

Stingers That Don't Get Better

Chris Warrell, MD
Orthopaedic Sports Medicine
Orlando Orthopaedic Center
February 3, 2018





Official Collegiate Team of OOC!

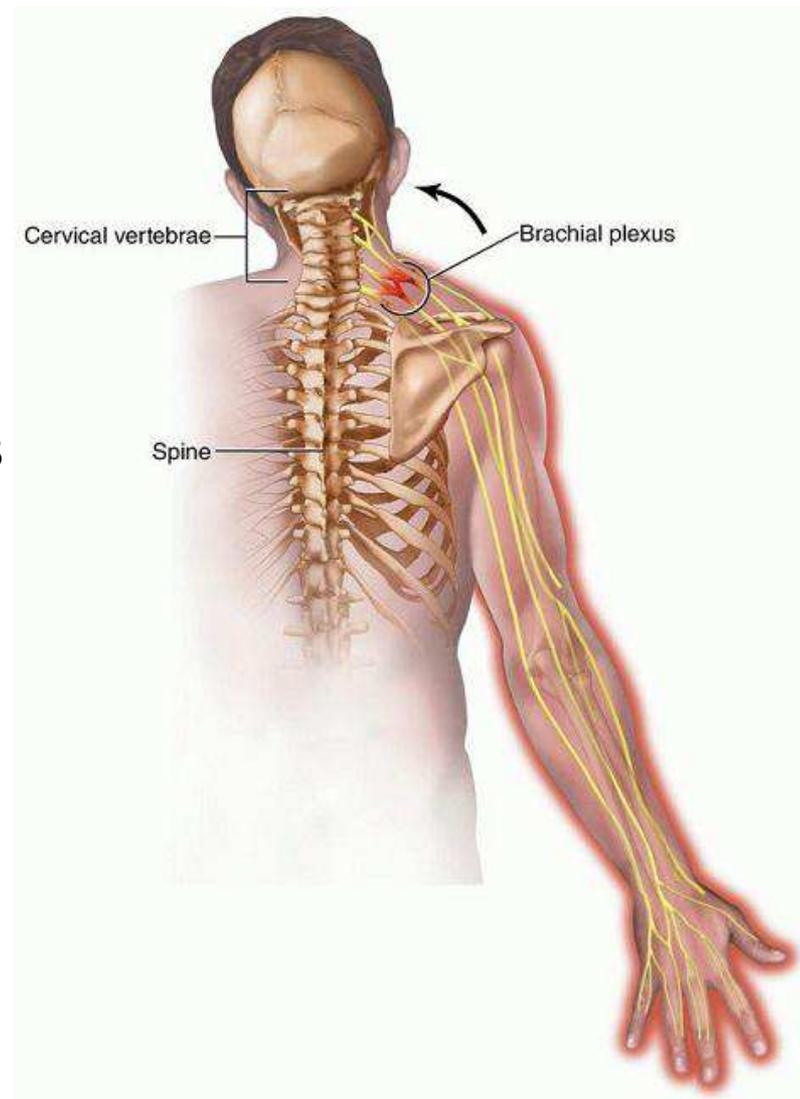




Stingers That Don't Get Better

Outline

- **When to be concerned**
- **Evaluation and work-up**
 - **Imaging**
 - **Electrodiagnostic studies**
- **Treatment**
- **Rehabilitation**
- **Return to Play**
- **When to disqualify / retire**
- **Controversies**

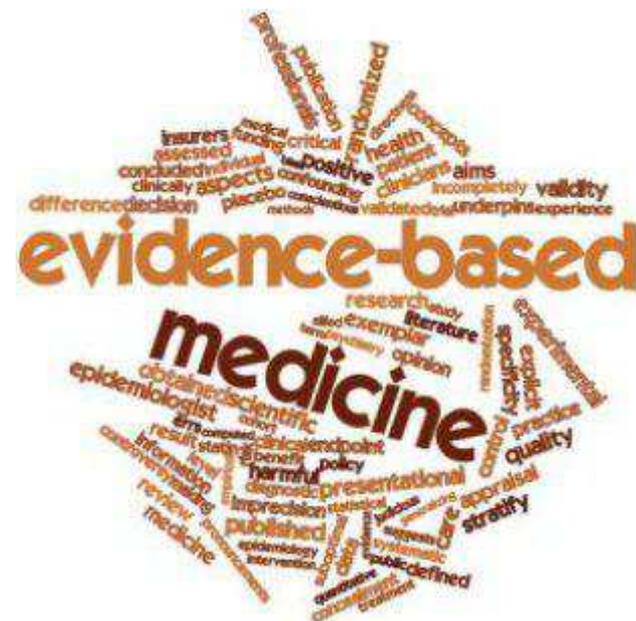




Stingers That Don't Get Better

Outline

- When to be concerned
- Evaluation and work-up
 - Imaging
 - Electrodiagnostic studies
- Treatment
- Rehabilitation
- Return to Play
- When to disqualify / retire
- **Controversies**
 - **Very little high level evidence**





Stingers That Don't Get Better

When To Be Concerned

- *Symptoms lasting > 48hrs*
- Anything indicating a higher lesion
 - Persistent neck pain, bilateral symptoms, loss of neck ROM, lower extremity symptoms
- Two or more stingers in a season

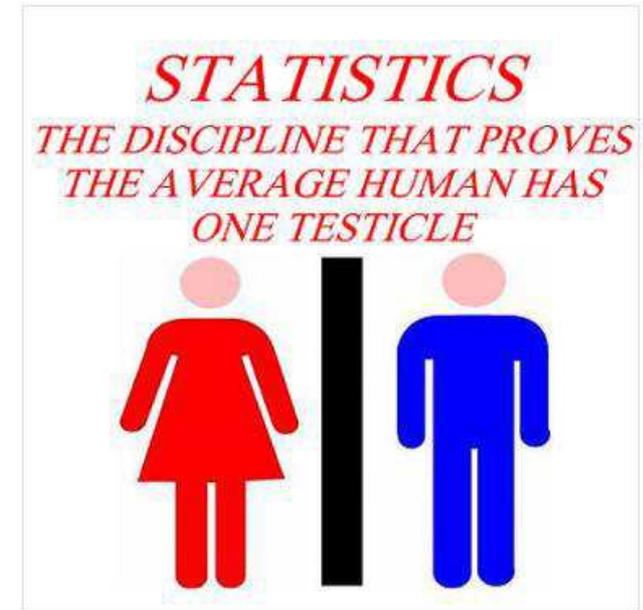




Stingers That Don't Get Better

Epidemiology

- Only 5-10% stingers persist more than a few hours
- Brachial plexus injuries and anatomic anomalies more common in younger (high school) athletes
- Cervical spine level injuries (esp. disc herniation) more common in collegiate/pro athletes

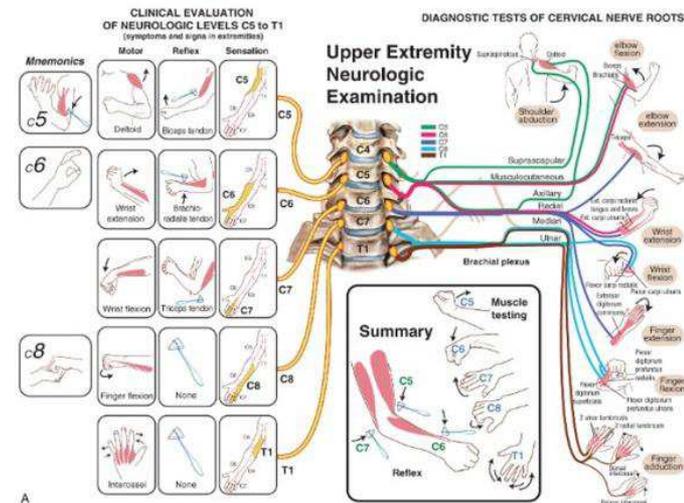




Stingers That Don't Get Better

Evaluation

- As discussed by Dr. McCleary
- **Serial examinations**
 - Time of injury
 - After game
 - 24 – 48 hours later
 - *Decision point for imaging*
 - Repeatedly over first 2 weeks
 - *Decision point for EMG/NCV*





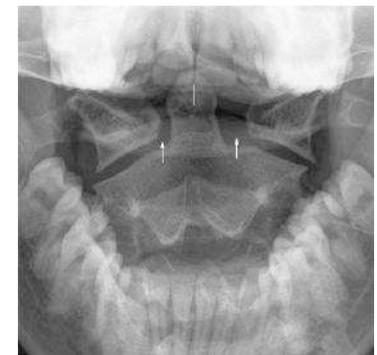
Stingers That Don't Get Better

Imaging

- **Plain radiographs**
 - AP, lateral, flexion, extension, open mouth odontoid
 - Cervical spine pathology
 - Anomalies
 - Fractures
 - Instability
 - *If index of suspicion is high enough to get xrays, get advanced imaging*



Klippel-Feil Anomaly in 16 yo



Acheson M, Livingston R, Richardson M, et al.: High-resolution CT scanning in the evaluation of cervical spine fractures: comparison with plain film examinations. AJR Am J Roentgenol. 148 (6):1179-1185 1987

Nunez D, Zuluaga A, Fuentes-Bernardo D, et al.: Cervical spine trauma: how much more do we learn by routinely using helical CT? Radiographics. 16:1307-1318 1996

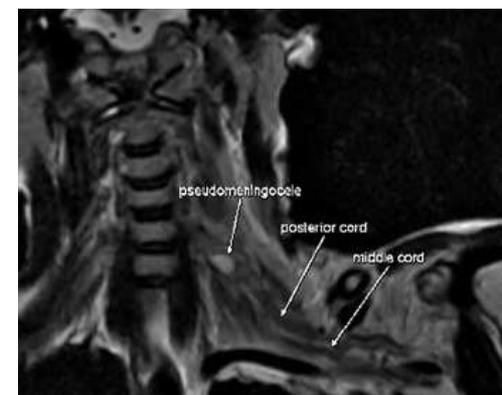
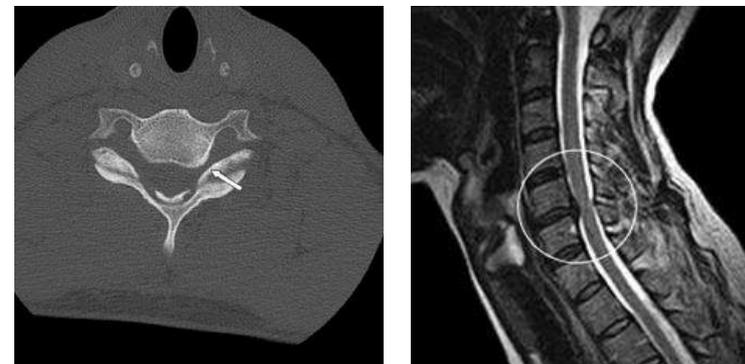
Bailitz J, Starr F, Beecroft M, et al.: CT should replace three-view radiographs as the initial screening test in patients at high, moderate, and low risk for blunt cervical spine injury: a prospective comparison. J Trauma. 66 (6):1605-1609 2009



Stingers That Don't Get Better

Imaging

- **Advanced imaging**
 - **MRI c-spine vs. CT myelogram**
 - **Disc herniation**
 - **Foraminal narrowing**
 - **Nerve root injury**
 - **Spinal canal stenosis**
 - **MRI brachial plexus**



Acheson M, Livingston R, Richardson M, et al.: High-resolution CT scanning in the evaluation of cervical spine fractures: comparison with plain film examinations. *AJR Am J Roentgenol.* 148 (6):1179-1185 1987

Nunez D, Zuluaga A, Fuentes-Bernardo D, et al.: Cervical spine trauma: how much more do we learn by routinely using helical CT? *Radiographics.* 16:1307-1318 1996

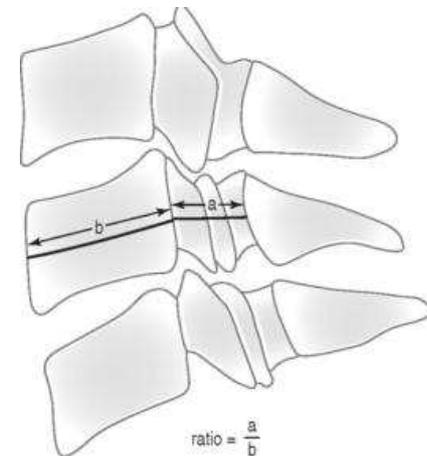
Bailitz J, Starr F, Beecroft M, et al.: CT should replace three-view radiographs as the initial screening test in patients at high, moderate, and low risk for blunt cervical spine injury: a prospective comparison. *J Trauma.* 66 (6):1605-1609 2009



Stingers That Don't Get Better

Imaging

- **Torg/Pavlov Ratio**
 - **Ratio of canal width to vertebral body width**
 - **Should be >1.0**
 - **<0.8 associated with increased risk (3-4x) of transient neurologic injury in contact athletes**

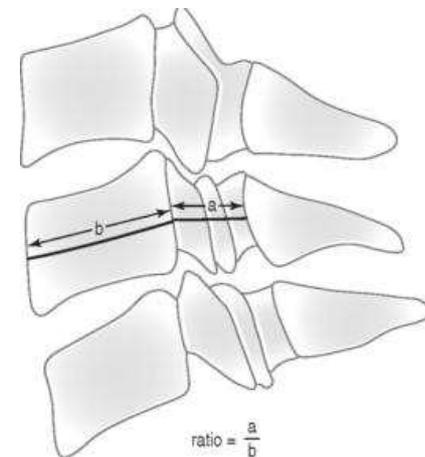




Stingers That Don't Get Better

Imaging

- **Torg/Pavlov Ratio**
 - **Not predictive of single stinger (PPV 22%)**
 - **Poor for screening**
 - **Significant risk factor for *repetitive stingers***

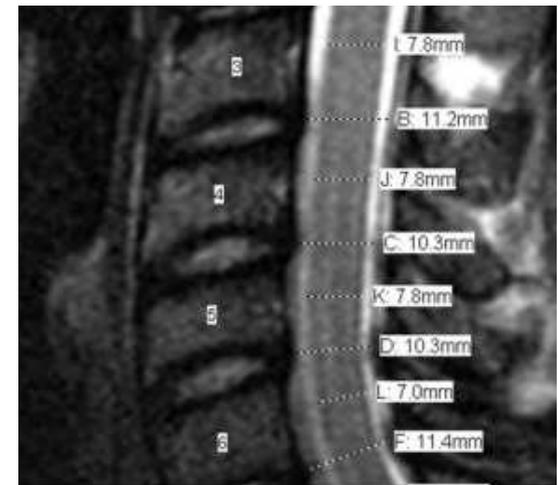




Stingers That Don't Get Better

Imaging

- **Mean Subaxial Cervical Space Available for the Cord (MSCSAC) Index**
 - **<5.0mm has 80% PPV for predicting chronic stingers**
 - **<4.3mm has 96% PPV (13x more likely)**



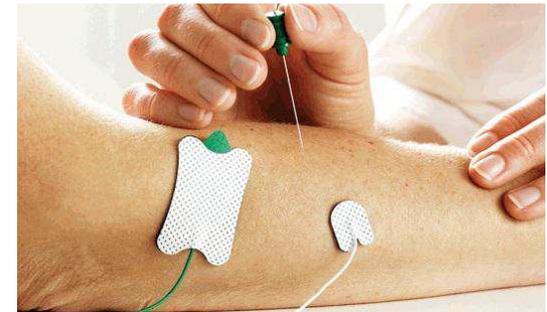
	Diameter, mm		
Level	Canal	Cord	Difference, Δ
C3	11.2	7.8	3.4
C4	10.3	7.8	2.5
C5	10.3	7.8	2.5
C6	11.4	7.0	4.4
Average			3.2



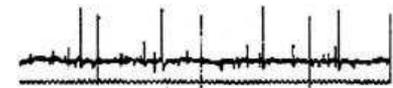
Stingers That Don't Get Better

Electrodiagnostic Studies

- Electromyography (EMG) and Nerve conduction studies
- Obtain **3-5 weeks** after injury
 - Maximal evidence of muscle denervation
 - Follows Wallerian (distal) degeneration of the nerve



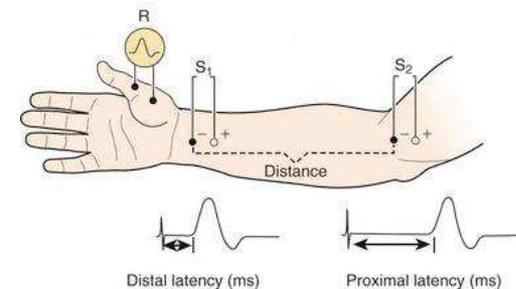
Fibrillation Potentials



Positive Sharp Waves



$$\frac{\text{Distance (cm)}}{\text{Proxi. lat.} - \text{Dist. lat. (ms)}} = \text{CV (m/s)}$$





Stingers That Don't Get Better

Electrodiagnostic Studies

- Can help determine **severity** of the injury

Grade	Nerve Injury	Electromyographic Findings	Prognosis
1	Neurapraxia	Normal	Most resolve within minutes
2	Axonotmesis	Positive waves with fibrillation	Recovery in 12-18 months
3	Neurotmesis	Acute denervation	Variable; possible complete loss of function

Fibrillation Potentials



Positive Sharp Waves

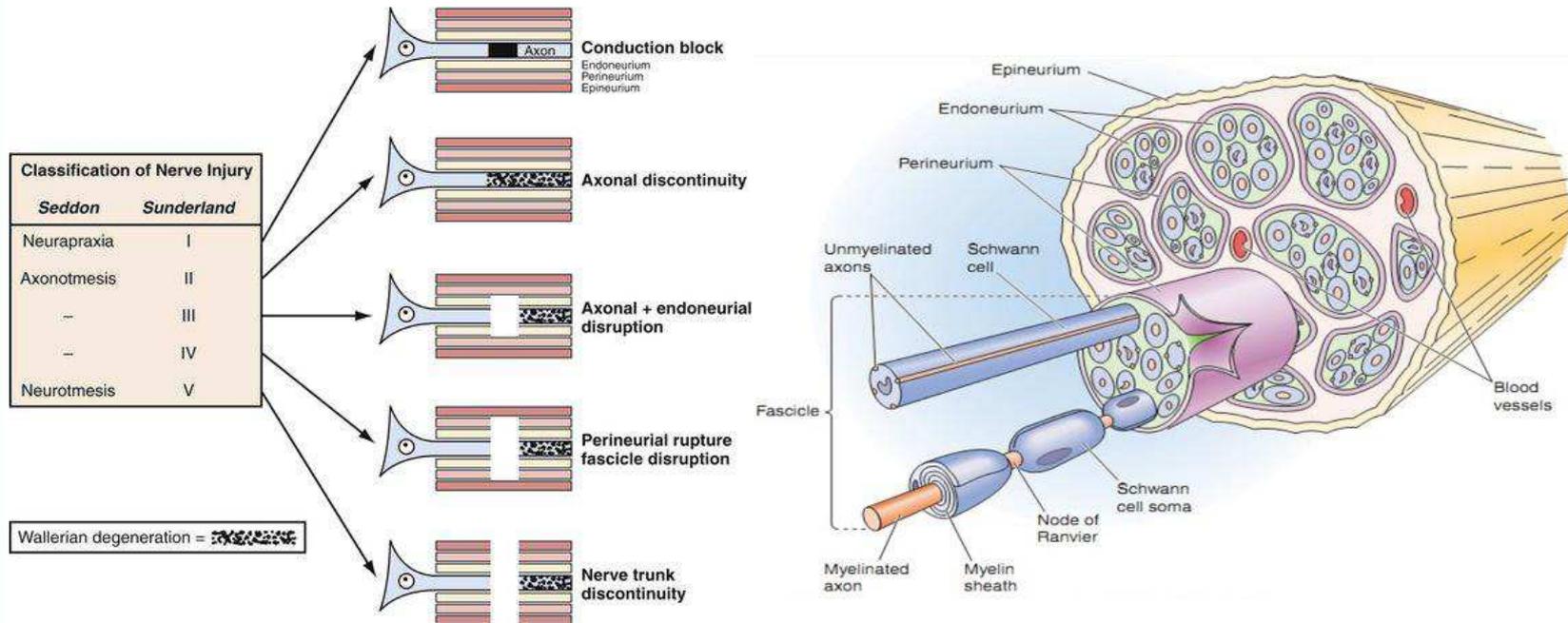




Stingers That Don't Get Better

Electrodiagnostic Studies

- Can help determine **severity** of the injury





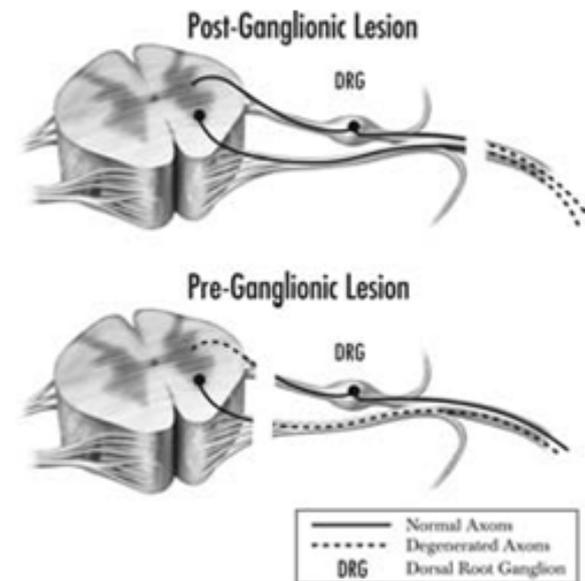
Stingers That Don't Get Better

Electrodiagnostic Studies

- Can help determine **location** of the injury

- Preganglionic: Involvement of rhomboids, serratus, cervical paraspinals; sensory nerve action potentials (SNAPs) preserved

- Postganglionic: spares above muscles; SNAPs disrupted





Stingers That Don't Get Better

Electrodiagnostic Studies

- Can help *monitor recovery*
 - Serial examinations
- Cannot reliably determine return to play
 - Electrical abnormalities can persist for months/years after resolution of symptoms



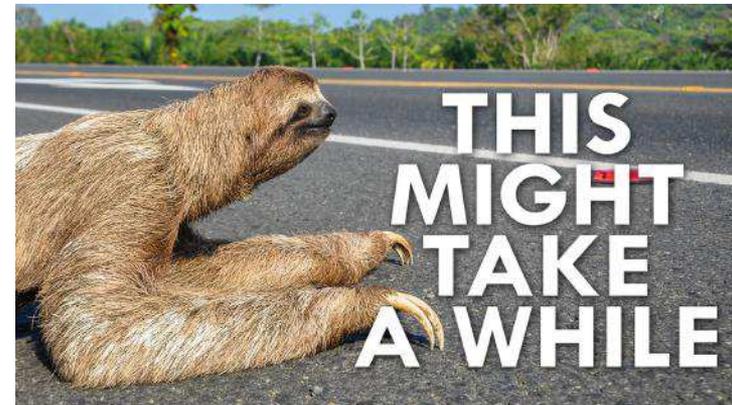


Stingers That Don't Get Better

Treatment

- **Grade I & II**
 - **Nonoperative**
 - **Spontaneous recovery**
 - **Nerve regenerates**
~1 mm/day, 1
inch/month
 - **Physical therapy &**
rehabilitation

Grade	Nerve Injury	Prognosis
1	Neurapraxia	Most resolve within minutes
2	Axonotmesis	Recovery in 12-18 months
3	Neurotmesis	Variable; possible complete loss of function

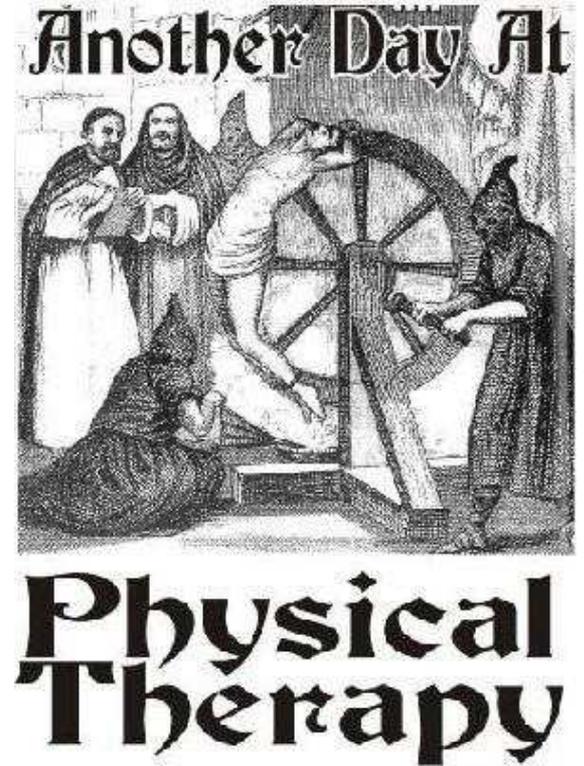




Stingers That Don't Get Better

Rehabilitation

- Restore cervical spine ROM
- Cervical spine strengthening
- Restore upper extremity ROM, strengthening
- Functional rehabilitation
- Sport specific rehabilitation





Stingers That Don't Get Better

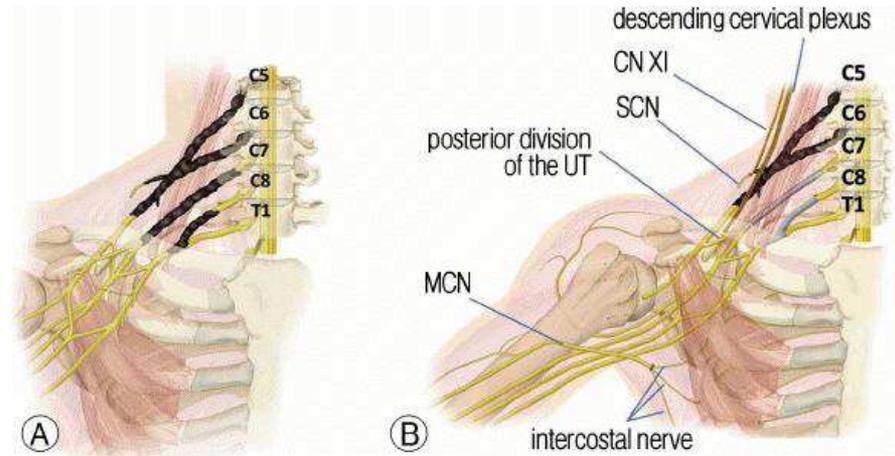
Treatment

- **Grade III**
 - **Typically require surgery**
as guided by imaging,

EMG/NCV

- **Nerve repair**
- **Nerve graft**
- **Nerve transfer**

Grade	Nerve Injury	Prognosis
1	Neurapraxia	Most resolve within minutes
2	Axonotmesis	Recovery in 12-18 months
3	Neurotmesis	Variable; possible complete loss of function

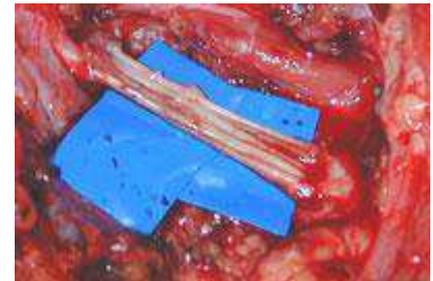
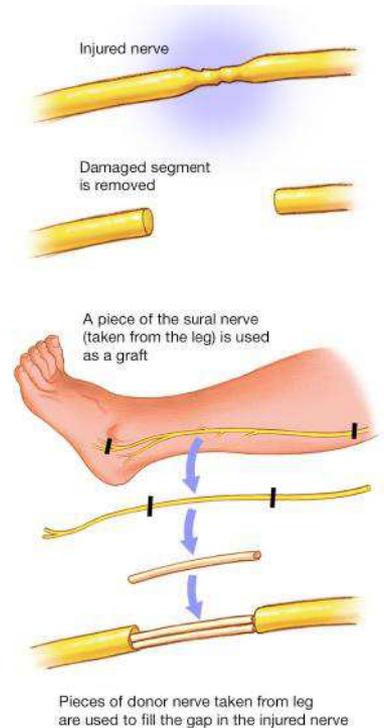




Stingers That Don't Get Better

Treatment

- **Grade III**
 - **Nerve graft**
 - **Typically postganglionic**
 - **Donor nerve to bridge gap**
 - **Sural**
 - **Med. brachial cutaneous**
 - **Med. antebrachial cutaneous**

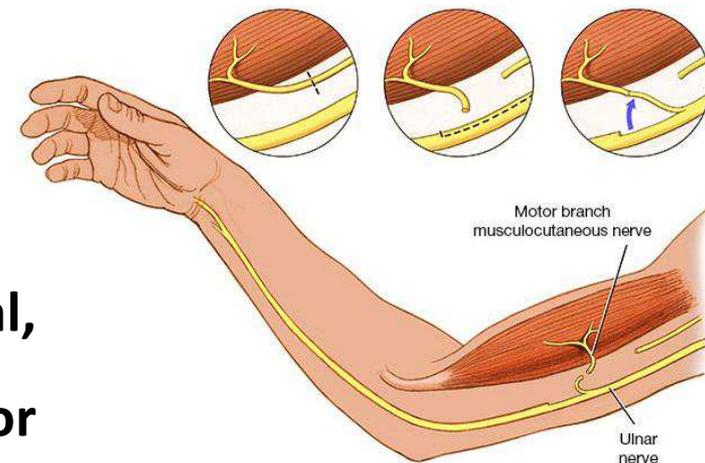




Stingers That Don't Get Better

Treatment

- **Grade III**
 - **Nerve transfer**
 - **Transfer nearby, functional, noncritical nerve (in part or whole) to critical nonfunctioning nerve**
 - **Faster, superior reinnervation**
 - **Initially described for elbow flexion (Oberlin procedure)**



Principles of Motor Nerve Transfers

- ✓ Donor nerve near target motor end plates
- ✓ Expendable donor nerve
- ✓ Pure motor donor nerve
- ✓ Donor-recipient size match
- ✓ Donor function synergy with recipient function
- ✓ Motor re-education improves function

Goodwin D, Kalantar SB. Stingers. In DeLee and Drez's Orthopaedic Sports Medicine: Principles and Practice. 4th Ed. Saunders. 2015

Weinberg J, Rokito S, Sibling J: Etiology, treatment, and prevention of athletic "stingers." Clin Sports Med. 2003;22(3):493-500

Garg R, Merrell GA, Hillstrom HJ, et al. Comparison of nerve transfer and nerve grafting for traumatic upper plexus palsy: a systematic review and analysis. JBJS Am. 2011;93(9):819-29

Mackinnon SE, Novak CB, Nerve transfers. New options for reconstruction following nerve injury. Hand Clin 1999;15(4):643-66



Stingers That Don't Get Better

Treatment

- **Grade III**
 - **Nerve transfer**
 - **Indications have expanded for nearly every motor/sensory function in the upper limb**

Palsy	Donor	Recipient
C5, 6	Spinal accessory Radial (long head of triceps) Ulnar fascicle Median fascicle	Suprascapular Axillary (anterior) Biceps branch Brachialis branch
C5, C6, C7	Spinal accessory Intercostals Ulnar fascicle Median fascicle	Suprascapular Axillary (anterior) Biceps branch Brachialis branch
C8, T1	Brachioradialis or brachialis branch Supinator branch	AIN PIN

Goodwin D, Kalantar SB. Stingers. In DeLee and Drez's Orthopaedic Sports Medicine: Principles and Practice. 4th Ed. Saunders. 2015

Weinberg J, Rokito S, Sibling J: Etiology, treatment, and prevention of athletic "stingers." Clin Sports Med. 2003;22(3):493-500

Garg R, Merrell GA, Hillstrom HJ, et al. Comparison of nerve transfer and nerve grafting for traumatic upper plexus palsy: a systematic review and analysis. JBJS Am. 2011;93(9):819-29

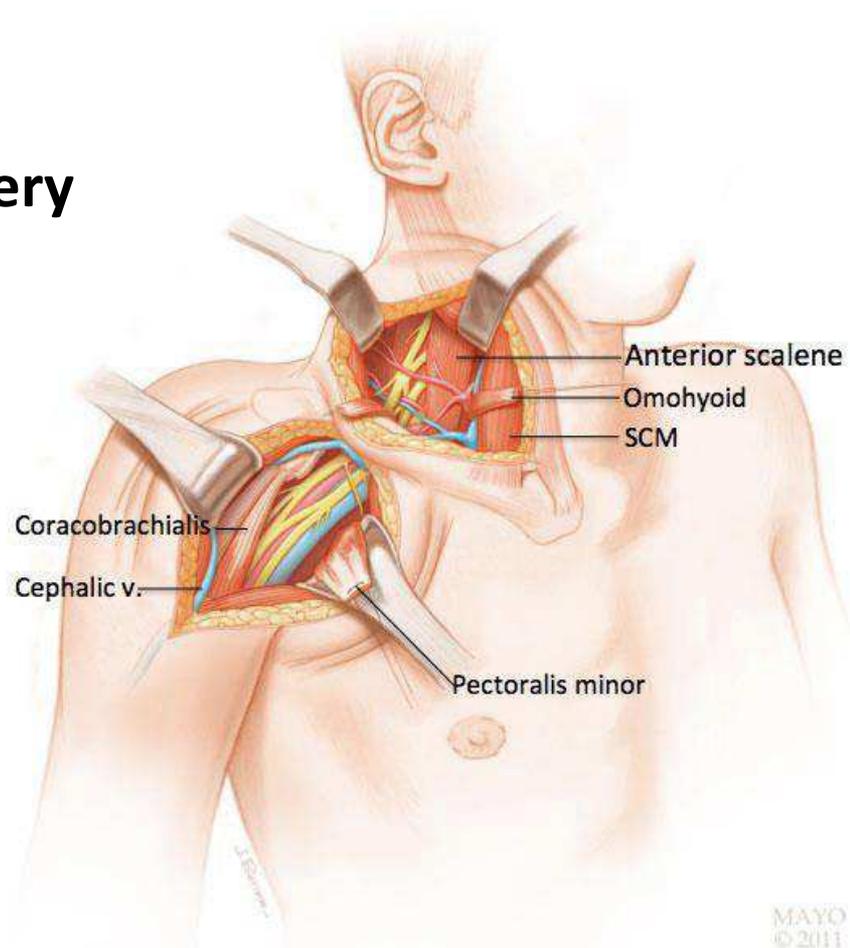
Mackinnon SE, Novak CB, Nerve transfers. New options for reconstruction following nerve injury. Hand Clin 1999;15(4):643-66



Stingers That Don't Get Better

Treatment

- **Grade III**
 - **Surgery**

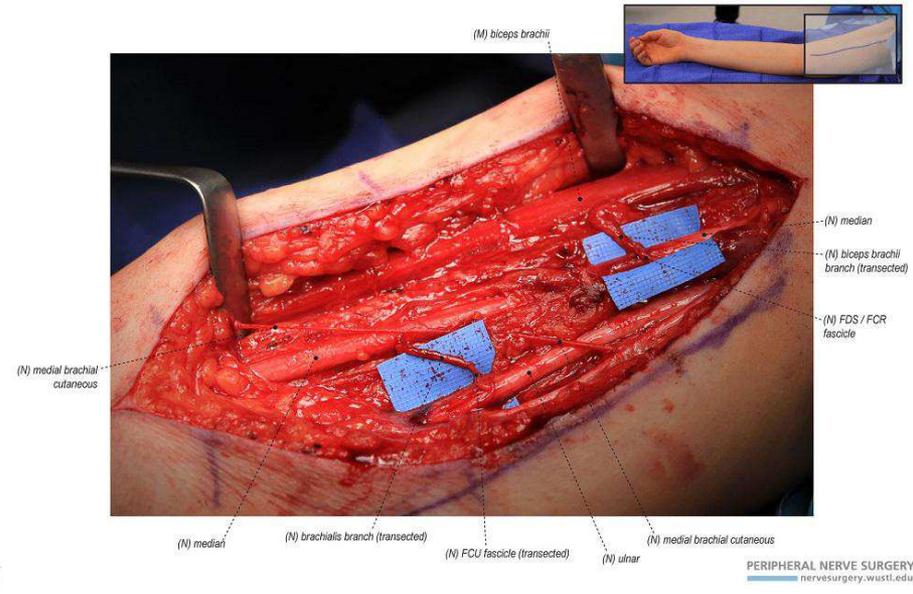
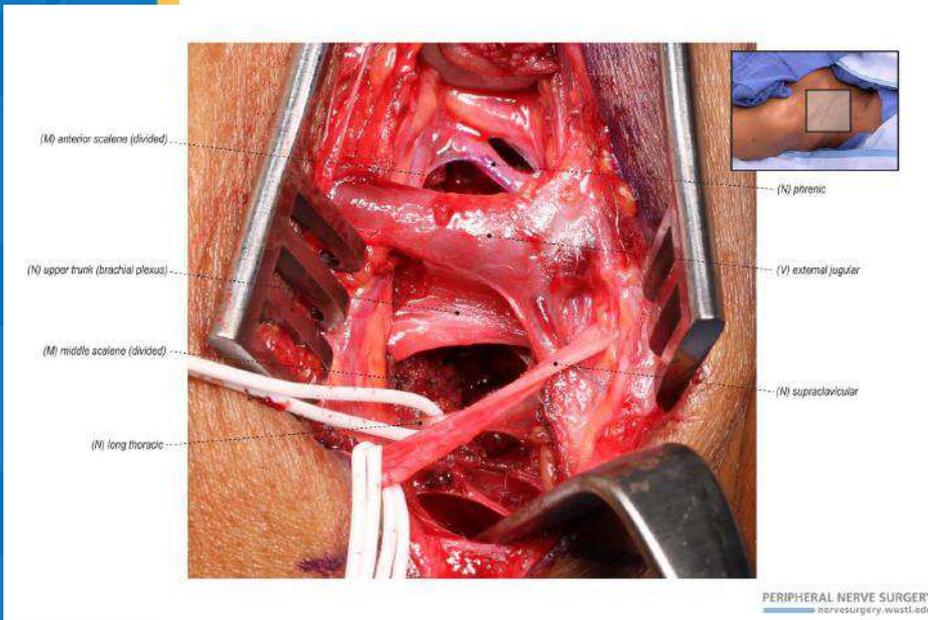




Stingers That Don't Get Better

Treatment

- Grade III
 - Surgery





Stingers That Don't Get Better

Return to Play

- **No formal published guidelines**
 - **General requirements**
 - **Adequate time to heal**
 - **Absence of underlying condition**
 - **Resolution of all symptoms**
 - **Full, pain free ROM**
 - **Appropriate cardiovascular fitness**
 - **Normal strength**
 - **Ability to perform sport-specific skills**
- without symptoms**





Stingers That Don't Get Better

Return to Play

- **Standaert et al (APMR 2009)**

Event	Sequelae	Diagnostic Evaluation	Return-to-Play
1 st stinger	Rapid resolution of all symptoms (seconds to minutes) No neurologic deficits Full, pain-free cervical & shoulder ROM	None required	No contraindication
	Persisting pain, paresthesias, neurologic deficit, or limited ROM	Yes—consider plain radiographs, MRI, EDX, others as indicated	Not in same game, not until all RTP criteria met
2 nd stinger, same season	Rapid resolution of all symptoms (seconds to minutes) No neurologic deficits Full, pain-free cervical & shoulder ROM	Yes—consider plain radiographs, MRI, others as indicated	Not in same game depending upon proximity and severity
	Persisting pain, paresthesias, neurologic deficit, and/or limited ROM	Yes—consider plain radiographs, MRI, EDX, others as indicated	Not in same game, not until all RTP criteria met, consider termination of season
2 nd stinger, different season	Rapid resolution of all symptoms (seconds to minutes) No neurologic deficits Full, pain-free cervical & shoulder ROM	Yes—consider plain radiographs, MRI, others as indicated	No contra-indication
	Persisting pain, paresthesias, neurologic deficit, and/or limited ROM	Yes—consider plain radiographs, MRI, EDX, others as indicated	Not in same game, not until all RTP criteria met



Stingers That Don't Get Better

Return to Play

- **Standaert et al (APMR 2009)**

Event	Sequelae	Diagnostic Evaluation	Return-to-Play
3 rd stinger or more, same season	Rapid resolution of all symptoms (seconds to minutes) No neurologic deficits Full, pain-free cervical & shoulder ROM	Yes—consider plain radiographs, MRI, others as indicated	Out for season, consider termination of participation in collision or contact sports
	Persisting pain, paresthesias, neurologic deficit, and/or limited ROM	Yes—consider plain radiographs, MRI, EDX, others as indicated	Out for season, consider termination of participation in collision or contact sports
3 rd stinger or more, different seasons	Rapid resolution of all symptoms (seconds to minutes) No neurologic deficits Full, pain-free cervical & shoulder ROM	Yes—consider plain radiographs, MRI, others as indicated	Not in same game depending upon proximity and severity, consider termination of season and/or participation in collision or contact sports
	Persisting pain, paresthesias, neurologic deficit, and/or limited ROM	Yes—consider plain radiographs, MRI, EDX, others as indicated	Out for season, consider termination of participation in collision or contact sports



Stingers That Don't Get Better

Return to Play

- **Protective equipment**
 - **Properly fitting shoulder pads**
 - **Collars**
 - **Recommended for RTP**
 - **limited supporting data**
 - **Limit hyperextension**
 - **Poor in limiting lateral flexion**

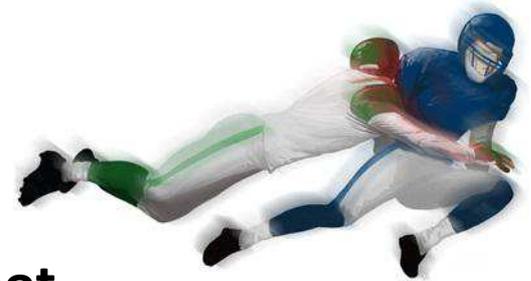




Stingers That Don't Get Better

Key Points

- 90-95% of stingers resolve quickly
- Serial examinations for those that do not
- Obtain imaging for symptoms >24-48hrs
- Obtain EMG for symptoms >2 weeks
- Most chronic stingers treated with observation, rehab
- Grade III injuries typically require surgery
- RTP when asymptomatic, no underlying abnormalities
- Consider removal from game, ending season, terminating participation for multiple/chronic stingers
 - Particularly if anatomic, radiographic abnormality





Stingers That Don't Get Better

Thank You

