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Traumatic Brachial Plexus Root Avulsion with Pseudomeningocele Formation

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ABSTRACT

We report a case of a 29-year-old gentleman with history of motor bike accident leading to right -sided Cervical 4, Cervical 6 & Cervical 8 transverse process fracture. With clinical suspicion of brachial plexus injury, initial ultrasonography (USG) of neck was performed which revealed the diffuse edema, resolving hematoma along the right brachial plexus with pseudomeningocele formation. Subsequent Magnetic Resonance Imaging (MRI) of brachial plexus showed pseudomeningocele formation resulting from the avulsion of right C7 and C8 nerve roots. The aim of this report is to highlight the uncommon condition, report of key clinical findings and management strategies.

Keywords: Brachial plexus injury, MRI, Pseudomeningocele, USG

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INTRODUCTION

Brachial plexus is a major neuronal structure providing motor and sensory innervations to upper extremity.¹ Magnetic resonance imaging (MRI), computed tomography (CT) and ultrasonography (USG) are used for evaluation of brachial plexus pathology among which MRI is the imaging modality of choice due to its superior soft tissue resolution. Fall injuries from height and road traffic accidents (RTA) are the common condition

associated with injury of brachial plexus in our region. Diagnosing brachial plexus injury can be clinically challenging, thus needs evaluation with MRI. The most significant role of brachial plexus MRI in the background of trauma is to differentiate pre and post-ganglionic injury that has significant implication on patient management.² USG, though less used for evaluation of brachial plexus, can be helpful for rapid evaluation of suspected brachial plexus injury.³

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CASE REPORT

A 29-year-old gentleman with the history of motor bike accident was referred to the emergency department of our hospital after initial management at local hospital. He had history of loss of consciousness (LOC) for approximately 10 minutes after the trauma, but was conscious and oriented with Glasgow Coma Scale of 15 at presentation to the hospital. CT evaluation revealed bilateral pneumothorax, pneumomediastinum, elevated right hemidiaphragm probably due to palsy, right C4, C6 & C8 transverse process fracture, fracture of shaft of right femur and mild cerebral edema. Clinical examination revealed features of right brachial plexus injury for which patient was initially asked for USG of neck. Ultrasound revealed linear hypoechoic collections along the course of right brachial plexus and hematoma in right scalene muscle. (Figure 1) With the ultrasound findings, pseudomeningocele was suspected and MRI of right brachial plexus was then performed for its confirmation and detailed evaluation. In MRI, preganglionic injury of right brachial plexus was seen with heterogeneous high signal intensity along the course of right brachial plexus in supra and infraclavicular regions in T2 and fat suppressed images. Avulsion of right C7 and C8 nerve roots were seen with pseudomeningocele formation. (Figure 2)



Figure 1. Ultrasound showing tubular hypoechoic areas of fluid collection along right brachial plexus with resolving hematoma in intramuscular plane.

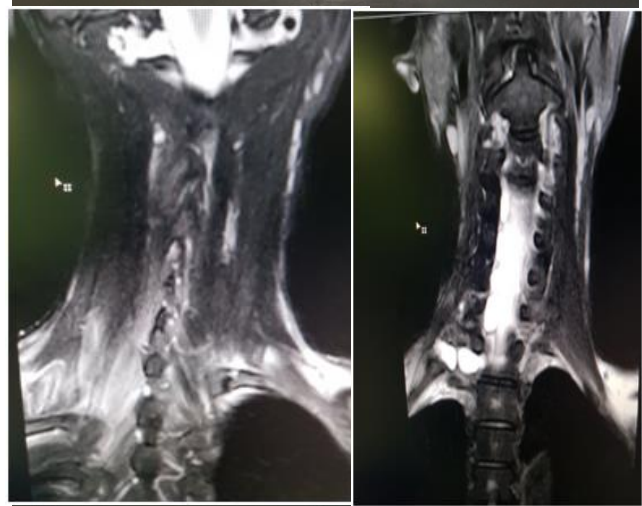


Figure 2 MRI showing avulsion of right C7 and C8 nerve roots with pseudomeningocele

High signal intensity was also seen in subcutaneous plane around the right shoulder and around right subclavian vessels, suggesting soft tissue injury. Due to extensive polytrauma, patient had a prolonged inpatient stay at the hospital. After his acute medical issues were resolved, he was transferred to physiotherapy and rehabilitation. Then, the patient was discharged from the hospital and asked for follow up reviews.

DISCUSSION

The brachial plexus provides motor and sensory innervations to the shoulder, chest, arm, forearm and hand of same side of the body. It is formed by anterior (ventral) branches of C5 to T1 nerve roots of the spinal cord which is separated anatomically into roots, trunks, divisions, cords and branches. These nerve roots unite to form three trunks. The trunks split into three anterior and three posterior divisions. These unite to form the three cords that further separate into five peripheral nerves.¹ The common causes of brachial plexus injuries are RTA, fall and birth injury; all of them stretch the brachial plexus leading to avulsion of the nerve roots and pseudomeningocele formation.⁴ The patients usually present as weakness or sensory changes along the distribution of the brachial plexus to the same side of the involved injury. Headache (positional) can also occur following traumatic brachial plexus injury which is related to pseudomeningocele formation and meningeal irritation from blood within CSF.⁵

Brachial plexus injuries can be divided into pre-ganglionic and post-ganglionic lesions. The pre-ganglionic lesions are avulsion of the nerve roots at their origin while postganglionic lesions may be lesions in continuity or nerve ruptures. The patient may have a permutation of both pre and postganglionic lesions⁶

MRI is considered as the investigation of choice for assessing brachial plexus injury and helps to differentiate pre and post ganglionic injury which dictates for prompt further management and knowing the prognosis of the condition. Complete imaging of brachial plexus needs focused multiplanar and multisequence MRI with scanning coverage of C4-T2 level and axilla. Due to the oblique course of brachial plexus, interpreting brachial plexus structures requires oblique sagittal and coronal sequences.

On MRI, the nerve roots and cord show homogeneous T2 low signal intensity. Features of root avulsion on MRI may be pseudomeningocele, absence of nerve roots at their presumed site and altered signal intensity within the spinal cord at same level. Pseudomeningocele although highly

indicative of nerve root avulsion, is not pathognomonic.⁷ Pseudomeningocele is an expansion of the CSF filled space containing the nerve root within the neural foramen that may extend peripherally into the paraspinal soft tissue as seen in our case. It may be associated with abnormal contour of the dura within the central spinal canal⁶

Post-traumatic pseudomeningoceles are often seen in cervical spine secondary to high-energy trauma mostly a traction injury as in our case. Paraspinal muscles enhancement due to disruption of the nerve supply to the muscles is another supporting finding for root avulsion injury. In post-ganglionic injury, the nerve roots, although identifiable at the origin from spinal cord, are indistinct distally. Fluid collections around the ruptured nerves, thickening of the nerves with fibrosis and denervation of adjacent muscles are other features of post-ganglionic rupture.⁸ USG has been little used for brachial plexus injury evaluation. Evaluation of preganglionic injury may be limited with pseudomeningocele, however, it can show pseudomeningocele, which indirectly may indicate root avulsion as in our case. USG has definite advantage in evaluation of post-ganglionic roots, given the sound ultrasound anatomy of the brachial plexus. It has better definition of nerve roots, trunks and cords as compared to the MRI. Also, its dynamic character makes it superior to MRI in brachial plexus evaluation.³

Management in patients in high energy traumas should always follow ATLS protocol and patients should remain in cervical spine precautions. Once brachial plexus injuries are identified the aim should be to improve function. Post ganglionic injuries have a favorable prognosis as the anterior horn cells in the spinal cord persists. Therefore, if continuity is established with surgery then chance of recovery can be improved. In patients with pre-ganglionic injuries such as root avulsions, nerve transfers are required as the cell bodies of the native motor neurons have receded.⁶

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