# Immediate brachial plexus injury following freestyle swimming: A rare case report

*By* Tasya Meidy Pradhana

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# Immediate brachial plexus injury following freestyle swimming: A rare case report

Tasya Meidy Pradhana[1], Yusak Mangara Tua Siahaan[1,2]

[1] Department of Neurology, Siloam Hospital Lippo Village, Tangerang, Banten, Indonesia

[2] Department of Neurology, Faculty of Medicine, Pelita Harapan University, Tangerang, Banten, Indonesia

Tasya Meidy Pradhana **ORCID ID:** 0009-0009-8709-1737

*Corresponding author:*
Tasya Meidy Pradhana
*E-mail* : tasyameidy12@gmail.com

## ABSTRACT

**Background.** Brachial plexus injury (BPI) is a serious condition affecting the upper extremity's motor and sensory functions. While most BPIs are caused by high-energy trauma, this case highlights an uncommon cause: freestyle swimming, which can induce strain on the brachial plexus.

**Case reports.** A 60-year-old female presented with acute right upper extremity weakness after a freestyle swimming session. Examination revealed flaccid paralysis, diminished reflexes, and sensory deficits in the C5-C6 dermatome. Motor testing showed supraspinatus and infraspinatus dysfunction. Electromyography, nerve conduction studies, and MRI confirmed upper trunk BPI with denervation and nerve injury signs.

**Conclusions.** While commonly linked to high-energy trauma, repetitive motions in freestyle swimming, such as shoulder abduction and external rotation, can overstretch the brachial plexus, leading to inflammation and upper trunk injury. Early diagnosis and a multidisciplinary approach are essential for adequate recovery.

**Keywords:** brachial plexus injury, freestyle swimming, upper trunk injury**,** swimming-related injuries

**Abbreviations**:

| | |
|---|---|
| BPI | Brachial Plexus Injury |

| | |
|---|---|
| MRI | Magnetic Resonance Imaging |
| MRC | Medical Research Council |
| EMG | Electromyography |
| NCS | Nerve Conduction Studies |
| PSW | Positive Sharp Waves |
| Fibs | Fibrillation Potentials |
| MUAP | Motor Unit Action Potential |
| BMI | Body Mass Index |
| NR | No Response |
| STIR | Short-Tau Inversion Recovery |
| ROM | Range of Motion |

## INTRODUCTION

The brachial plexus is a complex network of nerve fusions and divisions arising from the cervical and upper thoracic nerve roots (C5-T1), which ultimately branch into peripheral nerves that innervate the muscles and skin of the shoulder and arm [1]. Brachial plexus injury (BPI), although relatively uncommon, involves direct damage to this neural network, resulting in motor weakness ranging from weakness to paralysis, pain, and sensory disturbances. Brachial plexus injuries significantly impact individuals' physical, psychological, and socioeconomic well-being, creating substantial social and economic challenges [2,3]. Studies have shown that motorcycle accidents are the leading cause of BPI, accounting for 64.3% of cases, followed by car accidents, falls, assaults, bicycle accidents, run-over incidents, and obstetric-related injuries. Other causes, though less common, include injuries from knives, rifles, and collapsing walls. These events typically involve significant force, leading to traction or compression of the nerves in the brachial plexus [3–6].

However, the occurrence of BPI in low-impact and seemingly innocuous activities is rare and often unexpected. However, BPI can also occur in low-impact and seemingly innocuous activities, which are rare and often unexpected. One illustrative example is swimming, specifically freestyle swimming, which is not conventionally associated with the high forces typically required to induce such injuries. This unusual context underscores the wide range of situations that can result in these types of injuries. Identifying and examining these rare occurrences is vital for accurate diagnosis and increasing awareness among both clinicians and patients regarding the associated risks. This report describes a case of brachial plexus injury that occurred immediately during

freestyle swimming, offering an analysis of its mechanism, clinical presentation, and potential management strategies.

## CASE REPORT

A 60-year-old female presented with sudden right upper extremity weakness following her second 30-minute freestyle swimming session. She had no prior history of regular swimming. The weakness, accompanied by numbness in the right shoulder, upper arm, and forearm, persisted for 14 days before she sought medical attention. By the time of her neurology consultation, she also reported pain in the right shoulder and lateral arm. Notably, she denied any history of trauma, flu-like symptoms, diabetes, malignancy, radiation exposure, recent vaccination, or febrile illness.

The patient was alert during the physical examination and had a normal body mass index (BMI). Motor examination revealed flaccid paralysis of the right shoulder girdle and proximal arm muscles. Strength testing using the Medical Research Council (MRC) scale demonstrated severe weakness in shoulder abduction, external rotation, internal rotation, and elbow flexion, all graded 1/5. The active and passive range of motion for wrist and finger flexion and extension were within normal limits. Reflexes showed diminished biceps and brachioradialis reflexes on the right, with intact triceps reflex. Sensory loss was noted along the C5-C6 dermatomes. The cranial nerve examination and autonomic function were normal.

Diagnostic studies revealed significant findings. Brain MRI showed no intracranial haemorrhage or infarction. Cervical MRI indicated a bulging disc without nerve root compression. Right shoulder ultrasonography was normal. Laboratory tests, including complete blood count and inflammatory markers, were normal. Brachial plexus MRI showed thickening and oedema in the upper trunk, division, cord, and branches, with denervation changes in associated muscles. (Figure 1) Nerve conduction studies (NCS) demonstrated severe motor dysfunction, with no response in the right axillary and musculocutaneous motor nerves and sensory nerve involvement in the upper trunk of the brachial plexus. Needle EMG showed active denervation with PSWs, fibrillations in the biceps and infraspinatus, and no MUAPs in these muscles. (Table 1)

Management involved a multidisciplinary approach. Treatment began with high-dose intravenous methylprednisolone for 5 days, followed by a 2-week oral taper. Neuropathic pain was treated with gabapentin and pregabalin. Intensive physiotherapy focused on maintaining ROM and preventing muscle atrophy, with sessions twice daily for 1 week, then three times weekly outpatient. At 2 months, motor strength improved to 3/5, pain resolved, and sensory deficits reduced. Physiotherapy was adjusted to twice weekly to support recovery.

## DISCUSSION

Brachial plexus injury is a pathological disruption of the nerve network controlling motor and sensory functions of the upper extremity, often resulting in profound disability, impaired functional capacity, and substantial socio-economic and psychological burdens requiring extensive rehabilitation and adaptation [3,7,8]. The incidence of BPI in the general population is relatively low, ranging from 0.17 to 1.6 cases per 100,000 annually [5,8].

A 60-year-old female developed sudden right upper extremity weakness after her second freestyle swimming session. Physical examination revealed flaccid paralysis, reduced reflexes, and sensory deficits in the right C5-C6 dermatome, suggesting a lower motor neuron issue. Motor testing showed 1/5 strength in the supraspinatus (shoulder abduction) and infraspinatus (external rotation), indicating significant motor dysfunction, consistent with an upper trunk BPI, which can cause a "waiter's tip" posture, caused by paralysis of muscles responsible for shoulder abduction and external rotation [1–3,9].

Diagnosis of BPI was confirmed through EMG, NCS and MRI, which are crucial for assessing the injury's extent and providing insights into the structural damage, severity, and exact location [10,11]. Electromyography revealed denervation signs in the biceps, deltoid, and infraspinatus muscles, indicating active nerve injury, and NCS showed no sensory response in the lateral antebrachial cutaneous nerve and reduced responses in the median nerve, confirming BPI. Imaging with MRI confirmed the diagnosis, showing thickening and edema in the right brachial plexus and denervation changes in several muscles. These findings collectively support the diagnosis of an upper trunk BPI.

Traumatic BPIs, typically caused by high-energy mechanisms such as motorcycle accidents, predominantly affect young adult males and are the most frequently encountered type [3–5,8]. However, although less common, BPI can also result from low-energy mechanisms, as illustrated in this case. Several case reports have identified swimming, particularly in competitive swimmers [12,13], as a potential cause of lower trunk brachial plexus injury. However, to our knowledge, this is the first documented case of freestyle swimming inducing an upper trunk brachial plexus injury, with symptoms emerging only after the second session of a 30-minute swimming routine. Freestyle swimming poses a unique risk to the brachial plexus due to its biomechanical demands, particularly the repetitive, forceful abduction and external rotation of the shoulder. The overhead positioning during hand entry and the sweeping motion following an S-shaped pattern generate significant traction forces, especially when combined with lateral neck

flexion caused by arm extension or body rotation [7,12]. The C5-C6 roots of the brachial plexus are particularly vulnerable during extreme arm movements [7,14] , as they pass through narrow anatomical spaces and are subject to excessive tension when the arm is raised. These repetitive forces can overstretch the upper trunk (C5-C6) of the brachial plexus, leading to oedema, inflammation and, eventually, injury.

Managing BPI is challenging due to the absence of standardized treatment protocols. A multidisciplinary approach is often used, including pain management, therapy, and surgery if no improvement occurs after 6-12 months or if severe injury is confirmed [9,15,16]. In this case, symptoms within one month and no structural damage on MRI warranted conservative management. Treatment involved high-dose methylprednisolone for 5 days, tapered over 2 weeks, to reduce inflammation and nerve oedema, thereby supporting nerve recovery [17,18]. Early physical therapy targeted shoulder abduction and external rotation to restore muscle strength and prevent atrophy [19,20]. At 2 months, the patient showed improved motor strength (3/5), resolved pain, and reduced sensory deficits, emphasizing the value of early intervention and multidisciplinary care in acute BPI.

## CONCLUSION

This case demonstrates that brachial plexus injury (BPI) can result from low-energy activities like freestyle swimming, which strains the brachial plexus, particularly the upper trunk. While BPI is typically linked to high-energy trauma, this case shows that moderate activities can cause significant injury. Early diagnosis through electromyography, nerve conduction studies, and MRI is essential for proper treatment. Conservative treatment with corticosteroids and physical therapy led to significant improvement in two months. This case underscores the need for a multidisciplinary approach, including timely intervention, pharmacological treatment, and rehabilitation, even for low-energy trauma.

**Patient consent:** The patient gave written informed consent from the publication of the clinical details and/or clinical images

**Conflict of interest.** None

**Authors' contributions:** Conceptualizations, TMP and YMTS; Formal analysis, investigation, resources, TMP and YMTS; Writing – original draft preparation, TMP, Writing – review and editing, TMP and YMTS; Supervision, YMTS. All authors have read and agreed to the published version of the manuscript.

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## FIGURES, TABLES AND SCHEMES

### TABLES

**Table 1.** Summary of electromyography of the patient's right upper extremity.

| Side | Muscle | Nerve | Root | Insertional Activity | Fibs | PSW | Amp | Polyphasic MUAP | Recruitmen Pattern | Interference Pattern |
|---|---|---|---|---|---|---|---|---|---|---|
| Right | 1st Dorsal Interossei | Ulnar | C8-T1 | N | None | None | N | 0 | N | N |
| Right | Deltoid | Axillary | C5-6 | N | None | **1+** | N | 0 | N | N |
| Right | Biceps | Musculocutaneous | C5-6 | N | 2+ | **4+** | N | 0 | N | **No MUAP** |
| Right | Extensor Digitorum | Radial | C7-8 | N | None | None | N | 0 | N | N |
| Right | Flexor carpi radialis | Median | C6-7 | N | None | None | N | 0 | N | N |
| Right | Infraspinatus | Suprascapular | C5-6 | N | None | **4+** | N | 0 | N | **No MUAP** |
| Right | Rhomboid Major | Dorsal Scapular | C5 | N | None | None | N | 0 | N | N |

Fibs : Fibrilation Potentials, PSW : Positive Sharp Waves, MUAP : Motor Unit Action Potential

### FIGURES

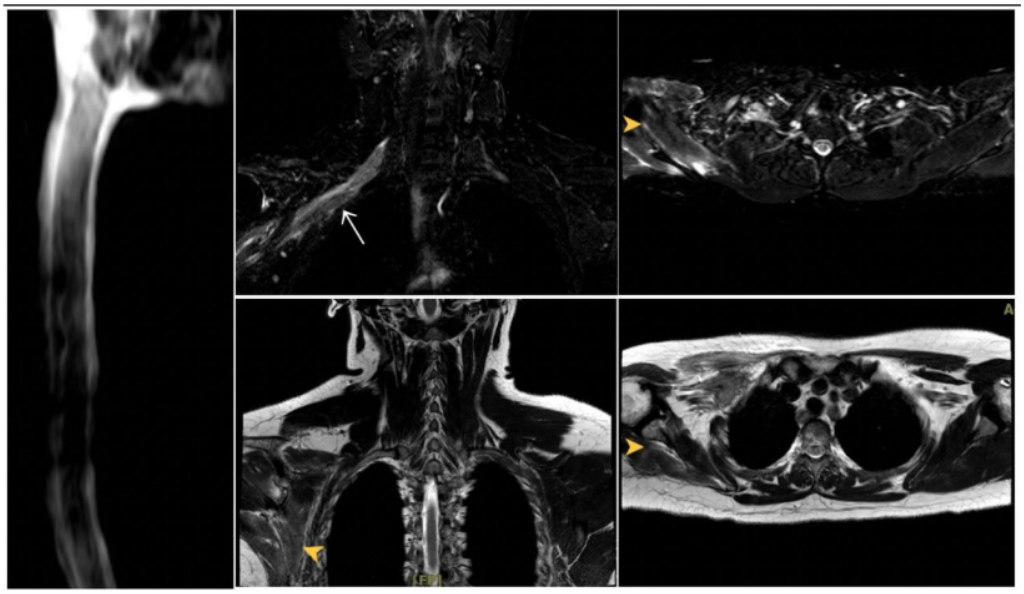

**Figure 1.** Coronal and axial T2W, STIR, and MR-myelography images reveal edema and thickening of the right brachial plexus at the trunk, division, cord, and branches (arrow). Hyperintensity and atrophy in the subscapularis, supraspinatus, infraspinatus, and short head of the biceps brachii muscles indicate denervation changes (arrowhead).