

Supplemental Material

Appendix A:

Systematic Review of Complications Associated with Stellate Ganglion Nerve Block: Search Strategies

All searches were conducted on November 27, 2018.

Ovid MEDLINE

12	limit 11 to (english language and yr="1990 -Current")
11	limit 10 to yr="1990 -Current"
10	3 and 9
9	4 or 8
8	5 or 6 or 7
7	chemodenervation.ti,ab,kw.
6	neurolys?s.ti,ab,kw.
5	"block*".ab,kw,ti.
4	exp Nerve Block/
3	1 or 2
2	((cervicothoracic* or stellate or stellatum or satellite) adj3 gangli*).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
1	Stellate Ganglion/

Cochrane Library (including CENTRAL)

ID	Search
#1	MeSH descriptor: [Stellate Ganglion] explode all trees
#2	((cervicothoracic* or stellate or stellatum or satellite) near/3 gangli*)
#3	#1 or #2

#4	MeSH descriptor: [Nerve Block] explode all trees
#5	block*:ti,ab,kw
#6	neurolys?s:ti,ab,kw (Word variations have been searched)
#7	chemodenervation:ti,ab,kw
#8	#5 or #6 or #7
#9	#4 or #8
#10	#3 and #9

Embase

No.	Query
#12	#3 AND #9 AND [english]/lim AND [1990-2018]/py
#11	#3 AND #9 AND [english]/lim
#10	#3 AND #9
#9	#4 OR #8
#8	#5 OR #6 OR #7
#7	chemodenervation
#6	neurolys?s
#5	block*
#4	'nerve block'/exp
#3	#1 OR #2
#2	(cervicothoracic* OR stellate OR stellatum OR satellite) NEAR/3 gangli*
#1	'stellate ganglion'/exp

Scopus

((TITLE-ABS-KEY ((cervicothoracic* OR stellate OR stellatum OR satellite) W/3 gangli*)) AND ((TITLE-ABS-KEY (block*)) OR (TITLE-ABS-KEY (neurolys?s)) OR (TITLE-ABS-KEY (chemodenervation)))) AND PUBYEAR > 1990 AND (LIMIT-TO (LANGUAGE , "English"))

Web of Science

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# 7	(#6) AND LANGUAGE: (English) <i>Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, CCR-EXPANDED, IC Timespan=1990-2018</i>
# 6	#5 AND #1 <i>Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, CCR-EXPANDED, IC Timespan=1990-2018</i>
# 5	#4 OR #3 OR #2 <i>Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, CCR-EXPANDED, IC Timespan=1990-2018</i>
# 4	TS=chemodenervation <i>Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, CCR-EXPANDED, IC Timespan=1990-2018</i>
# 3	TS=neurolys?s <i>Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, CCR-EXPANDED, IC Timespan=1990-2018</i>
# 2	TS=block* <i>Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, CCR-EXPANDED, IC Timespan=1990-2018</i>
# 1	TS=((cervicothoracic* OR stellate OR stellatum OR satellite) NEAR/3 (gangli*)) <i>Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, CCR-EXPANDED, IC Timespan=1990-2018</i>

CINAHL

#	Query	Limiters/Expanders
S10	S1 AND S7	Limiters - Published Date: 19900101-20181231 Narrow by Language: - english Search modes - Boolean/Phrase
S9	S1 AND S7	Limiters - Published Date: 19900101-20181231 Search modes - Boolean/Phrase
S8	S1 AND S7	Search modes - Boolean/Phrase
S7	S2 OR S6	Search modes - Boolean/Phrase
S6	S3 OR S4 OR S5	Search modes - Boolean/Phrase
S5	TI chemodenervation OR AB chemodenervation	Search modes - Boolean/Phrase
S4	TI neurolys?s OR AB neurolys?s	Search modes - Boolean/Phrase
S3	TI block* OR AB block*	Search modes - Boolean/Phrase

S2	(MH "Nerve Block+")	Search modes - Boolean/Phrase
S1	(cervicothoracic* or stellate or stellatum or satellite) N3 gangli*	Search modes - Boolean/Phrase

ClinicalTrials.gov

stellate | (ganglion OR ganglia) AND (block OR blockade)

Appendix B:

Table 1: Potential list of complications associated with SGNB

Systemic Complications	Local Injury related Complications
Seizures	<i>Thyroid</i>
Spinal block (subdural or Intraspinal)	Hematoma
Hypo/hypertension	<i>Lung</i>
Allergic reactions	Pneumothorax
Injection in the wrong space	Hemothorax
Arrhythmias	<i>Nerves</i>
Autonomic imbalance	RLN injury
Death	Horner's Syndrome
	Brachial Plexus Injury
	Phrenic nerve
	Transient locked-in syndrome
	Vagal nerve
	<i>Esophagus</i>
	Perforation
	<i>Vascular structures</i>
	Dissection
	Thrombosis
	Retropharyngeal Hematoma

	<p><i>Thoracic duct</i></p> <p>Chylothorax</p> <p><i>Infections</i></p> <p>Meningitis</p> <p>Cervical abscess</p>
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Appendix C: Expanded table illustrating characteristics associated with SGNB complication cases included in the study

First Author	Year	Type 1=Landmark 2=Fluoroscopy 3=USG 4=USG and Fluoroscopy 5=Unspecified	Population	Total Number of Patients in the SGNB arm	Complications	Rates (%)	Volume of Injectate	Drug	Complications	USG Approach 1= Out of plane 2= In plane
Manchikanti ¹	1990	1	brachial plexus neuropathy	1	1	100	16	0.5% lidocaine	Bilateral Horner's Syndrome	
Stannard ²	1990	1	arm pain	1	1	100	NA	NA*	dural puncture	
Bruyns ³	1991	1	causalgia	1	1	100	10	0.5% bupivacaine	subdural block	
Watanabe ⁴	1991	1	deafness	1	1	100	5	mepivacaine	myoclonus	
Mckay ⁵	1992	5	SGNB patients	6	6	100	NA	NA	hypertension (6)	
Noda ⁶	1992	NA	sensineural deafness	1	1	100	6-8ml	0.25% bupivacaine	hemomediastinum after heparinization	
Dukes ⁷	1993	1	Raynaud's syndrome	1	1	100	2.5	0.25% bupivacaine	transient locked in syndrome	
Naveira ⁸	1993	1	RSD	2	2	100	10	0.5% bupivacaine	persistent cough	
Omote ⁹	1993	1	progressive sys sclerosis	2	2	100	6	1% lidocaine	Raynaud's on contralateral side	
Wallace ¹⁰	1993	1	post herpetic neuralgia, RSD	2	2	100	15	0.25% bupivacaine	Bilateral sympathetic block, Bilateral RLN block	
Hogan ¹¹	1994	1	SGNB patients		12	100	10-12ml	1% lidocaine	hoarseness (8), brachial plexus block (2),	

									headache (1), difficulty swallowing (1)	
Masuda ¹²	1994	1	volunteer	1	1	100	8	mepivacaine	sinus arrest	
Lehmann ¹³	1996	5	RSD	1	1	100	12	0.25% bupivacaine	migraine	
Devulder ¹⁴	1997	5	Causalgia	1	1	100	10ml	0.5% bupivacaine	reading difficulties	
Saruki ¹⁵	1997	5	shoulder and neck pain	1	1	100	6	1% mepivacaine	subdural block	
Mishio ¹⁶	1998	1	hearing loss	1	1	100	7	1% mepivacaine	hemorrhage	
Kashiwagi ¹⁷	1999	1	Bell's palsy	1	1	100	5ml	1% mepivacaine	death - airway obstruction and post tracheal hematoma ^o	
Kay ¹⁸	1999	1	SGNB patients	50	1	2	12	0.25% bupivacaine	brachial plexus block w hemi diaphragmatic paralysis	
Harano ¹⁹	2000	2	Surgical sympathetecto my	188	10	5.32	6ml	0.03% methylene blue	intrathoracic bleeding (6), hematoma (4) ^π	
Drolet ²⁰	2001	1	pain and aide healing	1	1	100	10	NA	LMA puncture	
Leong ²¹	2001	1	CRPS	1	1	100	13	0.25% bupivacaine	delayed subdural	
Vadodaria ²²	2001	1	neck pain	1	1	100	10	0.25% bupivacaine	quadriplegic	
Mahli ²³	2002	1	Raynaud's, Buerger's disease	2	2	100	5	1% lidocaine	seizure	
Okuda ²⁴	2003	1	neck shoulder pain	1	1	100	8	1% mepivacaine	hematoma	

Tuz ²⁵	2003	5	hearing loss	1	1	100	10	prilocaine	locked in syndrome	
Lake ²⁶	2004	1	shoulder pain	1	1	100	10	0.5% bupivacaine	persistent ptosis	
Masuda ²⁷	2004	1	facial pain	1	1	100	NA	NA	cervical abscess	
Saxena ²⁸	2004	1	shoulder hand pain	1	1	100	11	1.5% lidocaine	sinus arrest	
Kimura ²⁹	2005	1	SGNB patients	7	7	100	5-8ml	1% mepivacaine	hypertension	
Balaban ³⁰	2005	1	CRPS	1	1	100	12	2% prilocaine	delayed subdural	
Shimada ³¹	2005	1	Ramsay hunt syndrome	1	1	100	5	1% lidocaine	cervical spondylitis	
Gwak ³²	2006	1	Neuropathic pain syndromes	40	13	32.5	6ml	1% mepivacaine	hoarseness	
Belena ³³	2006	1	CRPS	1	1	100	8	0.375% ropivacaine	left migraine headache	
Kurimoto ³⁴	2006	5	Central retinal artery occlusion	1	1	100	NA	NA	visual hallucinations	
Peatfield ³⁵	2007	5	Head ache	1	1	100	NA	NA	severe headache for 6 weeks	
Song ³⁶	2009	1	Volunteers	20	1	5	8ml	1% lidocaine	dysphagia and dizziness	
Radhakrishnan ³⁷	2009	1	CRPS	1	1	100	NA	NA	Internal jugular venous thrombosis	
Eyigor ³⁸	2009	2	CRPS	1	1	100	5	lidocaine	grand mal seizure	
Takanami ³⁹	2009	5	facial pain	1	1	100	NA	NA	hematoma	
Corsaro ⁴⁰	2009	1	algodystrophy of upper arms	1	1	100	8-10ml	0.25% bupivacaine	Transient locked in syndrome	

Kulkarni ⁴¹	2010	1	Upper arm peripheral vascular disease	20	25	100	10ml	2% lidocaine +0.25% bupivacaine	lightheadedness (16), bradycardia (2), hematoma (1), hoarseness (6)	
Chaturvedi ⁴²	2010	1	Brachial plexus injury	1	1	100	8ml	1% lidocaine	apnea, hypotension, locked in syndrome [^]	
Atici ⁴³	2010	1	CRPS	1	1	100	6ml	0.25% bupivacaine	coughing~	
Espinar ⁴⁴	2010	3	CRPS	1	1	100	10	bupivacaine	allergic reaction	NA
Rastogi ⁴⁵	2010	3	Facial pain	1	1	100	10	0.5% bupivacaine	Seizures and cardiac arrest	2
Nabil Abbas ⁴⁶	2011	2	Post mastectomy pain	50 ^o	NA	17.5	3ml	0.25% bupivacaine	Hoarseness and lump sensation (8), cough (1), hematoma (17), brachial plexus block (9)	
Jadon ⁴⁷	2011	2	SGNB patients	9	1	100	10	1% lidocaine +depo	dyspnea	
Makharita ⁴⁸	2012	2	Fascial pain	61	13	21.3	8ml	0.125% bupivacaine π	hoarseness (3), dysphagia (9), lower limb edema (1)	
Yoo ⁴⁹	2012	1, 3	CRPS	42	2	4.7	5ml	0.5% lidocaine	hematoma (2) in the blind arm	2
Hashemi ⁵⁰	2012	3	SGNB patients	26 ^o	4	15.3	5.5ml	1% lidocaine + 0.5% bupivacaine	brachial plexus block and hoarseness (1), coughing (3)	2
Sari ⁵¹	2012	5	CRPS	1	1	100	NA	NA	respiratory arrest	
Amhaz ⁵²	2013	1	Raynaud's	1	1	100	3ml	1% lidocaine	contralateral Horner's	

Kim ⁵³	2013	2	CRPS	1	1	100	3	0.25% bupivacaine	difficulty breathing	
Shankar ⁵⁴	2013	3	CRPS	1	1	100	10	1% lidocaine+ 0.25% bupivacaine	transient neuro injury	1,2
Othman ⁵⁵	2014	1	Breast cancer survivors	20	2	10	10ml	0.5% bupivacaine	Blood shot conjunctive (1), hoarseness (1)	
Kim ⁵⁶	2015	3	SGNB patients	35	3	100	5ml	1% lidocaine	dyspnea (2), hoarseness (1)	2
Park ⁵⁷	2015	3	Herpes zoster	1	1	100	4ml	1% mepivacaine	Transient global amnesia	NA
Uchida ⁵⁸	2015	5	pain lower lip	1	1	100	NA	NA	venous hematoma	
Ghai ⁵⁹	2016	3	Upper extremity pain	20	3	15	6ml	0.25% bupivacaine	hoarseness of voice	2
Hanling ⁶⁰	2016	3	PTSD	27	NA	13	5ml	0.5% ropivacaine	ptosis, dyspnea, increased anger/aggression, sore throat	2
Fujiwara ⁶¹	2016	3	left facial paralysis	1	1	100	2	1% mepivacaine	arterial puncture-seizures	NA
Datta ⁶²	2017	3	CRPS	208†	33	15.8	6ml	0.3% bupivacaine + dexamethasone	hoarseness/dysphagia (18), arm numbness (1), hematoma (11), pneumothorax (1), contralateral Horner's (1)	1
Kim ⁶³	2017	3	SGNB patients	51	11	21.5	5ml	0.5% mepivacaine	dizziness (4), hoarseness (7)	2
Karaman ⁶⁴	2017	1,2	SGNB patients	420	22	5.2	NA	NA	blood aspiration (blind n=12, fluoroscopy n=8) and	

									Pneumothorax (n= 2 in the blind group)	
Shaaban ⁶⁵	2018	2,3	Neuropathic pain syndromes	40	3	7.5	3ml	2% lidocaine	hematoma (2), hoarseness (1) both in fluoroscopy arm	1
Abbas ⁶⁶	2018	3	Post mastectomy pain	80	2	2.5	0.75ml	2% lidocaine	ptosis (2)	1
Vinod ⁶⁷	2018	4	SGNB patients	10	3	30	4ml	0.25% bupivacaine	hoarseness/ dysphagia	2

Table of SGNB associated complications with additional features included in the systematic review. NA- Not available, SGNB- stellate ganglion nerve block, RSD- reflux sympathetic dystrophy, RLN- recurrent laryngeal nerve, LMA- laryngeal mask airway, CRPS- complex regional pain syndrome.

Foot notes legends: * Drug not injected due to CSF aspiration. ° Negative aspiration test reported. ∞ None required surgical intervention. ^ Symptoms developed after injection of 2ml of injectate and blood tinge was noted. ~ Multiple episodes of SGNB performed in the same patient. † A total of 334 SGNB performed in the study. ø 200 SGNB performed in the study. © 101 SGNB procedures performed in the study. ∏ 31 patients received saline.

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Appendix D: Complications associated with SGNB from registered randomized controlled clinical trials

First Author	Year	Type 1=Landmark 2=Fluoroscopy 3=USG 4=USG and Fluoroscopy 5= Unspecified	Population	Total Number of Patients in the SGNB arm	Complications	Rates (%)	Volume of Injectate	Drug	Complications^β
Bonelli ¹	1983	5	CRPS	10	NA		15ml	0.5% bupivacaine	
Harding ²	1986	1	Herpes Zoster ophthalmicus	15	7	46.67	9.5ml	1% lidocaine + 0.5% marcaine	Bloody tap (2), brachial block (1), nystagmus (1), hoarseness (5)
Glynn ³	1993	1	Reflux sympathetic dystrophy	6	NA		NA	Bupivacaine	
Kapral ⁴	1995	1,3	Reflux sympathetic dystrophy	12	1	8.33	5-8ml [#]	0.25% bupivacaine	5ml in ultra sound arm and 8 ml in blind, RLN palsy
Ikeda ⁵	1996	1	Volunteers	20	0	0	7ml	1% mepivacaine	
Inada ⁶	1997	1	SGNB patients	30	0	0	6ml	1% mepivacaine	
Otake ^{7*}	1998	5	CRPS	33	NA		6ml	1% mepivacaine	
Price ⁸	1998	1	CRPS	7	NA		15ml	1% lidocaine	
Fujino ⁹	1999	1	Sensineural hearing loss	10	NA		5ml	1% lidocaine	
Sugimoto ¹⁰	1999	1	Volunteers	9	NA		6ml	1% lidocaine	

Yokoyama ¹¹	2000	1	Volunteers	10	NA		7ml	1% lidocaine	
Arai ¹²	2004	1	Knee arthroscopy	10	0	0	10ml	1% lidocaine	
Donmez ¹³	2005	1	Bypass surgery	19	NA		15ml	0.5% bupivacaine	
Yildirim ¹⁴	2006	1	AV fistula surgery	25	NA		6ml	1% mepivacaine	
Nishiyama ¹⁵	2006	5	Post herpetic neuralgia and deafness	15	NA		6ml	1% mepivacaine	
Yildirim ¹⁶	2007	1	Bypass surgery	50	NA		10ml	0.5% ropivacaine	
Salvaggio ¹⁷	2008	5	Facial Pain	25	NA		10ml	Levobupivacaine	
Lipov ¹⁸	2008	2	Breast cancer survivors	13	0	0	7ml	0.5% bupivacaine	
Goebel ¹⁹	2008	1	Chronic upper body pain syndromes	18	0	0	5ml	Buprenorphine	
Song ²⁰	2009	1	Volunteers	20	1	5	8ml	1% lidocaine	dysphagia and dizziness
Nabil Abbas ²¹	2011	2	Post mastectomy pain	50 [^]	NA	17.50	3ml	0.25% bupivacaine	Hoarseness and lump sensation (8), cough (1), hematoma (17), brachial plexus block (9)
Makharita ²²	2012	2	Fascial pain	61 ^α		13	21.31	8ml 0.125% bupivacaine	hoarseness (3), dysphagia (9), lower limb edema (1)

Liu ²³	2013	1	Severe trauma victims	15	NA		8ml	0.75% ropivacaine		
Othman ²⁴	2014	1	Breast cancer survivors	20		2	10	10ml	0.5% bupivacaine	Blood shot conjunctive (1), hoarseness (1)
Liu ²⁵	2014	1	Bell's palsy	48		0	0	10ml	1% lidocaine	
Guo ²⁶	2014	5	Esophageal cancer	20	NA			NA	1% lidocaine	
Kumar ²⁷	2014	3	Upper extremity orthopedic surgery	30 ^{\$}	NA			3ml	2% lidocaine	
Walega ²⁸	2014	2	Postmenopausal women	20		0	0	5ml	0.5% bupivacaine	
Guo ²⁹	2014	5	Esophageal surgery	15	NA			NA	1% lidocaine	
Yeo ³⁰	2015	3	Volunteers	10	NA			7ml	1% lidocaine	
Chen ³¹	2015	1	Elective surgery under general anesthesia	80	NA			10ml	1% lidocaine	
Choi ³²	2015	3	Shoulder surgery	20		0	0	4ml	0.375% Levobupivacaine	
Park ³³	2015	3	Breast cancer related lymphedema	32		0	0	4-5 ml	0.5% bupivacaine	
Maki ³⁴	2016	2	Postmenopausal women	40		0	0	5ml	0.5% bupivacaine	
Chen ³⁵	2016	3	Laparoscopic cholecystectomy	40	NA			7ml	1% lidocaine	

Hanling ³⁶	2016	3	PTSD	27	NA	13	5ml	0.5% ropivacaine	ptosis, dyspnea, increased anger/aggression, sore throat
Leftheriotis ³⁷	2016	1	Atrial fibrillation	36	0	0	8ml	1% lidocaine	
Peng ³⁸	2017	3	Thoracolumbar surgery	20	0	0	6ml	1% lidocaine	
Chen ³⁹	2017	1	laparoscopic cholecystectomy	30	0	0	7ml	1% lidocaine	
Kim ⁴⁰	2017	3	SGNB patients	51	11	21.57	5ml	0.5% mepivacaine	dizziness (4), hoarseness (7)

Supplemental Table 1: Complications reported from registered randomized clinical trials (Cochrane Controlled Register of Trials- CENTRAL) evaluating SGNB. Abbreviations: SGNB- stellate ganglion nerve block, ml-milliliters, PTSD- Post traumatic stress disorder, USG- ultrasound guidance, CRPS- complex regional pain syndrome, RLN- recurrent laryngeal nerve.

Footnote Legends: * SGNB number not specified. # 5ml in ultra sound arm and 8 ml in blind arm, \$ 15 received saline injection, ^200 SGNB performed, α 31 received saline, β frequency in parenthesis when reported in the manuscript.

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Appendix E. Articles describing complications associated with SGNB published between 1950-1989

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