International Journal of ChemTech Research
CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555
Vol.11 No.03, pp 01-08, 2018

Brachial plexus injuries: An interactive teaching and learning academic model

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Abstract : The purpose of this educational paper is to report the feedback from academics and students regarding newly introduced interactive teaching- learning model aiming to master brachial plexus injuries. An interactive questions and answers format was presented to number of academics and students at college of medical rehabilitation sciences. All academics and 90% of students reported that the newly introduced interactive teaching- learning model was helpful. It has been concluded that the interactive teaching- learning model is feasible and self-explanatory to be used and adopted by students and academics to facilitate the educational process.
Keywords : Brachial plexus, injuries, teaching, learning, educational model.

Introduction

Brachial plexus is a group of intertwined nerves that emerge from the spinal cord in the cervical region and travel down the arm.[1] The nerves either motor or sensory control different muscles and provide feeling in the arm respectively.[1]Brachial plexus injuries vary from simple traction injury to more severe rupture or avulsion.[2-4] Minor injuries will completely recover within few weeks; however severe injuries are more likely to cause permanent disability.[5]Disability manifests itself as loss of feeling and/or loss of different upper extremity movements.[6-8]It is not uncommon to sustain brachial plexus injury during obstetric hard labor.[9]Nerve repair and microsurgery have demonstrated advances in restoration of function.[10]Teaching brachial plexus structure and function is a core and essential part of any physical therapy or rehabilitation program; however learners'

International Journal of ChemTech Research, 2018,11(03): 01-08.

DOI : http://dx.doi.org/10.20902/IJCTR.2018.110301

competence and capabilities in mastering brachial plexus function and dysfunction has not been investigated.[11,12]There is a gap in the body of knowledge regarding adopting a feasible model to facilitate the educational process through having specific teaching- learning framework. We hypothesize that the interactive teaching- learning approach is feasible and self- explanatory to be adopted by academics and students. The main purpose of the study is to report the feedback from academics and students regarding newly introduced interactive teaching- learning model aiming to master brachial plexus injuries.

Materials and Methods

An overview of the anatomy of different parts of brachial plexus will be discussed along with the details of common injuries encountered by different sections of brachial plexus. An interactive teaching and learning approach using interactive questions and answers format will be presented to guide learners step by step towards mastering significant brachial plexus injuries. For the purpose of discussion, the interactive teaching and learning format will start by having a real case scenario that set a framework to present different questions regarding brachial plexus injuries. Instruction for learners to answer teaching- learning model was included (Fig. 1). Anatomy of brachial plexus was included for convenience of the learners (Fig. 2). A case scenario[13] and a total of 30 questions and answers will be presented. The author has answered questions by consulting multiple references.[1-14]

Case Scenario:

Adam, Omar, and Ibrahim are three college students who went on summer vacation. Students had very good time swimming and playing beach ball. Students had a wild beach buggy ride that unfortunately ends up in a very bad accident. The three were together on the beach buggy and when Omar lost control, the three had a bad fall after getting into accident with another beach buggy. Attendants said that the clash was very bad and the ambulance came within 5 minutes. Students were alert and did not lose consciousness. The emergency physician cleared the three students after having all necessary investigations with no fracture according to the X- ray report. The physician instructed all students to follow up with the neurologist. The neurologist recommended intensive physical therapy to rehabilitate the brachial plexus (BP) injury.*Adam* chief complaints are severe weakness of wrist extensors, shoulder abductors, and arm extension and adduction. *Omar* chief complaints are significant weakness of right scapular retraction, and initiation of shoulder abduction. *Ibrahim* has the medical diagnosis of long thoracic nerve palsy.

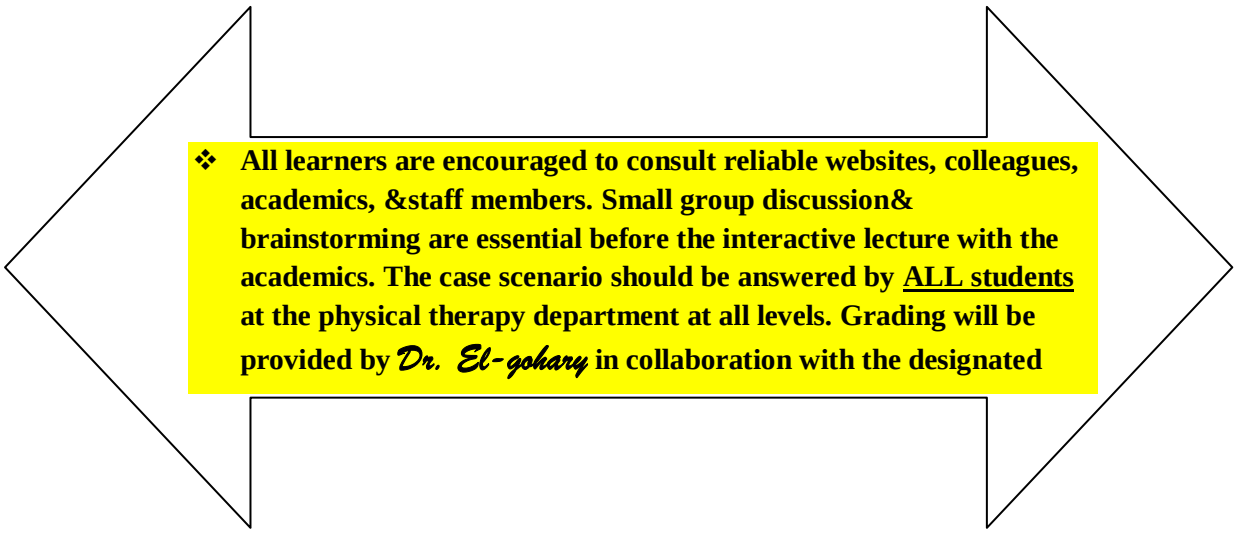

Figure 1.Instructions to learners to answer the brachial plexus educational model.

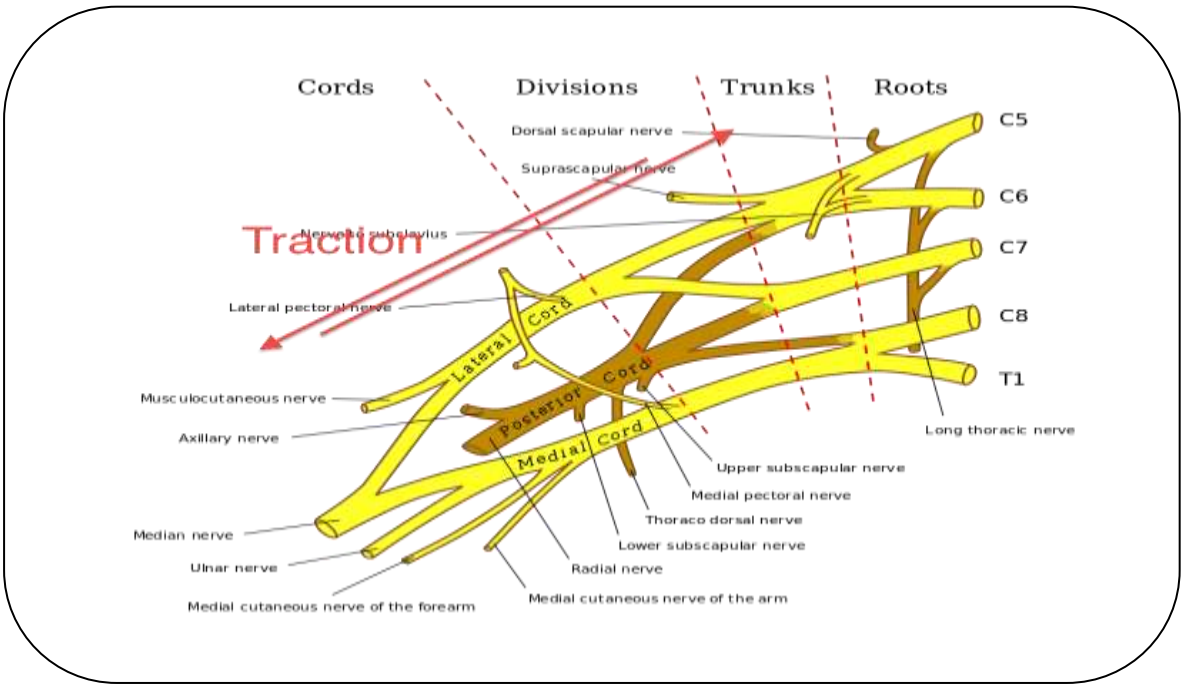

Figure 2. Anatomy of brachial plexus

Q1: Regarding Adam complaints, which cord of brachial plexus is more likely to be involved?

- The posterior cord of brachial plexus.

Q2: Regarding Omar complaints, what are the nerves that were involved?

- Dorsal scapular nerve.
- Suprascapular nerve.

Q3: Regarding Omar complaints, where the nerves involved branches off from BP?

- C5 root gives off dorsal scapular nerve.
- Upper trunk gives off suprascapular nerve.

Q4:Common causes of long thoracic nerve injury are:

- Direct blow to the rib area
- Over stretching
- Sustained bearing of excessive weight over the shoulder

Q5: Long thoracic nerve evolves from:

- The root of neck vertebrae C5-C7.

Q6: Can deep tissue massage cause long thoracic nerve injury?

- Yes.

Q7: The major symptoms associated with long thoracic nerve palsy include:

- Shoulder pain
- Winged scapula

- Reduced overhead activity

Q8:Diagnostic imaging techniques (anatomical and physiological) include:

- MRI scan
- EMG
- NCV

Q9: Upper brachial plexus injury occurs when:

- The head and neck are violently moved away from the ipsilateral shoulder.

Q10: Lower brachial plexus injury occurs when:

- The upper limb is abducted above the level of the head with considerable force.

Q11: Total BP injuries usually involve:

- Rupture ofC5- C6
- Avulsion of C8- T1

Q12: Prevalence of brachial plexus injuries:

- C5-C6 root injuries account for 20- 25% of traumatic BP injuries
- C8-T1 root lesion account for 3%
- Total plexus injuries C5-T1 accounts for 75%

Q13:Thoraco dorsal nerve:

- Emerges mainly from C7, C8, and some nerve fibers from C6.
- It contributes pure motor innervation to the latissimusdorsi muscle.
- The innervated muscle produces extension, rotation, and adduction of the arm.
- Damage to Thoraco dorsal nerve causes weakened arm pull-ups& adduction.

Q14: Suprascapular neuropathy:

- The typical patient is a young overhead athlete.
- Atrophy presents as supraspinatus and/or infraspinatus weakness.
- Activities that exacerbate symptoms include overhead motions and sports activities.

Q15: Axillar nerve injury

- One nerve injury is called mononeuropathy
- Numbness occurs over the outer shoulder
- Weakness occurs at shoulder abduction movement
- Some patients cannot bend arm at the elbow.
- Unable to raise the arm at the shoulder.

Q16: Radial nerve palsy can incorrectly suggest median and ulnar weakness because of a decreased ability to stabilize the thumb and wrist. To differentiate, clinicians can easily test:

- Thumb opponent movement
- Thumb adduction

Q17: Ulnar nerve provides sensation over:

- The entire fifth digit
- Medial half of the fourth digit
- The ulnar aspect of the palm.
- Ulnar nerve entrapment is the 2nd most common entrapment neuropathy in the UE.

Q18: When the ulnar nerve is divided at the wrist, the following muscles are still functioning:

- Opponenspollicis
- Superficial head of flexor pollicisbrevis
- Lateral two lumbricals

Q19: Enumerate two functional activities that patients with ulnar nerve palsy have difficulties with during daily activities?

- Opening a jar.
- Turning doorknobs

Q20:Symptoms of ulnar nerve entrapment can:

- Range from mild transient paresthesias to clawing of small and ring fingers
- The sensory changes can include numbness, tingling, or burning.
- The elbow area is probably the most common site of pain in an ulnar neuropathy.

Q21:Musculocutaneous nerve arises from the lateral cord of the brachial plexus:

- Its fibers being derived fromC5, C6 and C7
- It innervates the (coracobrachialis, biceps brachii, and brachialis)
- Musculocutaneous nerve could be compressed due to hypertrophy or entrapment between the brachialis and biceps brachii
- Musculocutaneous nerve entrapment may lead to a painless loss of muscle strength in elbow flexion and forearm supination.
- Weight lifting for long time could result in hypertrophy and nerve compression. Initial treatment should include avoidance of biceps curls or other biceps exercises.
- Isolated injury causes weakness of elbow flexion and forearm supination
- Sensory disturbance is present on the most radial side of the forearm. The biceps reflex is also affected.

Q22: Heavy backpacks can cause damage to the upper trunk of the brachial plexus: Dysfunction can be severe and prolonged with similar injuryas occurs with Erb's palsy from breech deliveries.

Q23: Median nerve is the most frequently injured nerve reported to the clinic.

- The median nerve receives fibers from roots C6, C7,C8,T1 and sometimes C5.
- Median nerve passes between the two heads of the pronator teresmuscle.
- Median nerve gives off the palmar cutaneous branch that supplies the skin of the central portion of the palm.
- Palmar digital branch of the median nerve supplies sensation to the lateral 3 ½ digits and the lateral two lumbricals.
- When median nerve is damaged, the ability to abduct and oppose the thumb may be lost due to paralysis of the thenar muscles. The deformity is called Ape hand deformity.

Q24: Median nerve injury makes the following ADL difficult or impossible:

- Brushing teeth
- Tying shoes and turning door knobs
- Writing and making phone calls

Q25: Carpal tunnel syndrome (CTS) is:

- Caused by compression of the median nerve as it passes under the carpal tunnel.
- The most needed test is nerve conduction velocity
- Physical diagnostic tests include the Phalentest andTinel'ssign

Q26: Describe skin wrinkle test used with nerve denervation?

- It offers a pain-free way to identify denervation of the fingers.
- After submersion in water for 5 minutes, normal fingers will become wrinkled whereas denervated fingers will not.

Q27:Compression of the median nerve at different levels of its course produces variable symptoms and/or syndromes. The areas are:

- Bicipitalaponeurosis also known as lacertus fibrosis
- Between the two heads of the pronator teres
- Compression at the carpal tunnel

Q28: Median nerve palsy is often caused by:

- Deep penetrating injuries to the arm, forearm or wrist
- Blunt force trauma
- Neuropathy

Q29: Median nerve palsy (MNP):

- High MNP involves lesions at the elbow and forearm areas.
- Low MNP involves lesions at the wrist.

Q30:Compression of the median nerve underneath the bicipitalaponeurosis:

- Reproduction of symptoms to the forearm is more likely to occur during elbow flexion of 120°- 130° degrees with the forearm in maximal supination.
- Is sometimes misdiagnosed with elbow strain, medial or lateral epicondylitis.

Results

A group of academics and students at the physical therapy program were interviewed to give their feedback regarding the interactive teaching- learning model purported to educate learners about brachial plexus injuries. About six academics with over than 10 years of academic experience have reported that the newly introduced model was greatly helpful in facilitating the educational process about brachial plexus injuries. About 90% of the students indicated that the interactive teaching- learning model was feasible and provided a sequential step by step approach for learning. About 10% indicated that they have some difficulties to extract information from different internet sources.

Discussion

The findings of this study showed that the interactive teaching- learning model is feasible but robust in educating learners. Most of academics reported that the interactive educational model was feasible and self-explanatory to learners. Academics added that the questions- answers format was interesting and sequentially guided learners to discuss different parts of brachial plexus. The interactive teaching- learning model can be administered by academics with different academic experiences at different academic settings. Academics should introduce the interactive teaching- learning model from early years of studying at college level to the last semester. Every academic should hold a series of training seminars and workshops to educate learners about different strategies to acquire information and facilitate understanding of the questions included. The interactive educational model facilitated the process of active learning among learners.[13,15] Learners confirmed that some questions needed a series of discussions and analyses to come up with an answer.[15] Moreover, questions that tested higher order thinking skills prompted learners to survey different academic websites.[15]Furthermore, active searching for reliable information was an essential skill needed by the majority of learners. Academics indicated that the blueprint matrix was fundamental in representing different topics at different educational levels.[11,14,16]In essence, the newly introduced teaching- learning model provides a paradigm shift in the way of educating students regarding sophisticated topics.

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