Burner/Stinger Syndrome

Indexing Metadata/Description

› Title/condition: Burner/Stinger Syndrome
› Synonyms: Stinger/burner syndrome; brachial plexus injury; brachial plexitis; brachial plexopathy, brachial plexus neuropraxia
› Anatomical location/body part affected: Brachial plexus/upper extremity
  • Brachial plexus: The ventral rami of the C5-C8 and T1 nerve roots create the brachial plexus, which passes between the anterior and middle scalenes, then posterior to the clavicle where it terminates into the radial, median, and ulnar nerves. An injury to the brachial plexus can impair the motor and sensory branches of these peripheral nerves in the upper extremity(8)
  • Collectively, “stingers” may include injury to the cervical spinal cord, cervical nerve roots, or brachial plexus(4)
  • Erb’s point: The brachial plexus is most superficial and susceptible to direct trauma at Erb’s point, where the C5 and C6 nerve roots unite in the lateral neck area (over the supraclavicular fossa) to form the upper trunk(8)
› Area(s) of specialty: Neurological Rehabilitation, Orthopedic Rehabilitation, Sports Rehabilitation
› Description
  • Cervical burner/stinger syndrome (BSS), often called simply a “burner” or “stinger,” of the upper extremities is a common injury in collision sports (e.g., football, rugby, ice hockey, wrestling)(6)
  • Common mechanisms of injury include distraction of shoulder and head in opposite direction, cervical compression and extension to the same side the head is sideflexed toward, and direct trauma to exiting nerve root or brachial plexus(4)
  • BSS is characterized by immediate pain, weakness, and paresthesia (burning, stinging) symptoms radiating from the shoulder down the upper extremity(8)
  • In most cases, BSS is an acute mild injury with symptoms lasting only several minutes. However, 5% to 10% of those affected have symptoms lasting up to several weeks
  • 50 to 65% of collegiate football players report experiencing BSS(4)
  • 33.9% of high-school rugby players reported a history of at least one BSS(5)
  • BSS might be the most common upper extremity nerve injury in contact sports(4)
  • Treatment is aimed at restoring pain-free cervical, scapular, and upper extremity ROM and muscle strength and flexibility(7)
› ICD-10 codes
  • G54.0 brachial plexus disorders
  • G54.5 neuralgic amyotrophy (inappropriate for sports-related injury)
  • S14.3 injury of brachial plexus
  • M54.10 radiculopathy, site unspecified
  • M54.13 radiculopathy, cervicothoracic region
  • M54.14 radiculopathy, thoracic region
(I CD codes are provided for the reader’s reference, not for billing purposes)
Reimbursement: No specific issues or information regarding reimbursement has been identified for burner/stinger syndrome

Presentation/signs and symptoms
• The hallmark initial symptom of BSS is difficulty with moving the involved arm. Typically, the athlete will shake the arm or support it with the opposite hand\(^6\)
• Burning, numbness, and pain radiating down the arm follows a circumferential pattern rather than a dermatomal pattern\(^6\)
• Muscle weakness occurs in more than one major muscle group acting on the shoulder (e.g., external rotators, flexors, and abductors)\(^8\)
• Cervical ROM often is reduced in chronic cases\(^2,6\)
• Symptoms are never bilateral. Rarely is a lower extremity involved\(^4\)
• Symptoms can last less than a minute or up to several weeks\(^6\)
• Referral to physical therapy is usually deferred, unless symptoms are prolonged or recurrent

Causes, Pathogenesis, & Risk Factors

Causes
• There are three mechanisms of injury in BSS
  – Traction: occurs when the head and involved shoulder are driven in opposite directions.\(^6\) This traction overstretches the cervical nerve roots and the upper brachial plexus. This mechanism of injury may explain shoulder dystocia (or Erb’s palsy) during vaginal childbirth when the infant’s anterior shoulder passes with traction through the pubic symphysis.\(^8\)(See Clinical Review…Brachial Plexus Birth Injuries; CINAHL Topic ID Number: T708444.) Traction may also explain BSS in a child forcefully pulled and lifted by one arm
  – Direct trauma: in some cases, the brachial plexus may be injured by a forceful blow to Erb’s point\(^6\)
  – Compression: the mechanism of BSS in older adults or those with cervical degenerative disorders is typically an axial load that compresses the cervical spine at the C5 nerve root and the C4/C5 neural foramen\(^6\)
• Most burner/stinger sports injuries result from direct trauma and/or traction to the head, neck, and shoulder\(^2\)

Pathogenesis
• BSS is classified as a peripheral nerve injury of the brachial plexus or involved cervical nerve root(s). The upper trunk (C5, C6) of the brachial plexus is most commonly injured\(^6\)
• In general, nerves are highly sensitive to traction or compression forces. Also, cervical nerve roots have little to no connective tissue surrounding them as they exit the neural foramina, making them more susceptible to compressive injuries\(^8\)
• The degree of nerve injury is usually determined by symptoms and electromyographic (EMG) and sensory nerve conduction results. The three degrees of nerve injury are as follows\(^2\)
  – Grade 1 (neurapraxia): this is the mildest and most frequent type of burner/stinger syndrome. Although the axonal structure is still intact, a nerve injury has resulted in a decrease of localized conduction
  – Grade 2 (axonotmesis): a nerve injury involving a disruption of the axonal continuity while the outermost connective tissue elements (epineurium) are still intact
  – Grade 3 (neurotmesis): the most severe nerve injury, in which the entire nerve is injured
• Authors of a cohort study (\(N = 49\) football players, mean age 20 years) in Japan found that 39% (19/49) had at least one episode of BSS. Cervical extension ROM was significantly lower in those with a history of BSS versus those without (50.9° vs. 60.2°)\(^2\)
• Authors of a cohort study (\(N = 164\) high-school rugby players) in Japan found that type 1 scapular dyskinesis (infero-medial scapula border prominence) was associated with a history of BSS\(^3\)
• Authors of a 6-year surveillance study in NCAA American football found that only 229 BSS episodes were reported across 153 teams averaged 1.5 BSS reported per team per season, with approximately 1 in 5 stingers being recurrent. Previous research has suggested that 50–65% of collegiate football players report at least one BSS injury. Researchers concluded that the transient nature of symptoms led to underreporting\(^4\)
Risk factors

• Prospective controlled studies with sufficient sample size to identify predictors for burner/stinger syndrome among athletes are lacking. Epidemiologic data indicate that participation in contact sports is the main risk factor (6).

• Burner/stinger syndrome is reported most often in football and wrestling, but is also common in rugby, ice hockey, basketball, boxing, and weight lifting (2).

  – Authors of the 6-year surveillance study in NCAA American football found that most BSS injuries were reported in Division 1 during the third quarter of competition by juniors. Most injuries were sustained by players on defense, due to contact while tackling or blocking. Player position of highest occurrence to lowest occurrence is as follows; defensive ends/linebacker, offensive lineman, defensive backs, and running backs (4).

• History of BSS

  – In Japan, authors of a descriptive epidemiology study concluded that young rugby players with a history of BSS have a reinjury rate for stingers per season of 37.3%. It was identified as the strongest risk factor for injuries and lasting symptoms (5).

  • Presence of cervical disc disease, stenosis, or other forms of cervical degeneration (3).

  • Presence of a cervical lesion, such as osteoblastoma, can increase the risk of recurrent burner/stinger syndrome (8).

  • Presence of glenohumeral instability (3).

Overall Contraindications/Precautions

• Continuing weakness and hypomobility of the neck and shoulder girdle are red flags for returning to sport because these deficits may contribute to recurrence in the same season (3).

• Recurrent burner/stingers are associated with permanent motor and sensory loss (6).

• See specific Contraindications/precautions to examination and Contraindications/precautions under Assessment/Plan of Care.

Examination

• Contraindications/precautions to examination

  • Although severe cases of BSS are not common (only 5% to 10% of cases are severe), the exam should nevertheless rule out more serious associated injuries (e.g., cervical nerve root injury, spinal cord trauma) (2).

  • Red flags indicative of an injury other than BSS (3):

    – Bilateral upper extremity symptoms

    – Lower extremity symptoms

    – Severe neck pain or neck pain with other symptoms not consistent with burner/stinger syndrome

    – Altered consciousness

    – Decreased or apprehension to cervical ROM

    – Continued doubt of diagnosis

    – Transient quadriparenesis

  • The athlete should be evaluated as soon as possible after the injury and then at weekly intervals for at least 2 weeks following the injury to monitor for late occurring paresis or paresthesia (6).

  • Avoid upper limb neural tension testing if the patient is experiencing symptoms without applied tension.

• History

  • History of present illness/injury

    – Mechanism of injury or etiology of illness

      - Was trauma involved? (e.g., contact/collision sport)

      - Ask the patient to describe what happened. Did the neck undergo forced lateral flexion, rotation, and hyperextension?

      - Did symptoms occur right away?

      - How have symptoms progressed since onset?

      - Have any new symptoms surfaced since the injury?

    – Course of treatment

      - Medical management: Ask about patient’s current medical management for symptoms. How has the condition responded to treatments?
- **Medications for current illness/injury**: Determine what medications clinician has prescribed; are they being taken and effectively controlling symptoms? Common medications used for this condition include acetaminophen and/or NSAIDs, neuropathic pain medications such as gabapentin and tricyclic antidepressants, and 14-day course of prednisolone.

- **Diagnostic tests completed**
  - The diagnosis is usually based on the history and clinical findings. Cervical spine radiographs are indicated if the patient complains of neck pain, neck stiffness, and/or painful cervical ROM.
  - MRI may be indicated with recurrent BSS injuries, concomitant neck pain, sensory and motor symptoms lasting longer than 1 hour or if neurological symptoms are in a particular nerve root distribution, or bilateral upper extremity symptoms. Recurrent BSS injuries have shown evidence of cervical disc disease and narrowed cervical canals.
  - EMG tests are recommended when weakness and neck pain persist for more than 3 weeks after the injury. It may take at least 21 days for signs of denervation, even though reduced recruitment is immediate. EMG will differentiate between cervical nerve root injuries from a brachial plexus injury.

- **Home remedies/alternative therapies**: Document any use of home remedies (e.g., ice or heating pack) or alternative therapies (e.g., acupuncture) and whether or not they help.

- **Previous therapy**: Document whether patient has had occupational or physical therapy for this or other conditions and what specific treatments were helpful or not helpful.

- **Aggravating/easing factors**: Inquire about aggravating or precipitating factors and length of time each item is performed before the symptoms come on or are eased.

- **Body chart**
  - Use body chart to document location and nature of symptoms.
  - Symptoms are always unilateral, radiating from the neck/shoulder to the hand. If symptoms are bilateral or also found within the lower extremity, a cervical fracture or spinal cord contusion should be suspected.
  - **Nature of symptoms**: Ask about acute and ongoing symptoms that followed the injury. Acute symptoms include shoulder and neck pain and intense burning, numbness, or tingling in the arm. Weakness, heaviness, or “deadness” in the arm may have followed the pain.
  - **Rating of symptoms**: Use a visual analog scale (VAS) or 0–10 scale to assess symptoms at their best, at their worst, and at the moment (specifically address if pain is present now and how much).
  - **Pattern of symptoms**: Document changes in symptoms throughout the day and night, if any (a.m., mid-day, p.m., night); also document changes in symptoms due to weather or other external variables.
  - **Sleep disturbance**: Document number of awakenings/night, if applicable.
  - **Other symptoms**: Document other symptoms patient may be experiencing that could exacerbate the condition and/or symptoms that could be indicative of a need to refer to physician.
  - **Respiratory status**: Is there any respiratory compromise or concern?

- **Barriers to learning**
  - Are there any barriers to learning? Yes ___ No ___
  - If Yes, describe ________________________

- **Medical history**
  - **Past medical history**
    - **Previous history of same/similar diagnosis**
      - Any history of burner/stingers?
      - Has the patient experienced neck pain prior to the current injury?
      - Has a cervical spine disorder ever been diagnosed in the patient?
    - **Comorbid diagnoses**: Ask patient about other medical concerns, such as diabetes, cancer, heart disease, complications of pregnancy, psychiatric disorders, and orthopedic disorders.
    - **Medications previously prescribed**: Obtain a comprehensive list of medications prescribed and/or being taken (including OTC drugs).
    - **Other symptoms**: Ask patient about other symptoms he/she may be experiencing.

- **Social/occupational history**
  - **Patient’s goals**: Document what the patient hopes to accomplish with therapy and in general.
  - **Vocation/avocation and associated repetitive behaviors, if any**
    - Does the patient participate in contact/collision sports?
    - What is the occupation of the patient? Are there any tasks that he or she cannot perform?
– Functional limitations/assistance with ADLs/adaptive equipment
  - Assess functional limitations
  - If the patient is an athlete with a history of burner/stinger syndrome, does he or she wear equipment to protect from reinjury? Is the equipment properly fitted?
– Living environment: Stairs, number of floors in home, with whom patient lives, caregivers, etc. Identify if there are barriers to independence in the home; any modifications necessary?

› Relevant tests and measures (While tests and measures are listed in alphabetical order, sequencing should be appropriate to patient medical condition, functional status, and setting):

  • Assistive and adaptive devices: Assess for proper fit and proper use of any assistive equipment or adaptive devices that may have been prescribed
  • Balance: Assess standing static and dynamic balance if patient reports unsteadiness or if cervical compressive myelopathy is suspected. See Clinical Review…Cervical Compressive Myelopathy; CINAHL Topic ID Number: T708511
  • Circulation: Assess distal radial and ulnar pulses
  • Cranial/peripheral nerve integrity: Perform a systematic sensory and motor examination of the peripheral nervous system within the patient’s tolerance. Upper limb neural tension testing may elicit symptoms with cervical lateral flexion to the contralateral side. This test should not be conducted if the patient is experiencing symptoms without neural tension
  • Gait/locomotion: If symptoms are present, is the affected arm held in such a way as to decrease tension on the brachial plexus?
  • Joint integrity and mobility
    – Assess cervical spine mobility for any joint restrictions that may be contributing to limited motion
    – Assess thoracic joint mobility to ensure that the spine is capable of positioning into an upright posture
    – Assess the glenohumeral joint for excessive laxity
    – Assess scapular mobility for type 1 dyskinesis
  • Muscle strength
    – Assess tone and strength of the shoulder, scapular, and cervical musculature
    – Perform manual muscle testing (MMT) to uncover any myotomal weakness
      - Deltoid: shoulder abduction (C5-6, axillary)
      - Supraspinatus: shoulder scaption (C5-6, suprascapular)
      - Infraspinatus: shoulder external rotation (C5-6, suprascapular)
      - Biceps brachii: elbow flexion (C5-6, musculocutaneous)
      - Pronator teres: forearm pronation (C6-7, median)
      - Triceps brachii: elbow extension (C7-8, radial)
      - Abdutor digiti minimi: fifth digit abduction (C8-T1, ulnar)
    – Patients with BSS tend to present with weakness involving the upper trunk of the brachial plexus (C5-6). Weakness is most often noticed in the deltoid, biceps, supraspinatus, infraspinatus, and coracobrachialis muscles
  • Observation/inspection/palpation (including skin assessment)
    – Swelling, hematoma, and ecchymosis indicate a more serious trauma than is usually seen in uncomplicated burner/stinger syndrome
    – Inspect shoulder for asymmetry, muscle atrophy, or deformities that can suggest a fracture, nerve injury, or other prior injury
    – Palpate Erb’s point and entire upper extremity, as needed
    – Palpate the cervical spine for midline tenderness, crepitus, step-offs, or swelling. If tenderness is noted over the cervical spine, a cervical fracture or spinal cord contusion should be suspected
  • Posture
    – Assess neck and shoulder girdle posture in sitting and standing. Note any asymmetry or abnormality
    – Scapular winging and dyskinesis may be present
    – The cervical spine may be held in flexion to alleviate pressure on cervical nerve roots impinged at the neural foramen
  • Range of motion
    – Assess active ROM initially, followed by passive ROM. Assessing cervical passive ROM without clearing the cervical spine first could risk further injury
    – Measure ROM at the shoulder, elbow, and cervical spine by goniometry. Assess movements of the clavicle and scapula during shoulder elevation and depression
• **Reflex testing:** Assess deep tendon reflexes (biceps/brachioradialis C5-6, triceps C7-8), which may be diminished

• **Sensory testing:** Assess for sensory changes in the upper extremities, as deficits may be found, especially in the C5 and C6 dermatomes. Assess 2-point discrimination and pin prick⁸
  
  – Web space between thumb and index on back C6, radial nerve
  – Palm side of DIP joint of middle finger C7, median nerve
  – Lateral hand proximal to fifth digit C8, ulnar nerve
  – Side of mid-forearm proximal to fifth digit T1

• **Special tests specific to diagnosis**
  – If patient does not report ongoing pain, assess for provocation of pain with brachial plexus traction tests. Does pain quality and location match burner/stinger symptoms?
  – Spurling’s test⁸
    - Applies a compressive force onto the neural foramina where the cervical nerve roots exit
    - Applies an axial load on top of the head while the cervical spine is laterally flexed. (Note: this test can also be performed with ipsilateral cervical extension and rotation)
    - Found to be positive in 70% of patients with BSS
    - Note that the test can be falsely negative in patients with a traction-type mechanism of injury, as they are typically younger and most likely free of cervical spine disorders
    - The test should not be performed if the maneuver is contraindicated due to the presence of a severe cervical pathology (e.g., fracture, dislocation)

**Assessment/Plan of Care**

› **Contraindications/precautions**
  
  • Only those contraindications/precautions applicable to this diagnosis are mentioned below, including with regard to modalities. Rehabilitation professionals should always use their professional judgment in their assessment and treatment decisions

  • Clinicians should follow the guidelines of their clinic/hospital and what is ordered by the patient’s physician. The summary below is meant to serve as a guide, not to replace orders from a physician or a clinic’s specific protocols

  • Administer physical and electrotherapeutic modalities as indicated¹

• **Cryotherapy contraindications**¹
  – Raynaud’s syndrome
  – Cryoglobulinemia
  – Cold urticaria
  – Paroxysmal cold hemoglobinuria
  – Impaired circulation
  – Cold intolerance
  – Over area of peripheral vascular disease

• **Cryotherapy precautions**¹
  – Hypertension
  – Thermoregulatory disorders
  – Over an open wound
  – Over superficial nerves for extended periods
  – Very young or very old
  – Poor cognition
  – Personal aversion to cold
  – Area of poor sensation

• **Thermotherapy contraindications**¹
  – Decreased circulation
  – Decreased sensation
  – Acute/subacute traumatic and inflammatory conditions
  – Skin infections
  – Impaired cognition or language barrier
– Tumor present
– Tendency for hemorrhage or edema
– Heat rubs

• **Electrotherapy** contraindications/precautions\(^{(1)}\) (in some cases, *when approved by the treating physician*, electrotherapy may be used under some of the circumstances listed below when benefits outweigh the perceived risk)
  – Do not place electrodes near carotid bodies, cardiac pacemakers or implantable cardioverter defibrillators (ICDs), phrenic nerve or urinary bladder stimulators, phrenic nerve, eyes, gonads, areas with known peripheral vascular disease, areas with hemorrhage, areas with active osteomyelitis
  – Cardiovascular disease (e.g., uncontrolled hypertension/hypotension, irregular heart rate)
  – Impaired sensation, mental status, communication
  – Thrombophlebitis
  – Pregnancy
  – Over pharyngeal area
  – Acute inflammation
  – Seizure history
  – Confused patients
  – Immature patients
  – Obesity
  – Osteoporosis
  – Cancer/neoplasms
  – Used in close proximity to diathermy treatment

• **Therapeutic ultrasound** contraindications\(^{(1)}\)
  – Over the region of a cardiac pacemaker or other implanted electronic devices
  – Over the pelvis, abdominal, and lumbar regions during pregnancy
  – Over the eyes and testes
  – In area with infection or bleeding
  – If a tumor is present in the area
  – In the area of a deep vein thrombosis (DVT) or thrombophlebitis
  – Over the heart, stellate, or cervical ganglia
  – Over open epiphyseal plates

• **Therapeutic ultrasound** precautions\(^{(1)}\)
  – Sensory deficits
  – Persons who cannot communicate effectively (e.g., impaired cognition, language barrier)
  – Circulatory impairments
  – Plastic or metal implants
  – Note: Always decrease ultrasound intensity if the patient complains of discomfort

› **Diagnosis/need for treatment:** Prolonged symptoms of burner/stinger syndrome; and reduced strength and flexibility of the neck, shoulder girdle, and upper extremity. Rehabilitation is indicated to enable safe return to sport or work

› **Rule out**\(^{(2)}\)
  – Acromioclavicular separation
  – Clavicle fracture
  – Shoulder subluxation/dislocation
  – Peripheral neuropathy in upper extremity
  – Thoracic outlet syndrome
  – Cervical fracture/dislocation
  – Cervical spinal cord lesion
  – Spinal accessory neuropathy
  – Ruptured cervical disc
  – Cervical radiculopathy
  – Brachial neuritis
  – Rotator cuff tendinosis
Prognosis

• Most athletes experience spontaneous resolution of mild symptoms and return to sport, sometimes on the field of play. However, it is not unusual for burner/stingers to recur in the same season, with increased severity and duration of symptoms.(2)

• Formal guidelines are lacking for return to sports participation after recovery from BSS. However, the presence of any of the following should be considered at least a relative contraindication for returning to athletic activity(6):
  – Unresolved weakness
  – Cervical anomalies that suggest spinal nerve injury
  – Abnormal electrodiagnostic tests and imaging
  – Evidence of cervical compressive myelopathy (see Clinical Review... Cervical Compressive Myelopathy, referenced above)
  – Continued BSS pain
  – Painful and limited cervical ROM

Other considerations

• In a case study, a 16-year-old high school football linebacker presented to a spring pre-participation sports physical with a history of 13 BSS episodes, while tackling, the season prior. MRI revealed mild cervical canal stenosis and electrodiagnostic testing revealed mild chronic bilateral neurogenic changes at the superior trunk of the brachial plexus. He was allowed return to play wearing a Kerr collar and he competed the next 2 years without injury.(6)

Treatment summary

• Treatment is aimed at restoring pain-free shoulder, cervical, and scapular ROM. This is followed by improving posture and strength and flexibility imbalances. Concentric and eccentric strength in all directions should be emphasized(6)

• Improving functional strength should include the affected neck, shoulder girdle, and upper extremity, as well as the trunk/core

• Clinical trials are lacking on the effectiveness of modalities, such as cryotherapy, ultrasound, and electrostimulation, for post-burner/stinger rehabilitation

<table>
<thead>
<tr>
<th>Problem</th>
<th>Goal</th>
<th>Intervention</th>
<th>Expected Progression</th>
<th>Home Program</th>
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<tbody>
<tr>
<td>Muscle spasms and pain</td>
<td>Resolve muscle spasms and symptoms</td>
<td><strong>Physical agents and mechanical modalities</strong></td>
<td>N/A</td>
<td>Instruct patient in use of heat/cold therapy as needed for pain</td>
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<td>Use of an ice pack for reducing acute pain or a heat pack for decreasing muscle spasm may be possible</td>
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<td><strong>Manual therapy</strong></td>
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<td>Apply soft-tissue mobilization or myofascial release techniques to reduce tenderness and muscle spasms, if indicated</td>
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</table>
| Reduced cervical, scapulothoracic, and shoulder ROM | Normalize ROM | **Manual therapy**  
Thoracic spine mobilization and gentle scalene stretching may be performed to reduce neural tension onto the brachial plexus | **Therapeutic exercises**  
As cervical ROM improves, more conventional exercises for increasing shoulder and upper extremity ROM, as needed | Continue prescribed exercises at home |
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<tr>
<td>Normalizing cervical ROM should be performed first and can be done with passive and active exercises</td>
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<tr>
<td>Neck, shoulder girdle, and upper extremity weakness</td>
<td>Normalize neck, shoulder girdle, and upper extremity muscle strength</td>
<td><strong>Physical agents and mechanical modalities</strong></td>
<td><strong>Therapeutic exercises</strong></td>
<td>Continue prescribed exercises at home</td>
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<td>Electrotherapy may be effective in minimizing muscle atrophy/strength loss in the acute stages</td>
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<td><strong>Therapeutic exercises</strong></td>
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<td>Chest-out posturing helps to improve head and neck alignment, which can reduce stress onto the spine with a weakened musculature.</td>
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<td>Scapulothoracic: Side-lying external rotation, side-lying forward flexion, prone horizontal abduction with external rotation, and prone extension</td>
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<td>Neck: Isometric neck flexion, side-flexion, extension, and rotation</td>
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<td>Shoulder: Rotator cuff and abductor exercises with elastic band/tubing</td>
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<td>Elbow: Biceps curl and triceps extension with free weights</td>
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<td>Decreased functional capacity for daily activities or sports</td>
<td>Restore prior functional capacity in daily activities and/or sports</td>
<td><strong>Sport specific training</strong>&lt;br&gt;Provide patient education regarding good form during training</td>
<td>For full return to sport (including games): AROM in the cervical spine should be normal, the patient should not experience pain during cervical ROM, and there should be normal upper extremity strength&lt;sup&gt;(6)&lt;/sup&gt;</td>
<td>Encourage gradual return to sport/activities after symptoms resolve</td>
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**Desired Outcomes/Outcome Measures**

› Resolved muscle spasms and symptoms  
  • VAS  
› Normalized ROM  
  • Goniometry  
› Normalized neck, shoulder girdle, and upper extremity muscle strength  
  • MMT  
› Restored prior functional capacity in daily activities and/or sports  
  • Functional sport-specific testing  
  • Short Form Health Survey (SF-36)

**Maintenance or Prevention**

› Persistence of any residual upper extremity symptoms, neck pain, restricted cervical or shoulder ROM, and suspicion of cervical injury are reasons to defer the athlete’s return to sport<sup>(6)</sup>  
› Special preventive management on return to sport should include the following:  
  • Proper tackling technique: analyze the tackling techniques of athletes involved in contact sports with tackling, since improper technique is a major contributing factor in BSS. Proper tackling technique should include continued eye contact with the opposing player and avoidance of dropping the shoulder<sup>(4)</sup>  
  • Adequate equipment: neck rolls, adequate shoulder padding, and other equipment that prevents excessive cervical lateral flexion and cervical hyperextension should be recommended<sup>(6)</sup>  
› Cervical collars in football equipment decrease cervical extension and lateral flexion to decrease the risk of injury. has Authors of recent research have suggested that of the Bullock collar, cowboy collar, and Kerr collar, the Kerr collar minimizes head acceleration force through the neck<sup>(6)</sup>  
› Preseason and postseason conditioning programs are recommended for players at risk

**Patient Education**

› University of Rochester Medical Center website, “Health Encyclopedia: Burners and Stingers Syndrome in Children,”  
  https://www.urmc.rochester.edu/encyclopedia/content.aspx?ContentTypeID=160&ContentID=30
**Coding Matrix**

References are rated using the following codes, listed in order of strength:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>M</td>
<td>Published meta-analysis</td>
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<tr>
<td>SR</td>
<td>Published systematic or integrative literature review</td>
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<tr>
<td>RCT</td>
<td>Published research (randomized controlled trial)</td>
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<tr>
<td>R</td>
<td>Published research (not randomized controlled trial)</td>
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<tr>
<td>C</td>
<td>Case histories, case studies</td>
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<tr>
<td>G</td>
<td>Published guidelines</td>
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**References**