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Analysis and update on neurosurgical management in adult patients with subdural hematoma

Abstract

The management of subdural hematomas in adult patients is a critical issue in neurosurgery, given the increased incidence of this condition in this population due to factors such as age-related brain atrophy and the use of anticoagulants. A detailed analysis of current strategies in the treatment of both acute and chronic subdural hematomas in this age group is presented below.

Keywords: subdural hematoma, adult, neurosurgical treatment, risk factors, elderly

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Introduction

Subdural hematoma (SH) is a collection of blood between the dura mater and the arachnoid, typically developing after mild head trauma, especially in adults. As the population ages, the incidence of SH has increased, becoming a significant challenge in the fields of neurosurgery and geriatrics.[1]

Risk factors include:

a) Previous head injuries: Even minor falls can result in bruising.

b) Use of anticoagulants: medications such as warfarin and aspirin increase the risk of bleeding.

c) Alcohol consumption: Alcohol abuse can predispose to injury and cognitive impairment.

d) Comorbidities: Medical conditions that affect clotting and brain health.

e) Symptoms of CAH can be subtle and may include cognitive impairment, confusion, weakness, and behavioral changes, often making early diagnosis difficult.

Multidisciplinary management

The management of HS in adults should be comprehensive and multidisciplinary, involving:

a) Neurosurgeons: These are responsible for assessing the need for surgical intervention, which may include surgical drainage through a burr hole, especially in symptomatic cases.

b) Geriatric physicians: who provide care for comorbidities and help optimize the patient's general condition.

c) Nurses and healthcare workers: responsible for ongoing monitoring and administration of postoperative care, as well as patient and family education on management and recovery.

d) Physiotherapists: who help in rehabilitation and functional recovery after surgery, crucial to restoring the patient's independence.[2]

Treatment approach

Treatment of HS can be conservative or surgical, depending on the clinical evaluation and imaging findings.

Conservative treatment: In asymptomatic or mildly symptomatic patients, observation and medical management may be chosen, including risk factor control and regular monitoring.

Surgical intervention: In cases where there is significant neurological deterioration, evacuation of the hematoma is recommended, generally by surgical drainage.[1]

The most common technique is drainage through a burr hole, which allows evacuation of the hematoma, and the placement of a subdural drain to prevent fluid collection.

Subdural hematomas are common in adults, with an increasing incidence that can reach 17 per 100,000 per year.

Risk factors include:

a) Advanced age

b) Use of anticoagulants

c) Previous head trauma

d) Alcohol consumption

Mortality associated with HS can reach up to 27% and recurrence rates vary between 10% and 15%.[1,5]

Treatment options

1. Surgical management

Surgical treatment is the preferred approach for subdural hematomas, especially in chronic cases. The most commonly used techniques are:

Craniotomy: Used in more complex cases or in large hematomas.

Burr hole craniostomy: This technique is the most common for HS and is associated with high success rates and lower morbidity compared to craniotomy.[1,5]

2. Conservative management

Conservative treatment may be considered in patients with mild symptoms or those with medical conditions that increase surgical risk. However, evidence suggests that patients with an adequate Glasgow Coma Scale (GCS) score may benefit from a "wait and see" approach, which could result in better outcomes compared with early surgery.[3,4]

3. Specific considerations for older patients

Studies have shown that patients older than 65 years have varied outcomes depending on the timing of surgery. Those who undergo early surgery tend to have higher mortality and complications. On the other hand, delayed surgery or conservative management in patients with adequate GCS may offer better outcomes.[3,4]

Factors affecting prognosis

Baseline functional status: A deteriorated preoperative functional status is associated with worse outcomes.

Preoperative neurological status: A low GCS on admission is a predictor of poor outcome.

Imaging parameters: The extent of the hematoma and the presence of cerebral edema are critical factors to consider.[4,5]

Criteria for surgical treatment

The criteria for choosing surgical over conservative treatment in patients with acute subdural hematoma are essential to ensure safe and effective management. The main criteria justifying surgical intervention are detailed below:

1. **Size of the hematoma**

Surgery is recommended in cases where the subdural hematoma is greater than 1.5 cm in diameter or when displacement of midline structures greater than 10 mm is observed on imaging studies. These findings suggest a significant mass effect that may compromise brain function.[10,11]

2. **Neurological status of the patient**

A deteriorating neurological status, as evidenced by a Glasgow Coma Scale (GCS) score below 12, is a clear indicator for surgery. Furthermore, the presence of focal neurological signs or rapidly deteriorating mental status also warrants surgical intervention.

3. **Acute symptoms**

The appearance of acute neurological symptoms, such as loss of consciousness, confusion, or motor deficits, indicates the need for urgent surgical evacuation. These symptoms may be a consequence of the mass effect of the hematoma or underlying brain damage.

4. **Associated complications**

The presence of complications such as laceration of the brain parenchyma or rupture of blood vessels may require an immediate surgical approach to control bleeding and minimize brain damage.

5. **Rapid clinical evolution**

If the patient shows progressive clinical deterioration, despite initial conservative management, surgery becomes a necessary option to prevent irreversible brain damage.

6. **Failures in conservative management**

In cases where conservative treatment has not shown improvement or the hematoma has not decreased in size, surgery should be considered as an alternative to avoid further complications and improve the prognosis.

7. **Risk considerations**

The decision should also consider the surgical risk versus the expected benefit. In patients without significant comorbidities and who are able to tolerate surgery, this option may be preferable. In conclusion, the choice of surgical over conservative treatment in patients with acute subdural hematoma is based on a careful assessment of hematoma size, neurological status, symptoms, and the patient's clinical course. Timely intervention is crucial to improve outcomes and reduce associated morbidity and mortality.[12]

What factors determine the need for a craniotomy rather than a craniostomy?

Craniotomy: is a surgical operation in which part of the skull bone is removed in order to expose the brain and the structures of the central nervous system. The bone flap is temporarily removed and at the end of the surgery it is replaced to provide new protection to the brain and its structures.

Craniectomy: It is a similar procedure that involves the permanent removal of the skull.

Factors determining the need for a craniotomy instead of a craniostomy in patients with subdural hematoma include clinical, radiological, and surgical considerations. The most relevant criteria are presented below:

1. **Size and extent of the hematoma**

Large hematomas: Craniotomy is preferred for large subdural hematomas or those causing significant mass effect, as it allows for more complete and effective evacuation of the hematoma.[13]

Septation or consolidation: In cases where the hematoma has septations or is consolidated, craniotomy is necessary to ensure adequate evacuation and prevent recurrence.

2. **Neurological status of the patient**

Neurological deterioration: If the patient has deteriorating neurological status (e.g., a Glasgow Coma Scale score less than 12), this indicates that craniotomy may be necessary to relieve intracranial pressure and treat underlying brain damage [9]

3. **Radiological characteristics**

CT imaging: Computed tomography (CT) may show features that suggest the need for a craniotomy, such as midline shift or the presence of significant cerebral edema. These features indicate that a craniotomy may not be sufficient to manage the situation .[13,14]

4. **Associated complications**

Parenchymal injuries: If there is evidence of damage to the brain parenchyma associated with the hematoma, craniotomy allows better visualization and treatment of these injuries, in addition to facilitating adequate hemostasis.[9]

5. **Surgical objectives**

Cerebral decompression: Craniotomy is preferred when more extensive decompression is needed to relieve pressure on the brain, especially in cases of refractory intracranial hypertension.[14]

6. **Hemostasis requirements**

Bleeding control: In situations where more rigorous control of hemostasis is required, craniotomy allows for better identification and coagulation of bleeding vessels, which can be crucial in preventing hematoma recurrence.

7. **Surgical considerations**

Ease of access: In some cases, craniotomy may be necessary to access specific areas of the brain that cannot be adequately reached by craniostomy, allowing for a more complete and effective intervention.[15]

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In summary, the choice between craniotomy and craniostomy depends on a careful assessment of hematoma size, the patient's neurological status, radiological features, and specific surgical needs. Craniotomy is generally preferred in situations requiring more extensive evacuation and more effective control of associated complications.

When is it better to perform a craniotomy instead of a craniostomy?

The choice between performing a craniotomy or a craniostomy in the treatment of subdural hematomas depends on several clinical and radiological factors. The following are the situations in which a craniotomy is most advisable:

1. Size and extent of the hematoma

Large hematomas: Craniotomy is recommended for subdural hematomas that are greater than 10 mm thick or that cause significant midline shift on computed tomography (CT). This is crucial to ensure complete evacuation of the hematoma and prevent complications.

2. Neurological status of the patient

Neurological deterioration: Patients with a Glasgow Coma Scale (GCS) score below 9, especially those showing signs of rapid deterioration, are candidates for craniotomy. This includes patients with acute neurological symptoms, such as loss of consciousness or motor deficits.

3. Radiological characteristics

Imaging complications: If CT shows features suggesting a complicated hematoma, such as septation or associated hemorrhage in the brain parenchyma, craniotomy allows for better visualization and treatment of these complications.

4. Hemorrhage control

Need for hemostasis: In cases where more rigorous control of bleeding is required, craniotomy is preferred, as it allows for better identification and coagulation of bleeding vessels, which is vital to preventing hematoma recurrence.

5. Brain decompression

Relief of intracranial pressure: Craniotomy is most appropriate when significant cerebral decompression is needed to relieve intracranial pressure, especially in patients with intracranial hypertension.

6. Surgical access

Access to specific areas: Craniotomy is necessary when access is required to areas of the brain that cannot be adequately reached by a craniotomy, allowing for a more comprehensive procedure.

7. Patient conditions

Risk factors and comorbidities: In young, healthy patients, where the surgical risk is lower, craniotomy may be the preferred option. However, in older patients or those with significant comorbidities, the decision should be more cautious, considering the risks and benefits.[15]

In summary, craniotomy is recommended in situations where the size of the hematoma, the patient's neurological status, and radiological features indicate that more complete evacuation and more effective control of associated complications are needed.

What are the differences in long-term outcomes between a craniotomy and a craniostomy?

The differences in long-term outcomes between a craniotomy and a craniostomy are significant and depend on several factors related to the type of procedure, the patient's condition, and the characteristics of the hematoma. Key findings regarding the long-term outcomes of both procedures are presented below:

1. Functional and cognitive outcomes

Craniotomy: Studies have shown that patients who undergo craniotomy tend to have better long-term outcomes in terms of cognitive function and ability to perform daily activities. For example, one study indicated that patients who underwent craniotomy showed better results on neuropsychological assessment scales compared to those who underwent decompressive craniotomy (DC) for traumatic injuries.[16]

Craniostomy: Although craniostomy can be effective for hematoma evacuation, patients may experience an increased risk of long-term complications, such as persistent neurological deficits. In some cases, patients who undergo craniostomy may be at increased risk of developing a vegetative state or severe dependence for daily activities.

2. Mortality

Mortality rate: Mortality in both procedures is comparable, although some studies have found that craniotomy may be associated with a lower mortality rate in certain settings. For example, in an analysis of craniotomy versus decompressive craniotomy, mortality rates were similar, but functional outcomes differed, with craniotomy showing a trend toward better outcomes.[17]

3. Postoperative complications

Complications in craniotomy: Craniotomy may be associated with a lower risk of intracranial complications compared with decompressive craniotomy, which may carry a higher risk of infection and complications related to postoperative management. However, craniotomy may require more frequent reoperations in cases of persistent intracranial hypertension or residual hematomas.[16,18]

Complications in craniostomy: Craniostomy, although less invasive, may not provide the same level of control over intracranial pressure and may be associated with an increased risk of long-term complications such as hydrocephalus or recurrent hematoma formation.[19]

4. Rehabilitation and quality of life

Quality of Life: Patients who undergo craniotomy tend to have a better long-term quality of life, with fewer severe disabilities and greater independence in daily activities. In contrast, those who undergo craniotomy may face greater challenges in rehabilitation and adaptation to daily life.[16]

In summary, although both procedures have their place in the management of subdural hematomas, craniotomy is generally associated with better long-term functional and cognitive outcomes, as well as a lower rate of severe complications. The choice between craniotomy and craniostomy should be based on a careful assessment of the patient's clinical condition and the specific characteristics of the hematoma.

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Other approaches

Trepans

One of the most widely used techniques for surgical drainage of chronic subdural hematomas is trephine drainage, where a minimal incision of approximately 2-3 cm is made in the skin and craniotomy is performed with an automatic stop drill bit or a Hutson arbor. Surgical indications for subdural hematomas include clinical neurological alterations, midline shift greater than or equal to 10 mm on CT scan, and hematoma thickness of 1 cm on image. This approach is used in situations where the surgical and transanesthetic risk is minimized, and by personnel with limited neurosurgical skills, as it can be performed by a general surgeon trained in trephine drainage. It is used when less advanced or specialized surgical instruments are available, as it represents a greater risk of transfer or presents considerable distances to access trained neurosurgical subspecialists.

Endoscopic drainage of subdural hematoma

The endoscopic technique for subdural hematoma drainage has been described for several years; however, the cost-benefit ratio is controversial due to the high cost of performing this procedure versus the comparable benefit of trephine drainage. This technique lacks the reliability under direct vision provided by the technique described. Endoscopic drainage is performed after prior antisepsis of the region, with scalp block and sedation. An anterior frontal orifice and posterior parietal orifice are created. An anterior and posterior trephine are performed, followed by hemostasis, hematoma drainage, insertion of a neuroendoscope, and cavity review. A search is made for bridging veins, clots, septa, or residual hematoma. The neuroendoscope is removed and closed in layers. It is important to note that there are different approaches to neuroendoscopy-guided hematoma drainage.

The use of neuroendoscope is reserved for public or private institutions where their financial capacity allows it. Craniotomy with Twist drill. (minitrepan) The minitrepan or twist drill is a rarely used type of approach in the drainage of subdural hematomas. It consists of making a trephine that goes from 4-6 mm and subsequent access to the subdural region for drainage. In a study reported by A. Gabarros et al., an increase in excellent results up to 95.2% of survival after drainage is reported. This result shows that craniotomy with minitrepan and continuous closed drainage offers a higher cure rate. However, there are different opinions about this approach since, in the experience of some authors, this type of approach presents a high recurrence rate and therefore an increase in mortality related to reoperation and hospital complications.

Methodology

Participants

The study population consisted of 33 patients hospitalized at the Puebla Regional Hospital, with an average age of 64.14 years, ranging in age from 37 to 86.

Data collection was carried out on patients hospitalized within the first half of 2024 for subdural hematoma.

Inclusion criteria

a) Any gender

b) Hospitalizations will occur during the first and second quarters of 2024.

c) Be between 33 and 90 years old

d) Be a beneficiary.

Exclusion criteria

a) Not being a beneficiary

b) Have a history of neurological pathology

c) Have a psychiatric history

d) Be outside the age range.

The study was conducted with the consent of the Department of Neurosurgery. The data collected will be confidential; however, this study poses no risk or consequence to the subject, in accordance with the provisions of Article 14 of the General Health Law's regulations regarding research involving human subjects. This is a completely risk-free procedure, and written informed consent is not required, as established in Article 21 of the regulations. Furthermore, the researchers are responsible for complying with the ethical codes established in the 1964 Helsinki Declaration, primarily respecting Articles 15, 16, 17, 20, and 21, as well as with the specific norms, laws, and regulations established in Mexico.

Procedure

The observational, descriptive, cross-sectional, retrospective, homodemic method was used and the information was obtained through a database of previous hospitalizations of patients as well as their surgical procedures. The content analysis was performed, being this of a cross-sectional nature, and the study population was randomized.

Statistical analysis

The data was emptied into the corresponding database in the SPSS computer program and once the information was obtained, it was sorted, classified and grouped according to the results of each measurement, based on the criteria relevant to the object of the research in factorial tables and through the aforementioned computer program, the analysis of the results was carried out, the statistical analysis was carried out through association measures of all the factors obtained from the gymnasts, they were analyzed through relative risk, Likewise, inferential statistics (Chi square) and Cramer's coefficient were used for factors that could trigger an increase in mortality and/or recovery from the condition.

Results

The analysis of the results shows us the greater representation of the male sex in relation to 70% of the male sex and 30% of the female sex. Graph 2 shows the data obtained during the incidence of the procedures performed. (Figure 1).

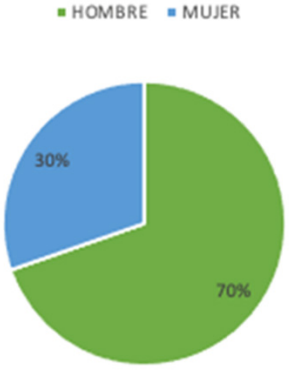

Figure 1 Graph on sex.

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The most important treatment being non-surgical medical treatment at 42%, followed by decompressive craniotomy at 36% and trepanation at 16%. (Figure 2).

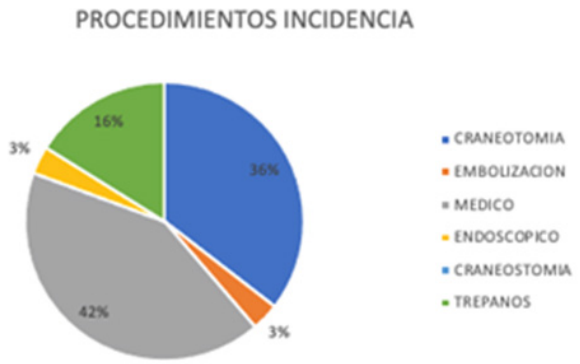

Figure 2 Incidence of procedures.

95% CI a relative risk of 1.7, CI (0.98-1.744), as well as a Cramer coefficient of 1, this gave us a POSITIVE association between some factors associated with the surgical procedure.

Craniotomy with Endoscopic Drainage is the one associated with the best prognosis and short-term recovery. (Figure 3).

Figure 3 Days of in-hospital stay.

It was also observed that depending on the procedure chosen, the length of hospital stay was reduced, resulting in embolization and decompression being associated with a shorter stay, with a faster recovery and a reduction in complications, which are shown in graph 4. (Figure 4).

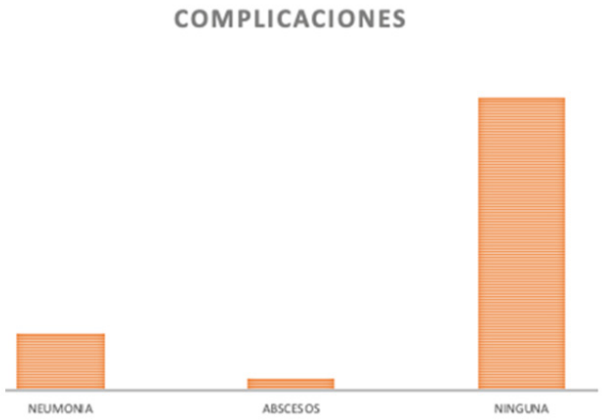

Figure 4 Associated complications.

The associated mortality in these patients was 36%, associated with complications in 50% of respiratory origin, with pneumonia associated with respiratory distress syndrome being the cause.

It was observed that strict monitoring of intensive neurological and respiratory parameters helps detect subtle changes in neurological syndromes, making their correction and mortality reduction easier and more timely. The origin of the accident is also essential determinants of survival. (Figure 5).

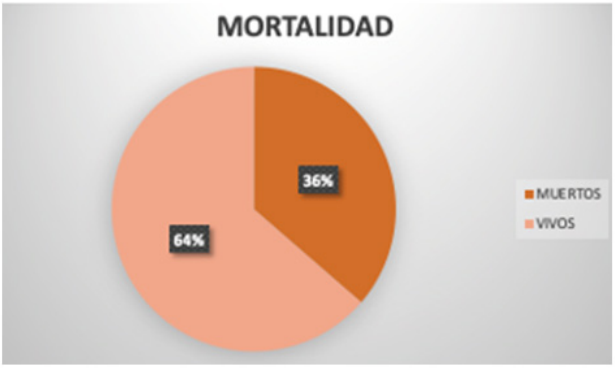

Figure 5 Mortality and survival

Discussion and conclusion

Neurosurgical management of subdural hematomas in adults should be individualized, considering factors such as clinical presentation, the patient's functional status, and surgical risks. The choice between surgical and conservative treatment should be based on a careful assessment of these factors, as well as the experience of the neurosurgical team. Future research is needed to establish clearer guidelines for the management of this vulnerable population, with the goal of improving clinical outcomes and patient quality of life.

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None

Conflicts of interest

The authors declare that there are no conflicts of interest.

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