Acute Subdural Hematoma Management in the Emergency Department


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Abstract
Acute subdural hematoma (ASDH) is a serious and potentially life-threatening condition that requires prompt and effective management in the emergency department (ED). This review article aims to provide an overview of the current evidence-based management strategies for ASDH in the ED setting. The article begins by discussing the pathophysiology of ASDH, emphasizing the rapid accumulation of blood between the dura mater and the arachnoid membrane following a traumatic brain injury. This can lead to increased intracranial pressure and potentially fatal brain herniation if not promptly addressed. The review then outlines the initial assessment and resuscitation of patients with suspected ASDH in the ED. The article then delves into the specific management strategies for ASDH in the ED, including the role of neurosurgical consultation, and the potential need for emergent surgical intervention to evacuate the hematoma and relieve pressure on the brain. In conclusion, this review article provides a comprehensive overview of the current evidence-based management of ASDH in the ED, emphasizing the importance of prompt recognition, accurate diagnosis, and timely intervention to optimize patient outcomes.

Keywords: ASDH, SDH, ED, management, surgical intervention

Introduction
Acute subdural hematoma is a serious medical condition characterized by the accumulation of blood between the brain and its outermost protective covering. This condition typically occurs as a result of a traumatic head injury, such as a fall or a car accident, where there is a rupture of blood vessels [1]. In other words, subdural hematomas are extra-cerebral collections of blood, either liquid or clotted, that occur between the subarachnoid layer and the dura matter. This hematoma doesn't result in the growth of the area of subarachnoid. This hematoma's cause is trauma almost always. Hematomas result in an accumulation that will cause the material to compress localized neurological manifestations and the brain. Additionally, it results in an elevation of intracranial pressure (and its
hematomas are mostly dependent on the interval between the resulting in injury and the start of clinical indications of indications. Subdural hematomas are categorized as follows: 1) Acute subdural hematoma: Clinical indications of it may appear and symptoms appear three days after trauma, 2) Subacute subdural hematoma: Clinical indications of it may appear first and symptoms appear from 4 to 21 days after the injury, 3) Chronic subdural hematoma: The beginning of clinical symptoms of it appear more than 21 days after injury [3]. The rapid accumulation of blood puts pressure on the brain, leading to potentially life-threatening complications if not promptly treated. Without prompt medical intervention, acute subdural hematoma can cause neurological deficits, such as severe headache, confusion, and loss of consciousness. As the pressure builds up, it can compress vital structures in the brain, leading to paralysis, seizures, or even coma. Emergency surgical intervention is often necessary to remove the accumulated blood and relieve the pressure on the brain, increasing the chances of a successful recovery. Early recognition and immediate medical attention are crucial in improving the prognosis and preventing long-term complications [4]. If left untreated, an intracranial hemorrhage can have devastating consequences. The longer the bleeding persists, the higher the risk of permanent brain damage or death. Therefore, prompt diagnosis and intervention are essential. Once the bleed is stopped and the pressure is relieved, rehabilitation therapy may be required to help the patient regain lost functions and improve their quality of life. With timely and appropriate medical care, many individuals can recover and resume their normal activities [5]. Among the intracranial injuries linked to abusive head trauma is a subdural hematoma. A diffuse axonal injury, parenchymal injury, and epidural hematoma are among the additional injuries associated with abusive head trauma that have been found. These injuries are reported under the general heading of child abuse in the findings of epidemiological studies. With an incidence of up to 17 per 100,000 child-years, the data on abusive head trauma is more reliable in Europe and the United States than in other regions. On the other hand, the prevalence of subdural hematoma in children under the age of two years is almost 13 per 100,000 child-years [6]. A study conducted in South Wales, England found that the incidence of subdural hematomas is higher below the age of one year (1:4761) [7], with a maximum of 21 cases per 100,000 child-years in this age group. Similar rates are reported by developing nations, but the available data is extremely sparse. Furthermore 50% to 60% of all subdural hematomas are acute in nature [4]. Incidence of brain hemorrhages vary depending on the underlying cause. However, studies have shown that certain risk factors such as high blood pressure, smoking, and excessive alcohol consumption can increase the likelihood of experiencing a brain hemorrhage. It is important for individuals to be aware of these risk factors and take necessary precautions to prevent a hemorrhage from occurring. Additionally, ongoing research is being conducted to develop new treatments and interventions that can further improve the outcomes for individuals who have suffered from a brain hemorrhage [8]. By adopting a healthy lifestyle, individuals can significantly reduce their risk of developing high blood pressure and avoid the potential complications associated with it. Quitting smoking and limiting alcohol consumption are also crucial steps in preventing brain hemorrhages. Furthermore, advancements in medical science have allowed for the development of new medications and surgical techniques that can better manage and treat brain hemorrhages, offering hope for improved recovery and long-term outcomes for patients [9].

Early management in the emergency department is crucial in preventing complications and improving outcomes for patients with a brain hemorrhage. Prompt evaluation and stabilization of the patient's condition, including measures such as controlling blood pressure and providing supportive care, can help reduce the extent of the hemorrhage and minimize the risk of further damage. Additionally, early intervention allows for the implementation of appropriate surgical or medical interventions, such as clot removal or medication administration, which can help mitigate the effects of the hemorrhage and promote recovery [10]. In severe cases, surgery may be necessary to remove the blood clot or repair any damaged blood vessels in the brain. Rehabilitation and therapy may also be recommended to help the patient regain lost functions and improve overall quality of life. However, it is important to note that the prognosis for a brain hemorrhage can vary depending on the severity and location of the bleed, as well as the individual's overall health and response to treatment. Therefore, close monitoring and ongoing medical management are crucial for a successful recovery [11]. In some cases, the effects of a brain hemorrhage can be long-lasting or permanent, such as in cases where there is significant brain damage. This can result in ongoing physical and cognitive challenges for the patient, requiring ongoing support and care. It is also important for the patient to make necessary lifestyle changes, such as managing blood pressure and reducing risk factors, to prevent future hemorrhages. With proper medical intervention and ongoing care, many patients are able to regain some level of functionality and lead fulfilling lives [8].

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Pathophysiology

Mechanism of injury and common causes of acute subdural hematoma include severe head trauma, such as a motor vehicle accident or a fall from a significant height. The forceful impact can cause blood vessels to rupture, leading to bleeding between the brain and the dura mater. Additionally, certain medical conditions, such as high blood pressure or the use of blood-thinning medications, can increase the risk of developing a subdural hematoma. Early recognition and prompt medical intervention are crucial in order to prevent further damage and improve patient outcomes [4, 12].

The brain moves in the opposite direction to the meninges during severe head shaking, which causes the bridging veins to burst and hemorrhage in the subdural region. This condition is known as "shaken baby syndrome" or "beaten infant syndrome" [13]. This prospective area may hold a sizable amount of blood at different phases, allowing it to exist in an acute or subacute state. Frequently, the bleeding is first recognized as a persistent subdural hematoma without any symptoms. The brain midline moves to the other side when there is enough blood clot to fill a significant amount of intracranial space. After the lateral third and fourth ventricles' volume decreases, the brain's structures encroach on the inner surface of the calvarium. The uncal part of the temporal lobe is pushed toward the foramen magnum by volumetric pressures when the intracranial space becomes restricted, which results in brain herniation [4].

The post-traumatic interval (PTI) may be understood by looking at the histological analysis of the clot that surrounds the dura. This interval's determination has pertinent medicolegal ramifications [14]. The timing of an insult might be useful in identifying the culprit when it comes to child abuse cases. The analysis is centered on the visualization of different dura cellular components as well as those inside the clot. Leukocytes, phagocytes, fibroblasts, hemosiderin-containing cells, fibrin, and blood vessel proliferation are all examples of blood vessel proliferation. Acute clots are those that include mostly intact blood cells and show no signs of lysis or substantial differentiation. The subdural clot becomes subacute when it forms with fibrin, hemosiderin-loaded macrophages, red blood cells, and lysed red blood cells in the core. These conclusions should only be used in forensic postmortem examinations; they are seldom decisive and are not absolute [15].

Initial Management Strategies in the Emergency department

Diagnostic techniques for subdural hematoma in the emergency department include computed tomography scans, magnetic resonance imaging, and clinical evaluation to accurately diagnose and assess the severity of the condition. Computed tomography scans provide detailed images of the brain and can reveal the presence and location of the hematoma. Magnetic resonance imaging is especially useful in cases where the CT scan may not have provided clear results or in monitoring the progression of the hematoma over time. In addition to these imaging techniques, clinical evaluation is crucial in determining the patient's overall condition and identifying any other potential injuries or complications. This includes assessing the patient's level of consciousness, motor function, and vital signs. The emergency department team will also take into account the mechanism of injury and any associated symptoms to make an accurate diagnosis and determine the appropriate management plan for the patient [16].

As soon as a subdural hematoma diagnosis is suspected, consult a neurosurgeon. Patients with head trauma should, if at all possible, be brought to a hospital that has a specialized trauma team from the outset, since this strategy has been linked to noticeably improved functional results for subdural hematoma survivors [17]. Patients with subdural hematomas had a lower death rate when they are quickly transported to a trauma center with a neurosurgeon on hand, should another institution be needed for diagnosis or treatment. When the patient is accompanied by adequately qualified professionals and suitable stabilizing procedures are implemented, the transfer may be emergent [18].

Initial management strategies in the emergency department for acute subdural hematoma typically involve stabilizing the patient's condition to prevent further deterioration. This includes ensuring an adequate airway, oxygenation, and ventilation. It is essential to maintain appropriate blood pressure and oxygen saturation levels while closely monitoring the patient's vital signs. In addition, intravenous access is established to administer fluids and medications as necessary. Once the patient's condition has been stabilized, further management strategies can be implemented in the emergency department. These strategies aim to reduce the pressure on the brain caused by the acute subdural hematoma and prevent any further complications [19]. Additionally, medications such as anticonvulsants may be administered to Once the patient's condition has been stabilized in the emergency department, further management strategies can be implemented to address the acute subdural hematoma. One key component of the initial management is the administration of medications to control intracranial...
pressure and prevent further bleeding. This often involves the use of osmotic diuretics such as mannitol or hypertonic saline to reduce cerebral edema and improve cerebral perfusion. Additionally, anti-seizure medications may be given prophylactically to prevent the development of seizures, which can further exacerbate the patient’s condition [20].

**Optimizing venous outflow and reducing ICP**

To maximize venous outflow from the brain, raise the head of the bed to a 30° angle and ensure that the head and neck remain in a midline position. Intracranial pressure (ICP) can be temporarily decreased by hyperventilation to a target partial pressure of carbon dioxide (pCO2) of 30 mm Hg; however, a pCO2 level of less than 25 mm Hg is strongly discouraged. To lower ICP, intravenous mannitol (0.25 g/kg) may be administered. Glucocorticoids, however, are not recommended in cases of head trauma [21, 22].

**Hemostasis**

It has been demonstrated that quick reversal of anticoagulation with warfarin reduces intracranial hemorrhage (ICH) mortality and the progression of hemorrhage [23]. Reversing anticoagulation may have some advantages, but each person’s risk must be considered. Prothrombin complex concentrate (PCC), vitamin K, fresh frozen plasma (FFP), and recombinant factor VII (rFVIIa) are among the methods for achieving hemostasis. The recommended dosage of vitamin K is 5–10 mg infused at a rate of 1 mg/min. It should be administered in all patients with anticoagulant-related ICH because it boosts synthesis of clotting factors and prevents rebound coagulopathy after FFP, PCC, or rFVIIa [24]. FFP dosage varies; typically, 10–15 mL/kg are required for complete reversal. In a single study, the immediate transfusion of two units of universal donor FFP decreased the mortality rate [23]. PCC dosage is customized for each patient. Factors II, VII, IX, and X are present in it. It requires a smaller volume than FFP. The international normalized ratio (INR) can be corrected in minutes by PCC. According to data, patients with ICH have better outcomes when PCC is used [25]. The recommended dosage range for rFVIIa is 10-100 mcg/kg; higher dosages carry a greater risk of thromboembolic events. Although there hasn't been any evidence of an improvement in mortality or functional outcome, its effects are swift. Heparin may be fully reversed with 1 mg protamine sulfate/100 units heparin. Low-molecular-weight heparin (LMWH) treatment is similar, but only a partial reversal is possible. Limited data supports the use of rFVIIa with pentasaccharide anticoagulants, such as fondaparinux. No specific reversal agents for direct thrombin inhibitors are noted; however, PCCs may have limited effectiveness in reversing rivaroxaban, and rFVIIa has theoretical potential for patients with ICH receiving dabigatran. There are not enough data on antiplatelet reversal [24].

**Intubation and imaging**

When the Glasgow Coma Scale (GCS) score is less than 12 or when additional signs exist, think about endotracheal intubation; this ensures airway protection throughout the diagnostic workup. Patients with head trauma who have evident loss of consciousness (LOC), are symptomatic, confused or amnesic, or exhibit any focal neurologic symptoms should get a head computed tomography (CT) scan as soon as possible. It is concerning when a focused neurologic symptom appears after traumatic head trauma. In patients with SDH who have cerebral edema, measuring the CT in Hounsfield units (HU) of white matter at the site of damage may be helpful in predicting the course of events. In one investigation, a white matter cut-off value of 31.5 HU demonstrated 80% sensitivity and 99.9% specificity for mortality [26].

**Surgical Interventions for Acute Subdural Hematoma**

These strategies may include neurosurgical consultation, medical management to reduce intracranial pressure, and potential surgical intervention to evacuate the hematoma [27]. Predictive techniques for hematoma development are required in acute subdural hematoma, a dangerous traumatic condition, in order to determine whether an emergency procedure is required. In one investigation, the incidence of “leakage” in patients with acute subdural hematoma was assessed using computed tomography angiography (CTA), and its predictive significance was determined. The findings show that in cases of acute subdural hematoma, the leaking sign is a sensitive predictor of hematoma growth and unfavorable outcomes. Strict supervision is required and forceful surgery may be necessary if the hematoma is minor but leaking indicator positive [28].

When sudden death is linked to significant head trauma, burr holes are a useful temporary measure, particularly if a herniation syndrome is clinically apparent [29]. Usually, an emergency craniotomy is required since the lesion is indicative of clotted blood and the burr hole is not curative. However, in the event that head CT imaging is not accessible, burr holes may direct surgical treatment. Start from the side of the pupil that has dilated the first. Ahmed et al.’s research assessed the in-hospital mortality
rate for patients who arrived at the hospital within four hours of presenting with acute subdural hematoma and undergoing emergency decompressive craniectomy (DC) or craniotomy (CO). Patients with a GCS score of 8 or higher and an Abbreviated Injury Scale (AIS) score of 3 or higher have significant brain injuries. Researchers found that choosing one surgical approach over another had no effect on overall mortality and that the overall in-hospital mortality rate for emergency CO or DC for subdural hematoma evacuation remained high [28].

Improvements in Acute Subdural Hematoma Management

Over the years, there have been significant improvements in the management of ASDH in the emergency department, leading to improved outcomes for patients. These may include neurosurgical consultation, neurological monitoring, and potential surgical intervention. These may include discussions with neurosurgeons regarding the need for surgical intervention, arranging for transfer to a higher level of care if necessary, and coordinating These strategies may include surgical intervention. One of the key advancements in ASDH management is advancements in surgical techniques for the evacuation of the hematoma, including the use of minimally invasive procedures and improved neurosurgical instruments. These advancements have led to reduced surgical complications and improved patient outcomes. Furthermore, there has been a greater emphasis on the use of multidisciplinary teams in the management of ASDH in the emergency department, including neurosurgeons, intensivists, and trauma specialists. This collaborative approach has improved communication and coordination of care, leading to better outcomes for patient [30, 31].

Overall, the improvements in ASDH management in the emergency department have resulted in reduced mortality rates and improved functional outcomes for patients. These advancements have also led to a better understanding of the long-term consequences of ASDH, allowing for more comprehensive and effective rehabilitation strategies for survivors of this condition. As research and technology continue to advance, it is expected that further improvements in ASDH management will continue to emerge, further benefiting patients in the emergency department [30].

Conclusion

In conclusion, the management of acute subdural hematoma in the emergency department is a complex and challenging task that requires prompt recognition and intervention. Early diagnosis and aggressive treatment are crucial in improving patient outcomes and reducing mortality rates. This review has highlighted the importance of a multidisciplinary approach, including rapid neuroimaging, neurosurgical consultation, and close monitoring of vital signs and neurological status. Additionally, the use of evidence-based guidelines and protocols can help standardize care and optimize patient management. It is essential for emergency department healthcare providers to stay updated on the latest advancements in acute subdural hematoma management to ensure the best possible outcomes for these critically ill patients. Further research and collaboration among healthcare professionals are needed to continue improving the care and outcomes of patients with acute subdural hematoma.

References


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