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# Traumatic Cervical Spinal Subdural Hematoma and Peripheral Nerve Injury with Complete Right Upper Extremity Monoplegia: A Rare Case

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**Abstrak:**
**Pendahuluan**: Hematoma subdural servikal (*cervical SDH*) merupakan kondisi neurologis yang jarang terjadi, tetapi dapat memperburuk tetraparesis serta cedera pleksus brakialis ipsilateral, yang keduanya menyebabkan defisit neurologis yang signifikan. Kehadiran hematoma subdural pada tulang belakang servikal memperumit perjalanan klinis dan memerlukan evaluasi segera. Interaksi antara *cervical SDH* dan cedera pleksus brakialis (PBI), yang sering dikaitkan dengan trauma, terapi antikoagulan, atau gangguan perdarahan spontan, sangat penting untuk diagnosis dan penatalaksanaan yang tepat. Intervensi multidisiplin yang cepat menjadi kunci dalam mendukung pemulihan neurologis secara optimal. **Penyajian Kasus**: Seorang laki-laki berusia 16 tahun mengalami cedera otak traumatik ringan setelah kecelakaan sepeda motor dengan kecepatan tinggi. Pasien mengalami laserasi di regio temporoparietal kanan, multiple abrasi, serta nyeri pada siku. **Kesimpulan**: Penatalaksanaan seorang remaja laki-laki berusia 16 tahun dengan hematoma subdural akibat kecelakaan sepeda motor melibatkan prosedur laminotomi, yang merupakan intervensi krusial dalam pemulihan neurologis.
**Kata kunci:** Cedera pleksus brakialis; Defisit neurologis; Hematoma subdural; Laminotomi

**Abstract:**
**Introduction:** Cervical subdural hematoma (SDH) is a rare but life-threatening condition that can cause severe neurological deficits, including tetraparesis and brachial plexus injury (BPI). It is most often trauma-related and requires prompt diagnosis and surgical intervention to prevent permanent damage. This study presents a rare pediatric case and highlights the importance of early recognition and coordinated management to optimize neurological recovery. **Case Presentation:** A 16-year-old male presented with neck pain and right upper limb monoplegia following a high-speed motorcycle accident. Initial injuries included a temporoparietal laceration and multiple abrasions. MRI revealed a cervical SDH compressing the spinal cord at C5–C6, correlating with brachial plexus dysfunction. Surgical decompression via C5–C6 laminotomy and hematoma evacuation was performed within 48 hours. Postoperative recovery was supported by targeted neurorehabilitation and electrodiagnostic evaluation. **Conclusion:** This case emphasizes the critical role of early MRI-based diagnosis and timely laminotomy in managing traumatic cervical SDH, particularly in pediatric patients. Prompt surgical decompression significantly improves the chances of neurological recovery and functional restoration in cases complicated by brachial plexus injury.
**Keywords:** *Brachial plexus injury; Laminotomy; Neurological deficit; Subdural hematoma*

## 1. Introduction

Cervical subdural hematoma (SDH) is a rare but serious clinical condition characterized by bleeding between the dura mater and the arachnoid mater, often secondary to trauma (1). It is classified by onset into acute (within 3 days), subacute (4–21 days), and chronic (after 21 days) forms (2). While trauma remains the most frequent cause, other etiologies include spontaneous bleeding, anticoagulant use, and vascular malformations (3). The accumulation of blood in the spinal subdural space exerts a mass effect on the spinal cord, potentially leading to spinal cord injury (SCI), which may result in permanent neurological deficits if not recognized and treated promptly.

SCI itself is a devastating complication of spinal trauma, resulting from mechanical compression or disruption of spinal cord tissue (4). Four primary mechanisms of injury are described: impact with sustained or temporary compression, disruption, and laceration or tearing of spinal tissues (5,6). Diagnosis relies on thorough clinical evaluation and imaging studies, with magnetic resonance imaging (MRI) being the modality of choice for detecting spinal hemorrhages, including subdural, epidural, subarachnoid, and intramedullary bleeding (7). Laboratory findings may support the diagnosis in chronic cases by indicating consumptive coagulopathy (8).

MRI provides superior visualization of hematoma location and extent, which is critical for surgical decision-making. Subdural hematomas typically appear with a concave contour, exerting pressure on the spinal cord. Differentiating these from other types of hemorrhage, such as subarachnoid or intramedullary, is essential for appropriate management (9,10). Early diagnosis using MRI allows timely intervention, such as decompressive surgery, to prevent irreversible cord damage. Laminotomy or laminectomy may be considered based on hematoma location and severity (11,12).

Brachial plexus injury (BPI) further complicates the clinical picture in young trauma patients. The brachial plexus, originating from C5–T1 nerve roots, controls upper limb function and is highly susceptible to trauma, especially from high-speed accidents (13,14). BPI is classified into neuropraxia, axonotmesis, and neurotmesis, with varying degrees of nerve damage and recovery potential (15,16). In Indonesia, motorcycle accidents are a leading cause of BPI in young males (17). Severe traction injuries may cause preganglionic root avulsion, often resulting in irreversible motor loss (18). Axonal regeneration is limited by secondary complications such as fibrosis and neuroma formation (19,20).

Accurate diagnosis of BPI involves a combination of clinical assessment, imaging—particularly MRI and CT myelography—and electrodiagnostic studies (21–25). MRI neurography (MRN) offers detailed fascicular imaging but is limited by accessibility and cost (23). Electrophysiological tests like EMG and sensory nerve action potentials (SNAP) are crucial for assessing injury severity and surgical candidacy (24,25).

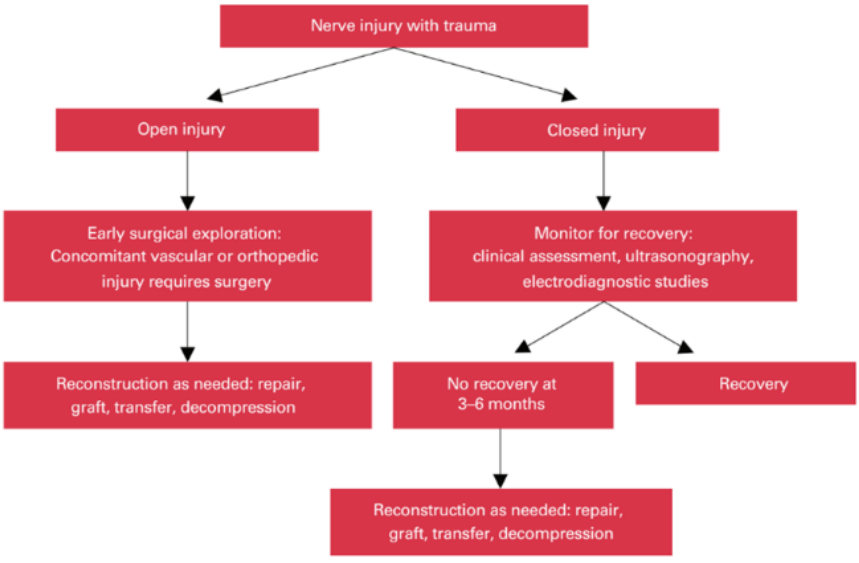



**Figure 1.** Management of nerve injury with trauma

Treatment prioritizes early stabilization, followed by rehabilitation to prevent joint contracture and manage neuropathic pain (26,27). Occupational therapy plays a central role in restoring function. In severe cases or when spontaneous recovery is unlikely, early surgical exploration, within 2–3 weeks for closed injuries, is recommended to optimize outcomes (28). A delay in surgical intervention beyond 3 months significantly worsens prognosis (29,30). Common complications include chronic pain, persistent weakness, and poor nerve regeneration due to neuromas (31). Therefore, a multidisciplinary approach combining surgical management and long-term rehabilitation is essential (32,33). This case report underscores the importance of rapid diagnosis and surgical intervention in cervical SDH, especially in pediatric and adolescent trauma patients. Early recognition and management are critical to minimizing long-term disability and improving neurological recovery in this rare and complex clinical scenario.

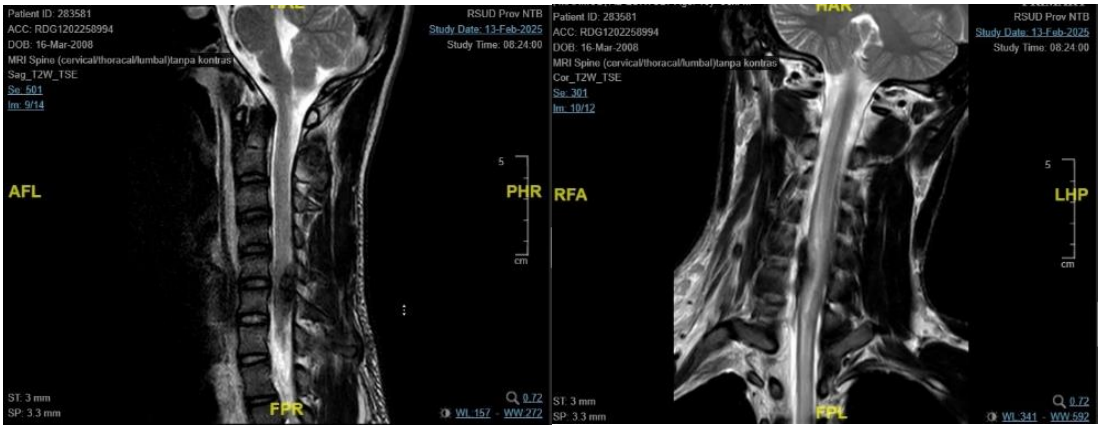
## 2. Case Presentation

Mr. M, a 16-year-old male, presented to the emergency department following a high-speed motorcycle accident on February 8, 2025, at approximately 16:00 WITA. He was a passenger on the motorcycle involved in a chain-reaction collision, initiated when the vehicle ahead braked suddenly, causing a car behind to crash into the motorcycle. He was initially treated at the Kopang Health Center and subsequently referred to our hospital with complaints of neck pain and inability to move his right arm. The patient had no prior history of hypertension, diabetes, or malignancy, nor any relevant family history. He denied smoking or alcohol use. After the accident, Mr. M experienced neck and right arm pain, rated 5/10 on the Visual Analog Scale (VAS), along with complete motor loss in the right upper limb. He reported a brief loss of consciousness but retained full memory of the incident. On arrival, his vital signs were stable: blood pressure 129/72 mmHg, heart rate 69 bpm, and respiratory rate 20 breaths per minute. The neurological assessment revealed a Glasgow Coma Scale (GCS) score of 14/15, isocoric pupils with normal light reflexes, right upper extremity monoplegia, and hypoesthesia in the C5–C8 dermatomes.

The initial diagnosis included cervical subdural hematoma at the C5-C6 level, resulting in significant compression of the spinal cord and disturbances in peripheral nerve function, including a suspected brachial plexus injury on the right. Additionally, the patient was diagnosed with multiple excoriation wounds and laceration wounds on various parts of his body. CT and MRI imaging illustrated in **Figure 2** confirmed the diagnosis.

The MRI revealed an extramedullary intradural lesion measuring 1 × 0.7 × 2.6 cm on the right side at the C5-C6 level, which caused significant compression of the spinal cord and edema. The lesion appeared isointense on T1-weighted images (T1WI) and hypointense on T2-weighted images (T2WI). It also caused a partial obstruction of cerebrospinal fluid (CSF) flow and hydrosyringomyelia extending from C1 to C5. MRI of the right brachial plexus showed tears/ruptures in the superior and middle trunks, although evaluation was limited due to the image quality.

**Figure 3** ilustrate the surgical procedure consisting of C5-C6 laminectomy and subdural hematoma evacuation was performed to reduce spinal cord compression. The operation was completed without complications. Postoperative pathological examination confirmed spinal subdural hematoma with areas of extensive necrosis, hemorrhage, and lymphocytic infiltration, which supported the decision for surgical intervention. Following the surgery, the patient was closely monitored in the recovery room, and medical interventions included the administration of intravenous fluids, neuroprotective drugs, and mannitol to manage cerebral edema. Postoperatively, the patient exhibited tetraparesis and a right-sided brachial plexus injury, in addition to the subdural hematoma at C5-C6. Despite intensive management, the prognosis for functional recovery remained uncertain due to the extensive nerve damage. The patient was scheduled for follow-up examinations and medical rehabilitation to restore motor and sensory function. Over the next few weeks, the patient reported a reduction in headache and anxiety, although motor weakness in the right extremity persisted. Neurological evaluations and MRIs continued to monitor nerve recovery. The patient was advised to follow a rehabilitation program to improve his functional abilities after the severe injury he sustained.

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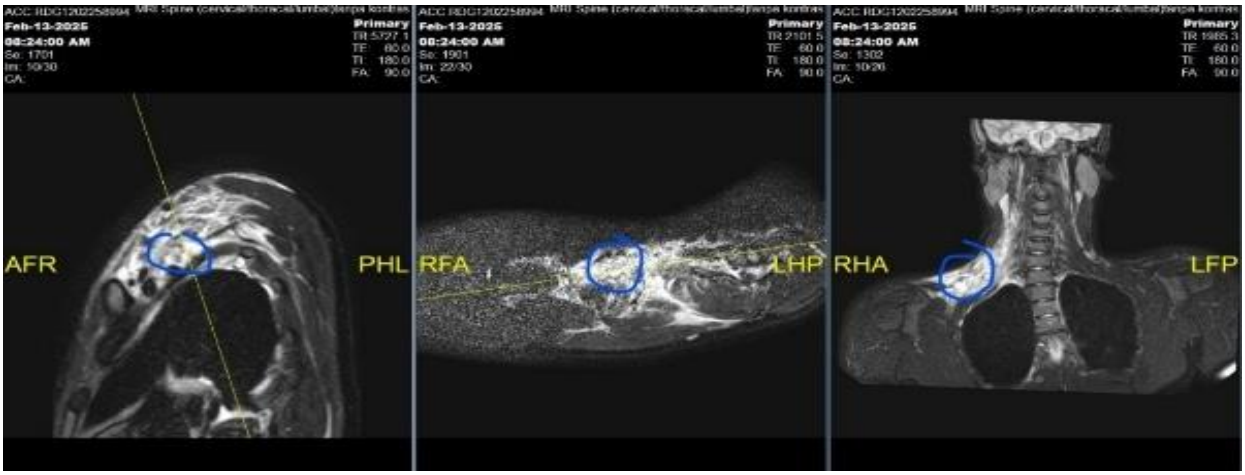



c

**Figure 2**. Magnetic Resonance Imaging (MRI) examination on 12th February 2025.
(a) Sagittal T2-weighted MRI of the cervical spine demonstrating a subdural hematoma compressing the spinal cord at the cervical level, contributing to neurological deficits including tetraparesis.
(b) Coronal T2-weighted MRI of the cervical spine highlighting the extent and lateral spread of the subdural hematoma, aiding in the evaluation of spinal cord displacement and involvement of adjacent structures.
(c) Coronal STIR MRI of the left brachial plexus (plexus brachialis sinistra) showing hyperintense signal changes consistent with brachial plexopathy, correlating with the patient's left-sided upper limb weakness and sensory loss.

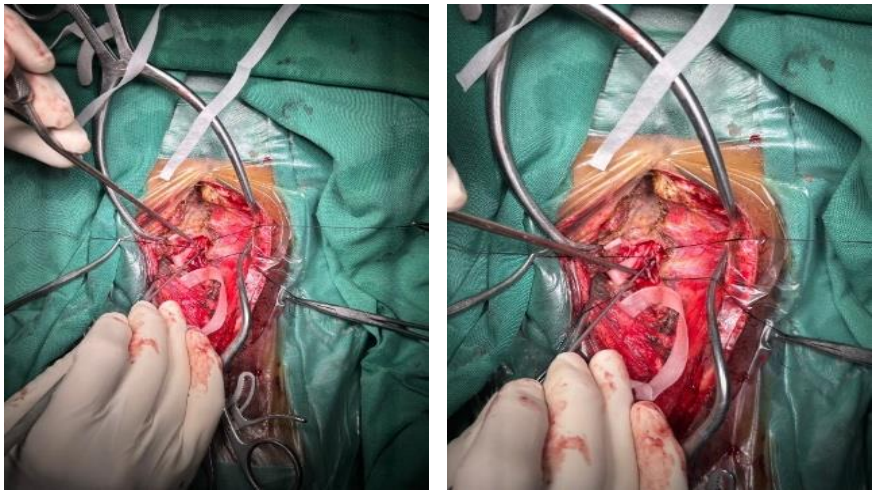


**Figure 3**. Durante operation

## 3. Discussion and Conclusions

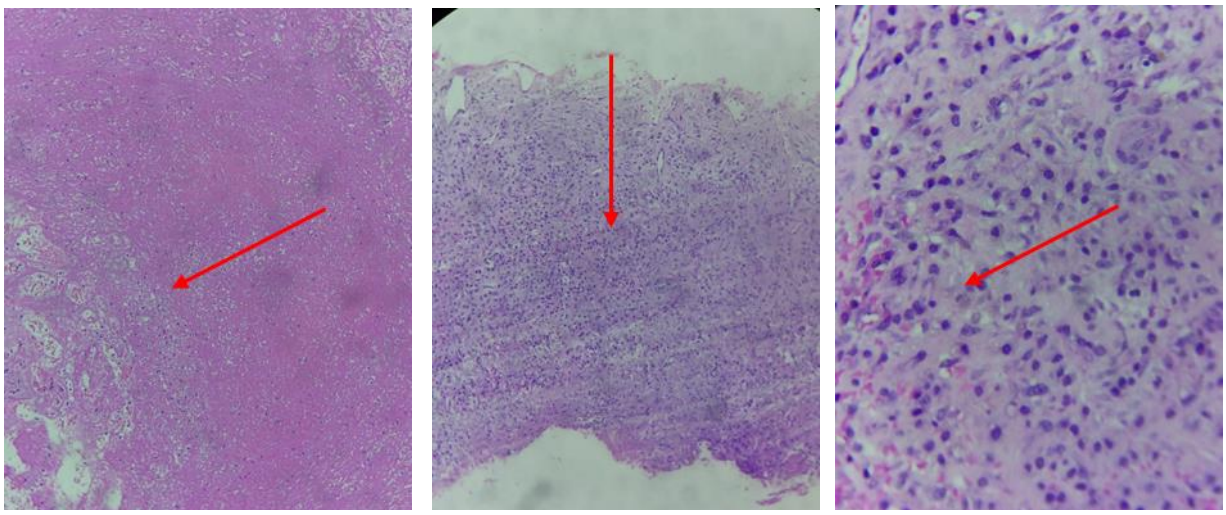
A case study was conducted on Mr. M, a 16-year-old male with traumatic cervical subdural hematoma (SDH) and peripheral nerve injury resulting in complete monoplegia of the right upper extremity. Cervical SDH is a serious but rare complication following traumatic spinal cord injury. Its presence can lead to significant neurological

disturbances, such as tetraparesis, due to compression of the spinal cord structures. The mass effect of the hematoma exacerbates ischemia and inflammation, worsening the patient's neurological condition. Therefore, early recognition and immediate surgical intervention are crucial to reducing permanent damage and improving patient recovery.

The decision to perform C5-6 laminotomy and subdural hematoma evacuation was based on MRI findings, which accurately determined the location of the hematoma and correlated with the patient's clinical symptoms (11). MRI is the imaging modality of choice because it is sensitive in detecting subdural hematomas in both acute and chronic phases, compared to computed tomography (CT) (12). Early detection through MRI enables timely surgical decisions that can reduce permanent neurological deficits (11,12).

Surgical evacuation of subdural hematomas is the primary treatment for spinal SDH, reducing spinal cord compression and restoring nerve function (13,14). Laminotomy was chosen because it provides direct access to the subdural space with a lower risk of additional spinal trauma compared to laminectomy, which can risk destabilizing the spine (15). Surgical intervention within the first 24-48 hours after injury can improve neurological outcomes, while long-term rehabilitation is crucial for full recovery (22,23).

This case became more complex due to the presence of a brachial plexus injury, which also contributed to dysfunction of the upper extremity (16). Differentiating between disturbances caused by spinal cord compression and peripheral nerve injury is crucial. Electrophysiological tests such as nerve conduction studies (NCS) and electromyography (EMG) are important for evaluating brachial plexus injury and planning appropriate rehabilitation (17,18). Postoperative rehabilitation is critical for improving neurological recovery, especially for patients with SCI and brachial plexus injuries. A multimodal approach, including physical therapy, occupational therapy, and functional electrical stimulation, is essential to accelerate motor recovery and enhance functional independence (10,19,20).The prognosis for neurological recovery after cervical hematoma evacuation heavily depends on the timing of surgical decompression and the presence of brachial plexus injury, which may prolong the recovery process (21). Surgical intervention within the first 24-48 hours after injury can improve neurological outcomes, while long-term rehabilitation is crucial for full recovery (22,23).



(a) (b) (c)

**Figure 4**. Postoperative histopathological examination of the evacuated cervical subdural hematoma.
(a) Macroscopic view of the hematoma specimen showing a brownish, solid, and elastic mass consistent with organized subdural hematoma tissue, indicating chronicity and possible repeated hemorrhagic events.
(b) Microscopic examination (H&E stain, low magnification) revealing extensive areas of coagulative necrosis and diffuse hemorrhage, supporting the diagnosis of a subdural hematoma with significant tissue damage.
(c) Higher magnification microscopy highlighting focal infiltration of lymphocytic inflammatory cells, suggesting a chronic inflammatory response and further justifying the need for surgical intervention

The macroscopic examination of the hematoma revealed a brownish color with a solid and elastic consistency, with the entire sample processed in a single cassette. Microscopic analysis revealed extensive areas of necrosis accompanied by significant hemorrhage, as well as infiltration of lymphocytic inflammatory cells in several focal areas. Based on these findings, the final diagnosis confirmed the presence of a spinal subdural hematoma, which required surgical intervention due to the extent of necrosis and significant inflammatory response.

This rare case demonstrates the importance of early MRI diagnosis and timely surgical evacuation in cervical SDH to prevent permanent neurological damage. It also highlights the need to differentiate spinal cord from peripheral nerve injuries, using imaging and electrophysiological tests to guide treatment. Laminotomy offers a safer surgical option, and individualized, multimodal rehabilitation is essential for recovery. Early intervention and comprehensive care are key to improving outcomes in similar complex cases.

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**Author Contributions:** Iqbal Muhammad: Conceived and designed the case study, performed the surgery, and wrote the manuscript. Bambang Priyanto: Performed the surgery, assisted in patient management, and reviewed the manuscript. All authors have read and agreed to the published version of the manuscript.

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**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**List of Abbreviations**

| | |
|---|---|
| *SCI* | Spinal Cord Injury |
| *MRI* | Magnetic Resonance Imaging |
| *CT* | Computed Tomography |
| *CSF* | Cerebrospinal Fluid |
| *BPI* | Brachial Plexus Injury |
| *NCS* | Nerve Conduction Studies |
| *EMG* | Electromyography |
| *VAS* | Visual Analog Scale |
| *GCS* | Glasgow Coma Scale |
| *T1WI* | T1-weighted Imaging |
| *T2WI* | T2-weighted Imaging |

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