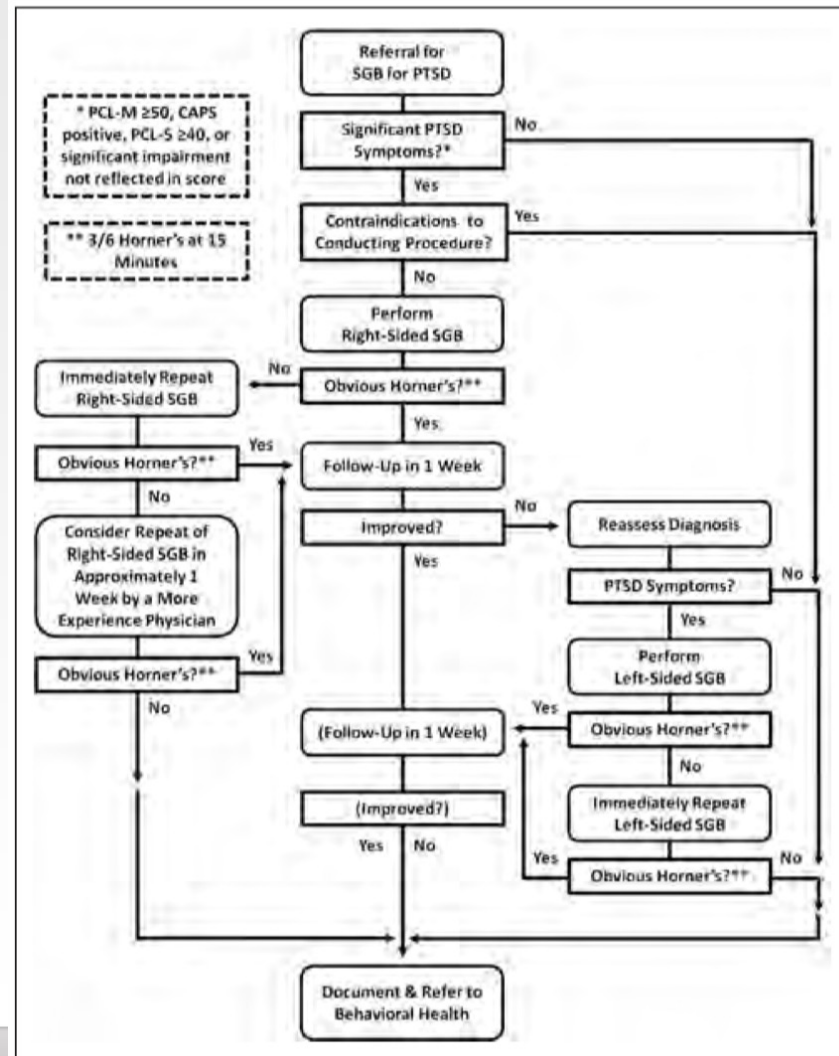
Horner's syndrome



# Systematic approach to SGB

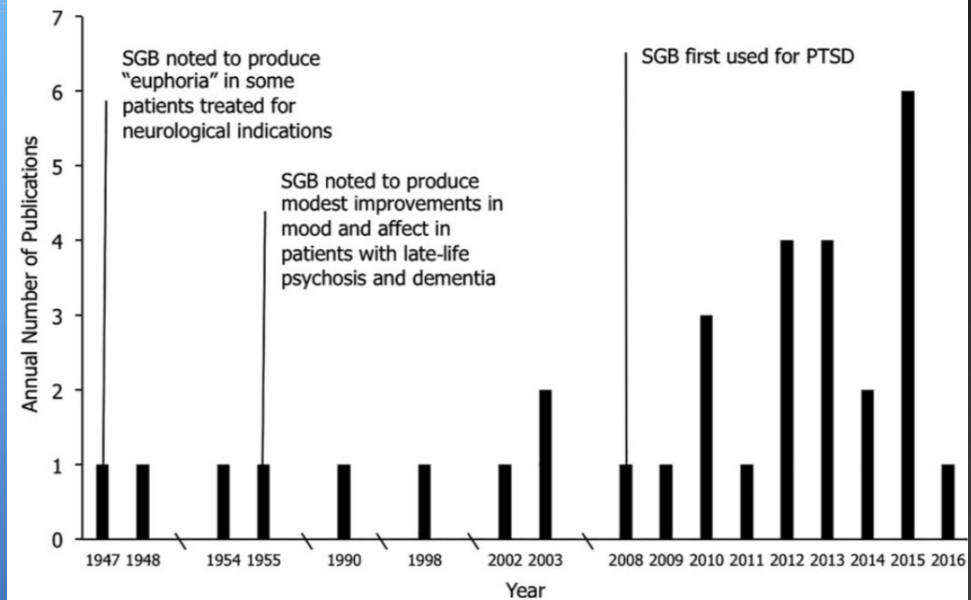
Mulvaney, Sean W., James H. Lynch, and Russ S. Kotwal. *Clinical guidelines for stellate ganglion block to treat anxiety associated with posttraumatic stress disorder*. ARMY INST OF SURGICAL RESEARCH FORT SAM HOUSTON TX, 2015

Figure 2 Flow diagram for stellate ganglion block (SGB) treatment of posttraumatic stress disorder (PTSD).





# History of SGB use to effect the brain



Summers, Mary R., and Remington L. Nevin. "Stellate Ganglion Block in the Treatment of Post-traumatic Stress Disorder: A Review of Historical and Recent Literature." *Pain Practice* 17.4 (2017): 546-553.



# Time line of SGB use for PTSD





# First report of use SGB leading to elimination of suicidal thoughts

- The patient was a 35 year old male with 8 years time in service (Army) as a truck driver. He had two deployments to Iraq 2004-2005 and 2007-2008. ... During this time the patient also reports psychological disturbance from seeing burning / dismembered bodies. .. He was admitted to the inpatient psychiatric ward 4 times between 22 MAR 2009 and 15 NOV 2010 for suicidality in the context of ETOH intoxication and PTSD symptoms. ... During the patient's final stay on the TAMC psychiatric inpatient ward, he screened 80 or 85 on his PCL-M. ... Two days post-procedure he was discharged from the ward, his PCL-M having dropped to 18, and his suicidal ideation having completely resolved. ..He was lost to follow up following the procedure ( Alino 2013)

- Alino J, Kosatka D, McLean B, et al: Efficacy of stellate ganglion block in the treatment of anxiety symptoms from combat-related post- traumatic stress disorder: a case series. Mil Med, 2013; 178: 473 -477



# JAMA Study 2019



- **Question** How does stellate ganglion block compare with sham treatment in reducing the severity of posttraumatic stress disorder symptoms over 8 weeks?
- **Findings** In this sham-controlled randomized clinical trial, 2 stellate ganglion block treatments 2 weeks apart were effective in reducing Clinician-Administered PTSD Scale for *DSM-5* total symptom severity scores over 8 weeks. The adjusted mean symptom change was  $-12.6$  points for the group receiving stellate ganglion blocks, compared with  $-6.1$  points for those receiving sham treatment, a significant difference.
- **Meaning** Stellate ganglion block treatment warrants further study as a posttraumatic stress disorder treatment adjunct.
- Olmsted, Kristine L. Rae, et al. "Effect of stellate ganglion block treatment on posttraumatic stress disorder symptoms: a randomized clinical trial." *JAMA psychiatry* 77.2 (2020): 130-138.





- **DESIGN, SETTING, AND PARTICIPANTS** This multisite, blinded, sham-procedure, randomized clinical trial used a 2:1 SGB: sham ratio and was conducted from May 2016 through March 2018 in 3 US Army Interdisciplinary Pain Management Centers. Only anesthesiologists performing the procedures and the procedure nurses were aware of the intervention
- (but not the participants or assessors); their interactions with the participants were scripted and limited to the 2 interventions. Active-duty service members on stable psychotropic medication dosages who had a PTSD Checklist–Civilian Version (PCL-C) score of 32 or more at screening were included. Key exclusion criteria included a prior SGB treatment, selected psychiatric disorders or substance use disorders, moderate or severe traumatic brain injury, or suicidal ideation in the prior 2 months.



- **RESULTS** Of 190 screened individuals, 113 (59.5%; 100 male and 13 female participants; mean [SD] age, 37.3 [6.7] years) were eligible and randomized (74 to SGB and 39 to sham treatment), and 108 (95.6% of 113) completed the study. Baseline characteristics were similar in the SGB and sham treatment groups, with mean (SD) CAPS-5 scores of 37.6 (11.2) and 39.8 (14.4), respectively (on a scale of 0-80); 91 (80.0%) met CAPS-5 PTSD criteria. In an intent-to-treat analysis, adjusted mean total symptom severity score change was  $-12.6$  points (95% CI,  $-15.5$  to  $-9.7$  points) for the group receiving SGB treatments, compared with  $-6.1$  points (95% CI,  $-9.8$  to  $-2.3$  points) for those receiving sham treatment ( $P = .01$ ).
- **CONCLUSIONS AND RELEVANCE** In this trial of active-duty service members with PTSD symptoms (at a clinical threshold and subthreshold), 2 SGB treatments 2 weeks apart were effective in reducing CAPS-5 total symptom severity scores over 8 weeks. The mild-moderate baseline level of PTSD symptom severity and short follow-up time limit the generalizability of these findings, but the study suggests that SGB merits further trials as a PTSD treatment adjunct.



# Horner's syndrome

**Is placebo possible ?????**



# Dogs/ PTSD and SGB





# **Neuroscience behind the SGB effect on PTSD**

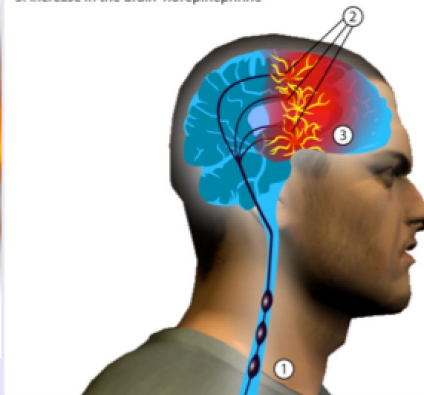


# Theoretical explanation of SGB effect on PTSD

- 1: Precipitating event, nerve trauma, PTSD triggering event
- 2: NGF increase
- 3: Retrograde transport of the NGF

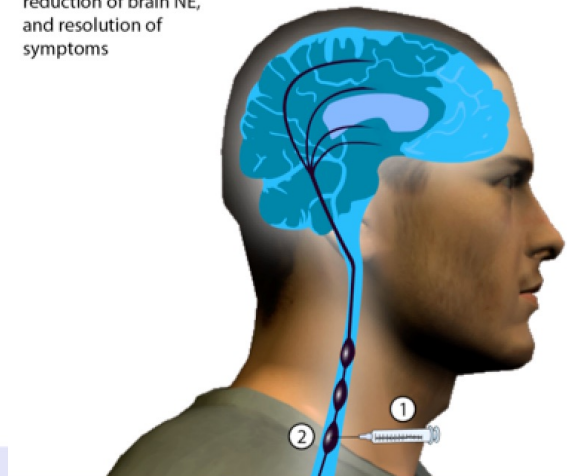


- 1: NGF increase in the Stellate Ganglion
- 2: Sprouting of the sympathetic fibers distally
- 3: Increase in the brain norepinephrine



- 1: SGB Stellate Ganglion Block

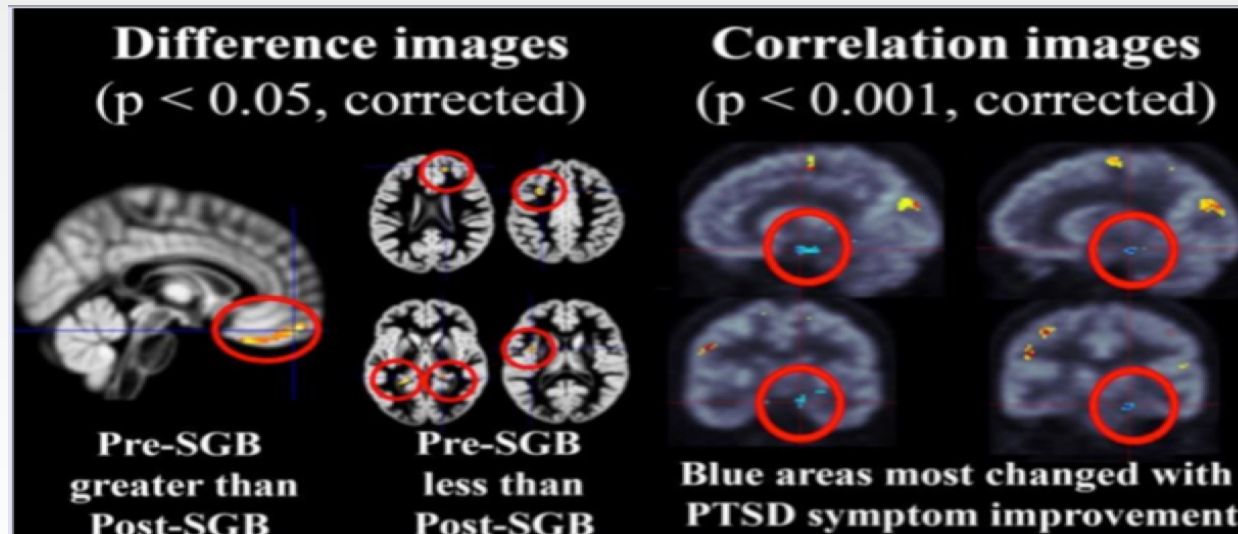
- 2: Reduction of NGF, decrease in sprouting, reduction of brain NE, and resolution of symptoms



Lipov, Eugene G., et al. "A unifying theory linking the prolonged efficacy of the stellate ganglion block for the treatment of chronic regional pain syndrome (CRPS), hot flashes, and posttraumatic stress disorder (PTSD)." *Medical hypotheses* 72.6 (2009): 657-661.



# Objective effects of SGB on PTSD



**SUMMARY:**

We found stellate ganglion block had efficacy for significantly reducing PTSD symptoms in a rapid and sustained manner that allowed functional brain glucose metabolic activity to be compared in the same subjects when they were suffering with PTSD symptoms versus when they were not. *In this small pilot study, the behavioral difference between having and not having PTSD symptoms appeared to be correlated primarily with differences in right amygdala and nearby hippocampal*



# **Stellate ganglion block and super cervical ganglion block combined**





# Patient 0 for the C6 and C3 block

The focus of this report is a 41-year Caucasian male veteran. The patient served 3 years of duty in Iraq as a marine and experienced heavy battle. The patient was familiar with our clinic due to previous treatments provided for lower back pain for this veteran. At the time of the patient's second presentation, complaints were: anxiety, night sweats, depression, claustrophobia, fear of crowds, irritability and suicidal ideation, including having a specific suicide plan.

The patient was diagnosed with PTSD at the local Veterans Administration Hospital 1 year prior. He had undergone conventional Cognitive Behavior Therapy and was placed on Modafinil 200mg QD and Viibryd (Vilazodone), a SSRI with a dose of 40mg QD, which he had minimal response.



# Continued

- Following evaluation of the patient, a recommendation for an immediate psychiatric admission to Veterans Administration Hospital was made, which was forcefully refused, The patient stated, “All I want is the injection.” At this point, another attempt was made to admit the patient to a civilian psychiatric hospital and again he adamantly refused. Being unable to admit the patient to the psychiatric hospital, an alternative plan was implemented, involving his wife who was present at the visit. The patient was asked to give up all his weapons and not drive alone until the SGB could be completed. The patient received a SGB within 2 days of the presentation with suicidal ideation.



## Continued

SGB was performed with no impact noted within 45 minutes. At this point a decision was made to enhance the efficacy of the sympathetic blockade by performing a superior cervical sympathetic ganglion injection. In the recovery room, 10 minutes following the completion of “sequential” cervical sympathetic blockade, the patient noted symptom improvement, spontaneously reporting, “I feel good and I am not thinking of suicide anymore.” In the following month, the patient was able to taper off his medication and noted feeling more alert and productive in his work, as an engineer.

The patient’s symptoms remained in remission as measured by PCL scores and his subjective experience at 6 months follow up . Following this, the patient was lost to follow up.



# Combined C6 and C4 block for PTSD

- **Objective:** Determine whether a two-level cervical sympathetic chain block may be more effective than a standard C6 level stellate ganglion block (SGB) for the treatment of posttraumatic stress disorder (PTSD).
- **Background:** A right-sided SGB has many medical publications supporting its safety and efficacy for the treatment of PTSD. However, in clinical practice, some patients do not respond to a C6 level SGB as anticipated. Currently, there are no published reports describing a two-level sympathetic block (2LSB) as a treatment modality. Thus, the purpose of this investigation is to initially assess safety and efficacy of this novel procedure as compared to the standard procedure.
- **Methods:** The PTSD Checklist (PCL-5) is routinely collected for patients prior to SGB or 2LSB for PTSD. We retrospectively evaluated baseline (T0) and 4 weeks (T1) PCL-5 scores in post-SGB/2LSB in our center.
- **Results:** One-hundred and forty-seven of 328 consecutive subjects underwent SGB (group 1) or 2LSB (group 2), in 51 females 96 males, (17 to 75 years). The mean improvement in PCL-5 scores at T1 for the SGB was 25.2 (20.40246-29.84997 CI 95%) ( $p < 0.001$ ) (N = 103) and 2LSB was 31.78 (26.05481- 37.49065 CI 95%) ( $p < 0.001$ ) (N = 44). Although the improvement was greater in group 2, there was no significant difference between group 1 and 2 at T1. There were no adverse events or complications reported in either group.
- **Conclusions:** Single SGB and 2LSB were both effective in treating PTSD. A 2LSB is safe and may be more effective than a standard SGB in the treatment of PTSD. Further research on this treatment modality is required before conclusions on the effectiveness of a 2LSB for the treatment of PTSD symptoms can be made.
- *Mulvaney SW, Curtis KE, Ibrahim TS (2020) Comparison C6 Stellate Ganglion versus C6 and C4 Cervical Sympathetic Chain Blocks for Treatment of Posttraumatic Stress Disorder (PTSD): Analysis of 147 Patients. J Neurol Disord Stroke 7(3): 1163.*

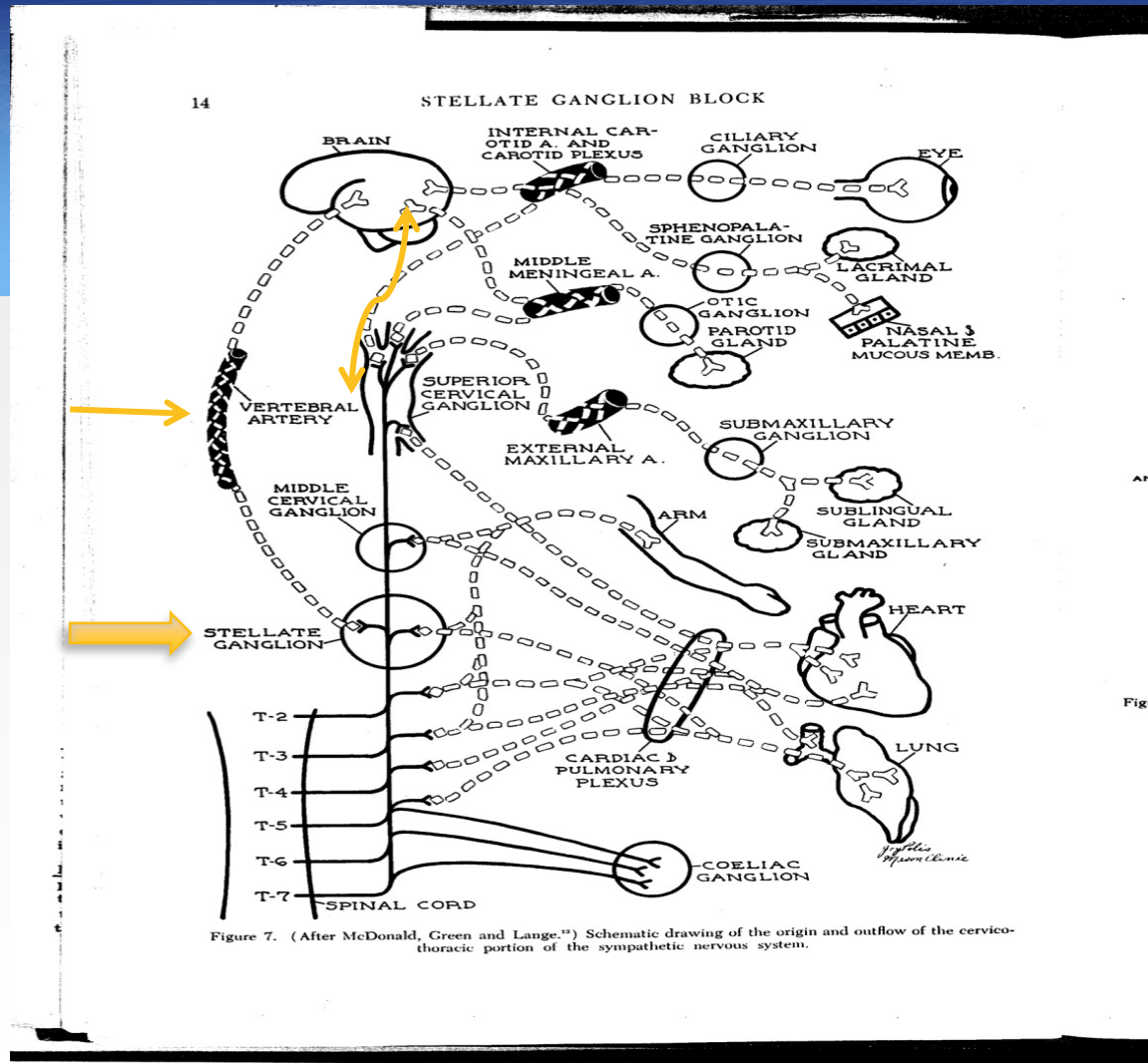


**Table 1:** PCL-5 Scores at Baseline and One Month .

	<b>Baseline</b>	<b>One Month</b>	<b><math>\Delta</math> PCL-5 Score at One Month</b>
C6 (n=103 patients)	60.9	35.7	25.2
C4-C6 (n=44 patients)	58.5	26.72	31.78

\*The difference between the change in mean scores of an SGB and 2LSB is 6.58 at one month.

# Cervical sympathetic blocks vs SGB ?





# Right side followed by Left side cervical sympathetic block

- **Results**

- Out of 205 patients, 68 did not have complete data set and were excluded, of 137 with complete data set, 20 did not respond to an RSGB and were included in the analysis. Ten of these patients subsequently received an LSGB, and 90% responded favorably (PCL-5 mean improvement = 28.3 points).

- Mulvaney, Sean W., et al. "The Successful Use of Left-sided Stellate Ganglion Block in Patients That Fail to Respond to Right-sided Stellate Ganglion Block for the Treatment of Post-traumatic Stress Disorder Symptoms: A Retrospective Analysis of 205 Patients." *Military Medicine* (2021).



## RESULTS

### **Right-Sided Stellate Ganglion Block (N = 10)**

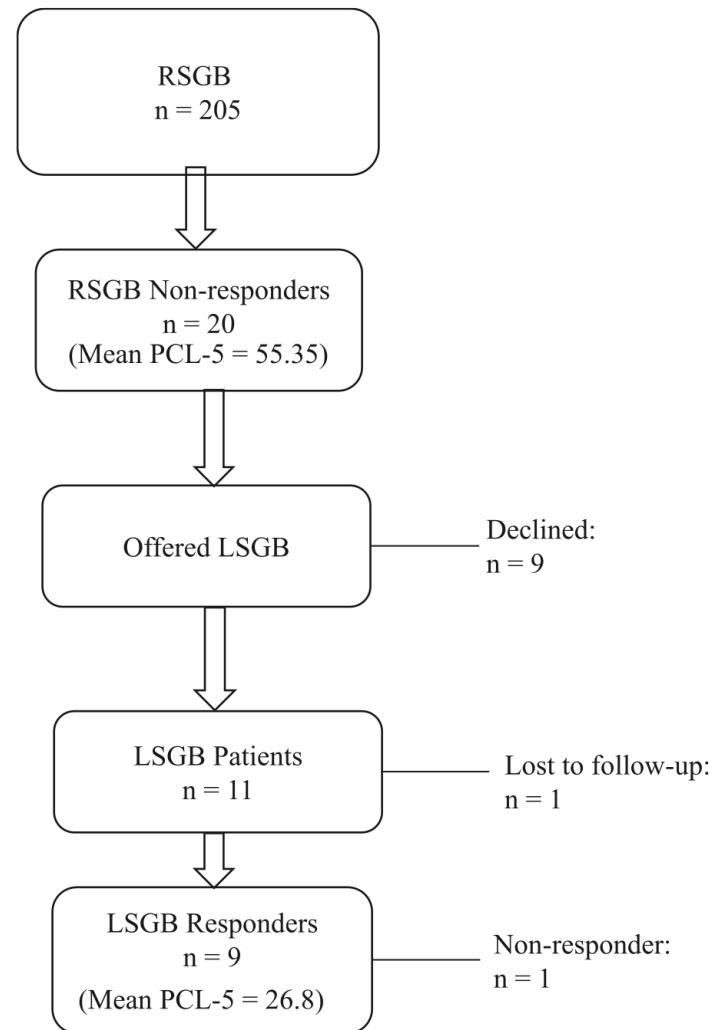
Out of 205 patients, 117 responded to an RSGB while 20 failed to respond to an RSGB. Sixty-eight patients failed to provide a PCL-5 score at 1 week and were therefore excluded from this analysis. The mean change in PCL-5 score for the 10 RSGB nonresponders from baseline to 1 week after RSGB was 6.2 (compared to 35.13 in the RSGB responder group). This slight improvement in these 10 patients is not statistically significant ( $P$ -value = .11; 95% CI: -2.00 – 13.00) and is less than the minimal clinically important difference (MCID) for this instrument.<sup>11</sup>

205 -68 ( exploded due to no PCL at F/u)

137 pt with data

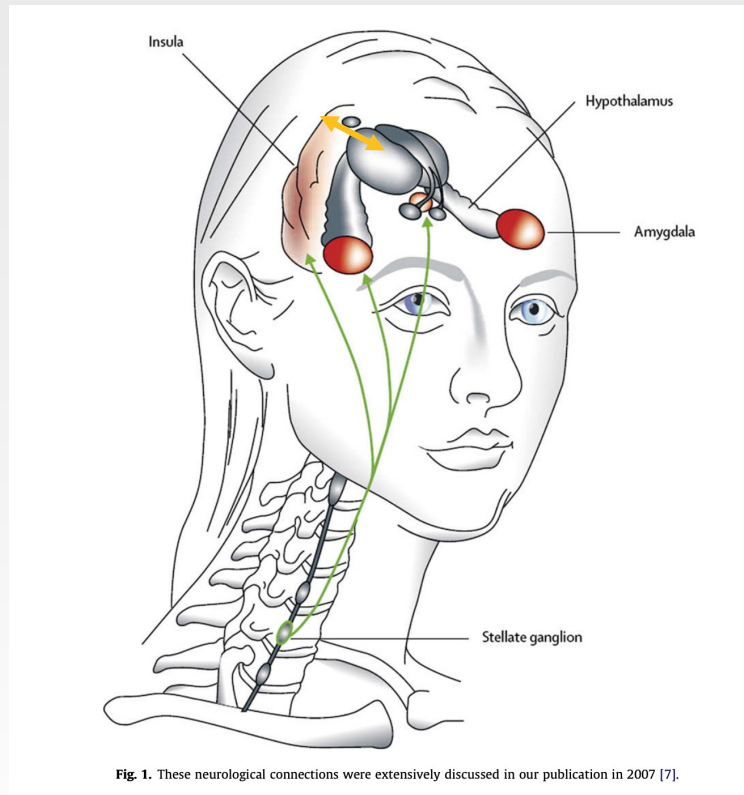
Of 137 20 failed to respond

Of 20 , 9 declined Left SGB



**FIGURE 1.** Analysis of treatment with addition of left-sided stellate ganglion block.





Lipov, Eugene G., et al. "A unifying theory linking the prolonged efficacy of the stellate ganglion block for the treatment of chronic regional pain syndrome (CRPS), hot flashes, and posttraumatic stress disorder (PTSD)." *Medical hypotheses* 72.6 (2009): 657-661.



Compared to no-trauma controls, **trauma-exposed women showed greater connectivity between the left amygdala** and the ventral anterior cingulate cortex (vACC) both during affective processing and at rest. Via fMRI

Kleshchova, Olena, et al. "Resting amygdala connectivity and basal sympathetic tone as markers of chronic hypervigilance." *Psychoneuroendocrinology* 102 (2019): 68-78.



# **Suicidal ideation**



# Norepinephrine and Suicidal ideation

- It has been suggested that alterations in NE, E, and 5-HT may have relevance for symptoms commonly seen in survivors with PTSD, including hypervigilance, exaggerated startle, irritability, impulsivity, aggression, intrusive memories, depressed mood, and suicidality(Southwick,1999)

- Southwick, S. M., et al. "Neurotransmitter alterations in PTSD: catecholamines and serotonin." Seminars in clinical neuropsychiatry. Vol. 4. No. 4. 1999.



# Insomnia and Suicidology

- “In support of a priori hypotheses, self-reported insomnia symptoms were cross-sectionally associated with suicidal ideation, even after accounting for symptoms of depression, hopelessness, PTSD diagnosis, anxiety symptoms and drug and alcohol abuse “( Ribeiro 2012) . “Although insomnia and nightmares were significantly associated with depressive and suicidal symptoms, after controlling for additional variables, such as depression and sex, only nightmares remained associated with suicidality”(Bernert 2005).

Bernert, Rebecca A., et al. "Suicidality and sleep disturbances." *SLEEP-NEW YORK THEN WESTCHESTER*- 28.9 (2005): 1135.

Ribeiro, Jessica D., et al. "Sleep problems outperform depression and hopelessness as cross-sectional and longitudinal predictors of suicidal ideation and behavior in young adults in the military." *Journal of affective disorders* 136.3 (2012): 743-750



# Impulsive behavior and suicide risk

- Impulsive behavior with or without violence increases suicide risk” (Brent 1994, Conner 2001). “These findings suggest that persons with PTSD are at higher risk for suicide and that in assessing suicide risk among persons with PTSD, careful attention should be paid to levels of impulsivity, which may increase suicide risk, and to social support, which may reduce the risk”. (Kotler 2001)

Brent DA, Johnson BA, Perper J, Connolly J, Bridge J, Bartle S, Rather C: Personality disorder, personality traits, impulsive violence, and completed suicide in adolescents. *J Am Acad Child Adolesc Psychiatry* 1994; 33:1080–1086

Conner KR, Conwell Y, Duberstein PR: The validity of proxy-based data in suicide research: a study of patients 50 years of age and older who attempted suicide, II: life events, social support and suicidal behavior. *Acta Psychiatr Scand* 2001; 104:452–457

Kotler, Moshe, et al. "Anger, impulsivity, social support, and suicide risk in patients with posttraumatic stress disorder." *The Journal of nervous and mental disease* 189.3 (2001): 162-167.



# **Future directions 1**

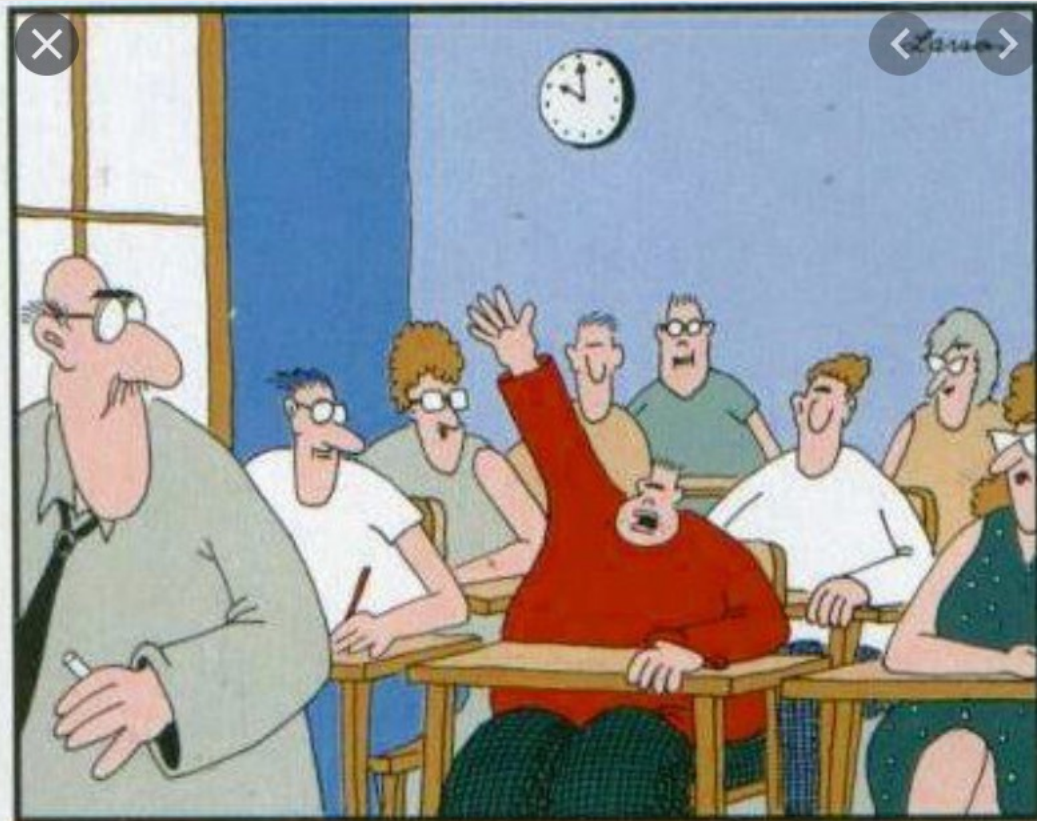
- **The next study , RTI #2 just got funded**
- **The study that should be done with fMRI , we are seeking 3,500,000 to have it done in a large medical center . To address placebo critique and determine neurobiologic changes in PTSD patients following Cervical Sympathetic Blocks**



## **Future directions 2**

- **Should we start with left sided SGB / DSI in patients that have a history of child hood abuse**
- **What is a true prevalence of secondary PTSD ? Can SGB /DSI be used to treat the whole family**





**"Mr. Osborne, may I be excused?  
My brain is full."**



# The End

Questions ?

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