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Sección de la revista

**RECURRENCE AND MORTALITY OF CHRONIC
SUBDURAL HEMATOMA: EXPERIENCE OF TWO
CENTERS IN A MIDDLE-INCOME COUNTRY.
RECURRENCIA Y MORTALIDAD DE HEMATOMA
SUBDURAL CRÓNICO: EXPERIENCIA EN DOS
CENTROS DE UN PAÍS DE MEDIANOS INGRESOS.
RECORRÊNCIA E MORTALIDADE DE HEMATOMA
SUBDURAL CRÔNICO: EXPERIÊNCIA DE DOIS
CENTROS EM UM PAÍS DE RENDA MÉDIA.**

Francisco Valderrama-Arias MD^{1,2}, Juan M. Torres MD^{1,2}, Nadin J. Abdala-Vargas MD^{1,2}, Gabriela Morales-Guarín MD³, Oscar F. Zorro-Guío MD¹, Hernando A. Cifuentes-Lobelo MD², William Cortes-Lozano MD², Jorge Arana-Carvahlo MD¹, Javier G. Patiño-Gómez MD^{1,2}, Edgar G. Ordóñez-Mora MD¹, Edgar G. Ordóñez-Rubiano MD¹.

¹Department of Neurological Surgery, Fundación Universitaria de Ciencias de la Salud (FUCS), Hospital de San José, Bogotá, Colombia

²Department of Neurological Surgery, Fundación Universitaria de Ciencias de la Salud (FUCS), Hospital de San José, Bogotá, Colombia.

³School of Medicine, Fundación Universitaria de Ciencias de la Salud (FUCS) Bogotá, Colombia.

Autor de Correspondencia

Edgar G. Ordóñez-Rubiano, MD
Neurological Surgery
Fundación Universitaria de Ciencias de la Salud (FUCS)
Hospital Infantil Universitario de San José
Bogotá, Colombia.
Dirección:
Calle 10 #18-75.
Correo Electrónico:
egordonez@fucsalud.edu.co

Abstract

Introduction: The objective of this study is to determine the prevalence of risk factors for recurrence and mortality among patients who underwent drainage of a chronic subdural hematoma (CSDH) in 2 centers in Colombia in a 3-year period.

Methods: Patients who underwent surgical drainage of a CSDH at the Hospital de San José and at the Hospital Infantil Universitario San José in Bogotá, Colombia from January 2016 to January 2019 were included. An analytic cross-sectional study was conducted. Demographic, clinical, and radiological features were collected.

Results: 165 patients were enrolled in the study. 50 (30.3%) were female. The mean patient age was 71 years (61-80). 90 (54.5%) had associated history of trauma. A total of 123 (74.5%) patients underwent surgical intervention with burrholes and 42 (25.5) underwent drainage through a mini-craniotomy. 17 (10.3%) patients suffered a recurrence that require reoperation. Only 9 (5.5%) had a fatal outcome. None of the variables were significant predictors for recurrence, while the use of oral anticoagulant therapy (OAT) ($p = 0.001$), the history of traumatic brain injury (TBI) ($p = 0.047$) and the heterogeneous density of the hematoma ($p = 0.018$) were significant predictors for mortality, respectively.

Conclusions: The use of OAT, the history of TBI, and the heterogeneous density of the hematoma in the CT scan were found to be significant predictors for mortality, while none of the analyzed variables were statistically significant

predictors for recurrence in patients who underwent surgical evacuation of a CSDH in our institutions.

Keywords: Chronic Subdural Hematoma, Low-to-middle Income Country, Burr Hole, Craniotomy, Recurrence, Mortality.

Resumen

Introducción: El objetivo de este estudio es determinar la prevalencia de los factores de riesgo para recurrencia y mortalidad en pacientes llevados a drenaje de hematomas subdurales crónicos en 2 centros en Colombia en un periodo de 3 años.

Materiales y Métodos: Se incluyeron pacientes operados de hematomas subdurales crónicos en el Hospital de San José y en el Hospital Infantil Universitario de San José en Bogotá, Colombia desde enero de 2016 hasta enero de 2019. Se realizó un estudio analítico de tipo corte transversal. Se revisaron las características demográficas, clínicas y radiológicas.

Resultados: Se incluyeron 265 pacientes en el estudio. 50 (30.5%) eran mujeres. El promedio de edad fue de 71 años (61-80). 90 (54.5%) tuvieron antecedente de trauma. Un total de 123 (74.5%) de los pacientes tuvieron drenaje con trépanos y 42 (25.5%) con una mini craneotomía. 17 (10.3%) pacientes tuvieron una recurrencia que requirió re-operación. Sólo 9 (5.5%) tuvieron un desenlace de mortalidad. Ninguna variable fue un predictor significativo de recurrencia. El uso de anticoagulantes ($p=0.001$), el antecedente de trauma craneoencefálico ($p=0.047$) y la densidad heterogénea del hematoma ($p=0.018$) fueron predictores significativos para mortalidad.

Conclusiones: El uso de anticoagulantes, el antecedente de trauma y la densidad heterogénea del hematoma en la escanografía fueron predictores significativos para mortalidad, mientras que ninguna de las variables analizadas fueron predictores estadísticamente significativos para recurrencia en pacientes llevados a drenaje de hematomas subdurales crónicos en nuestras instituciones.

Keywords: Hematoma subdural crónico, países de ingreso mediano-bajo, trepanación, craneotomía, recurrencia, mortalidad.

Resumo

Introdução: O objetivo deste estudo é determinar a prevalência dos fatores de risco para recorrência e mortalidade em pacientes encaminhados para drenagem de hematomas subdurais crônicos em 2 centros na Colômbia em um período de 3 anos.

Materiais e Métodos: Foram incluídos pacientes submetidos à drenagem cirúrgica de um CSDH do Hospital de San José e do Hospital Infantil Universitario San José de Bogotá, Colômbia, de janeiro de 2016 a janeiro de 2019. Foi realizado um estudo transversal analítico. Características demográficas, clínicas e radiológicas foram coletadas.

Resultados: 165 pacientes foram incluídos no estudo. 50 (30,3%) eram mulheres. A média de idade dos pacientes foi de 71 anos (61-80). 90 (54,5%) tinham história de trauma associada. Um total de 123 (74,5%) pacientes foi submetido à intervenção cirúrgica com buracos e 42 (25,5) à drenagem por minicraniotomia. 17 (10,3%) pacientes apresentaram recidiva necessária na nova operação. Apenas 9 (5,5%) tiveram desfecho fatal. Nenhuma das variáveis foi preditora significativa de recorrência, enquanto o uso de anticoagulante oral (OAT) ($p = 0,001$), a história de lesão cerebral traumática (TCE) ($p = 0,047$) e a densidade heterogênea do hematoma ($p = 0,018$) foram preditores significativos de mortalidade, respectivamente.

Conclusões: O uso do OAT, a história de TCE e a densidade heterogênea do hematoma na TC foram encontrados como preditores significativos de mortalidade, enquanto uma das variáveis analisadas foram preditores estatisticamente significantes de recorrência em pacientes com evolução cirúrgica em nossa instituição.

Palavras chave: Hematoma Subdural Crônico, País de Renda Baixa a Média, Burr Hole, Craniotomia, Recorrência, Mortalidade

Introduction.

Clinical presentation, management, and outcomes of chronic subdural hematoma (CSDH) in low- and middle-income countries (LMICs) are not well characterized in the literature. (Kitya et al., 2018) Trauma has been reported as the most common cause of CSDH for both high-income countries (Kudo et al., 1992) (HICs) and LMICs. (Kitya et al., 2018, Mezue et al., 2011) Brain contraction in the elderly is thought to be a contributing factor for the incidence of CSDH, as it results in tension on the bridging vessels, which can easily tear during minor trauma. (Adhiyaman et al., 2002, Kitya et al., 2018) Other causes including bleeding diatheses due to alcoholic liver failure and aspirin use could also predispose patients to have CSDH. (Kitya et al., 2018)

Despite efforts to understand the etiology and optimize the treatment, the CSDH remains a particularly challenging entity due to high recurrence rates (2%-37%) (Link et al., 2018) and considerable high mortality rates as well. This manuscript aims to describe surgical results and analyze the associated risk factors of recurrence and mortality in patients who underwent surgical evacuation of CSDHs in 2 centers in Colombia.

Recent research state that CSDH could be treated with medical treatment only, with medication such as corticosteroids, tranexamic acid, and/or atorvastatin. (Holl et al., 2019, Bansal et al., 2015, Kageyama et al., 2013) Furthermore, new minimally invasive treatments such as endovascular infusion of polyvinyl alcohol particles for embolization of the middle meningeal artery have been also reported as a successful treatment for new and recurrent CSDH. (Link et al., 2018) Even though, surgical drainage remains the cornerstone of treatment for compressive CSDH. (Liu et al., 2019) Twist-drill, burr hole, and craniotomy are the most remarkable surgical techniques used for new and recurrent CSDH evacuation. (Liu et al., 2019, Weigel et al., 2003)

Methods.

Clinical Data and Design

An analytical cross-sectional study of patients who underwent surgical evacuation for CSDH in the Hospital de San José, Bogota, Colombia and in the Hospital Infantil Universitario de San José, Bogota, Colombia, over a period of 3 years was conducted. Patients were enrolled from January 2016 to January 2019. Inclusion criteria for this study were: patients over 18 years old who were

admitted through the emergency room (ER) or those patients from the outpatient clinic that were consequently admitted to the ER and required surgical evacuation for a CSDH. All patients who had clinical symptoms related to the presence of a CSDH documented with an MRI or a CT scan and those with radiological presence of a CSDH with absence of clinical symptoms but with considerable brain compression (≥ 60 cc of hematoma volume) underwent emergent surgical evacuation for CSDH. Patients who were previously operated in a different institution or those who were operated before January 2016 were subsequently excluded. A retrospective chart review was performed. Demographic, clinical and radiological data was acquired.

Information regarding prior history of diabetes mellitus type 2, hypertension, consumption of aspirin, anticoagulants or alternative medication which could be related with the occurrence of the CSDH such as Ginkgo Biloba, Ginseng, and Omega-3 was registered. Clinical symptoms, admission Glasgow Coma Scale (GCS) score, and any antecedent of a previous traumatic brain injury (TBI) were also recorded. The radiological appearance (homogeneous or heterogeneous) of the hematoma, surgical technique, recurrences that required reoperation, as well as mortality were also registered. Authorization was requested to our Institutional Ethics Board to include the information of the subjects in this study, preserving their identity both in the analysis of the information and in all images presented. This is a retrospectively analyzed study with approval by the Fundación Universitaria de Ciencias de la Salud Review Board.

Surgical Procedure

After ER admission, all patients underwent full workout in order to rule out dyscrasias or any abnormalities in platelets count, prothrombin time (PT), or partial thromboplastin time (PTT). For those who presented corresponding abnormalities in this workout were consequently reverted accordingly. In both institutions, all patients had blood saving for all procedures (at least 2 units of red blood cells). In cases of consumption of aspirin within 7 days before surgery the patients underwent additional transfusion of 6 units of whole blood platelets before surgery and 6 units during the procedure if emergent drainage was required. In cases of aspirin consumption where the patient remained stable without neurological deterioration, the surgical procedure was performed after completing 7 days after the last aspirin consumed for the surgical procedure to avoid aspirin effects on intra- and postoperative bleeding.

In both institutions, the surgical procedure techniques were performed in the same fashion. Induction of anesthesia was performed with thiopental or propofol, and an initial neuromuscular block was performed with vecuronium or rocuronium to facilitate intubation as preferred by the anesthesiologist.

Anesthesia was maintained with nitrous oxide/oxygen, supplemented by isoflurane and fentanyl or remifentanyl in most cases. Whenever possible, light surgical anesthesia was maintained, relying on opioid agents to provide adequate analgesia. The head was positioned with 45° rotation accordingly to the hematoma location. All cases underwent burr hole or mini-craniotomy for hematoma evacuation. For both approaches we performed the incision accordingly to hematoma location as well. For most cases a 4cm-incision was done in the crossing point between the superior temporal line and the coronal suture. Decision whether to make a burr hole or a mini-craniotomy was taken as preferred by the senior attending neurosurgeon for each single case accordingly to the hematoma density in the CT scan. CSDHs with heterogeneous density suggesting septations or different consistencies of the hematoma were more likely to be drained through a mini-craniotomy. Mini-craniotomies were approximately of 4x4 cm of diameter. Additionally, when the collection could not be drained through an initial burr hole, then it was converted into a mini-craniotomy. In all cases the dura was carefully coagulated, opened, and marsupialized as well (**Figure 1**). After the dura is opened, the external capsule of the hematoma is opened carefully and the hematic content is slowly drained using both cottonoids and suction to prevent consequent post-drainage intracranial hemorrhages. Afterwards, the subdural space is revised, all remnants of clots are cleaned out with warm saline solution. When the returning fluid is clear then an 8 Fr Nelaton catheter is placed in the subdural space, with the tip of the drain in a frontal position. It is fixed and the galea and the skin are closed with Vycril and Prolene respectively in a usual fashion. The subdural drain is connected to a venoclysis set for postoperative draining. The catheter is removed after 24-48 hours according to the draining volume. The day the catheter is removed the patient is evaluated and discharged.

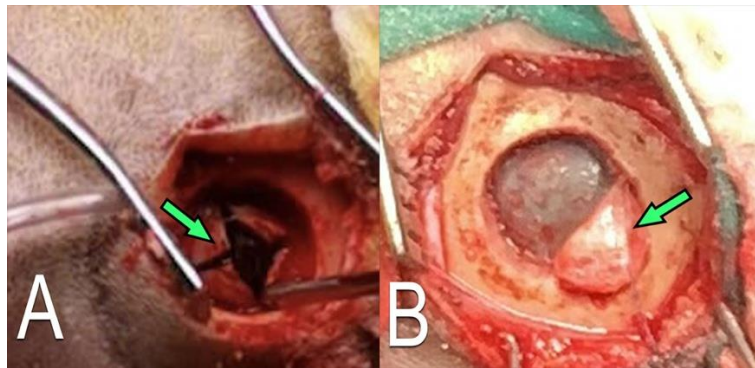


Figura 1. Surgical approaches for chronic subdural hematoma evacuation. (A) An extended burr hole is demonstrated. The dura is opened in a cruciate fashion after being superficially coagulated (**green arrow**). (B) A 3 cm mini-craniotomy is demonstrated. The dura is opened in a horseshoe fashion (**green arrow**). The external capsule of the hematoma is observed under the dura before it's opened.

Statistical Analysis

All variables were examined for normality of distribution using the Kolmogorov-Smirnov test. The quantitative variables were summarized as median and interquartile ranges (IQRs). The categorical variables were demonstrated as absolute frequencies and percentages. To determine the possible associated risk factors for reoperation and mortality the Chi-square was used. $p < 0.05$ was considered statistically significant. All the analytic tests were performed using the Stata © statistical software (version 13).

Results.

Between January 2016 and December 2018, a total of 165 patients who were operated for CSDH were collected (115 men, median of 71 years, [IQR (61 – 80) years], of these 54.5% (90) had a history of TBI, 38.2% (63) had a history of arterial hypertension, and diabetes mellitus 2 was present in 13.3% (22) of the patients. 64.2% (106) of patients consulted with headache at the ER. The consciousness impairment of each patient at the time of admission was evaluated with the Glasgow Coma Scale (GCS). 77.6% (128) of the patients had a GCS score between 13-15 and only 7.3% (12) had a GCS score ≤ 8 (**Table 1**).

In regard with the homogeneity of the hematoma density, we found that in 49.7% (82) of the images a homogeneous density of the CSDH was present. For first operation, 74.5% (123) of the hematomas were drained by craniotomy. From all the cases, the 87.9% (145) did not require a reoperation. Only 1.9% (3) from the total of patients required a second reoperation. The use of aspirin was present in 19.4% (32) of the patients, while the use of oral anticoagulant therapy (OAT) was present in 10.1% (18). Only 81.7% (134) of cases attended to their first postoperative control in the outpatient clinic. Finally, the overall mortality for our series was 5.5% (9) (**Table 1**).

Once the Chi-square test was performed for the possible risk factors of recurrence and mortality, three variables were associated with the mortality. The use of OAT had the strongest association with mortality ($p = 0.004$), the presence of heterogeneous density (areas of rebleeding) of the CSDH in the CT scan was associated with mortality ($p = 0.018$). Finally, the history of TBI was also associated with a fatal outcome ($p = 0.047$). Otherwise, the rest of variables were not found to be statistically significant associated with mortality.

All possible demographic, radiological and clinical risk factors analyzed in our study demonstrated no any statistically significant relationship with recurrence of the hematomas that required reoperation.

Table 1. Demographic, clinical, and radiological characteristics of patients who underwent surgical evacuation for chronic subdural hematomas.

Variable	Patients (n = 165)
Age [median (IQR)]	71 (61-80)
Sex [n (%)]	
Male	115 (69.7)
Female	50 (30.3)

Antecedents [n (%)]	
Hypertension	63 (38.2)
Diabetes mellitus type 2	22 (13.3)
Associated TBI	90 (54.5)
Use of aspirin	32 (19.4)
Use of oral anticoagulant therapy	18 (10.1)
Density on CT scan [n (%)]	
Homogeneous	82 (49.7)
Heterogeneous	83 (50.3)
Surgical technique	
Craniotomy	42 (25.5)
Burrhole	123 (74.5)
Clinical presentation [n (%)]	
Headache	106 (64.2)
Motor déficit	31 (18.8)
Seizures	18 (10.9)
Other	10 (6.1)
Glasgow coma scale score [n (%)]	
3 to 8	12 (7.3)
9 to 12	25 (15.1)
13 to 15	128 (77.6)
Number of follow-ups [n (%)]	
One	134 (81.7)
Two	75 (45.5)

Mortality	9 (5.5)
Reoperations [n (%)]	
None	145 (87.9)
One	17 (10.3)
Two	3 (1.9)

Discussion.

We found an overall 5.5% mortality rate and a 17% recurrence rate in our study. After risk factors were compared, some of the variables that we supposed that could be associated with CSDH recurrence such as the use of aspirin and the low admission GCS score demonstrated no statistically significant association. From those patients who received antiplatelet treatment, only 3 had rebleeding. However, this finding was not statistically significant. The present study showed that other clinical antecedents, the patient's clinical status, and other radiological features had no influence on recurrence or mortality.

The intraoperative decision whether to drain the hematoma through a burr hole or a mini-craniotomy was no statistically significant for presenting recurrence of the CSDH. The standards of each procedure were already mentioned in the methods section and are shown in **Figure 1 and 2**.

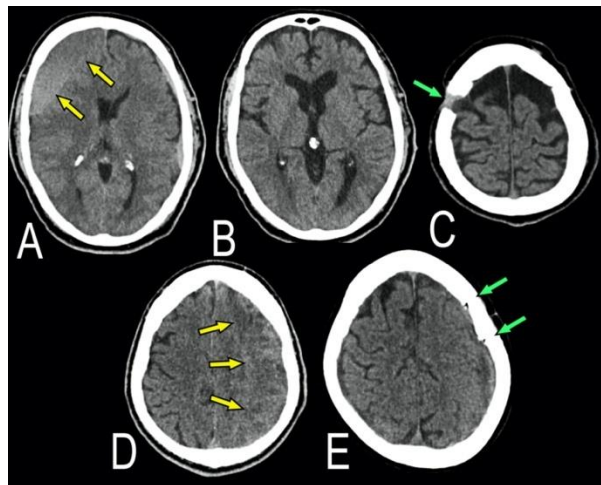


Figure 2. Pre- and post-operative CT scans of chronic subdural hematomas drained by a burr hole and a mini-craniotomy. (A) Patient 1. Pre-operative axial CT scan imaging of the head demonstrating a homogeneous isodense right frontal subdural hematoma (yellow arrows). (B, C) Post-operative axial CT scan imaging of the head demonstrating a right frontal burr hole (green arrow) and complete drainage of the hematoma. (D) Patient 2.

Pre-operative axial CT scan imaging of the head showing a right heterogenous iso- and hyper-dense subdural hematoma (yellow arrows). (E) Post-operative CT scan imaging of the head denoting the borders of a 3 cm mini-craniotomy (green arrows) and a subtle residual subdural hematoma.

We also found 3 important risk factors that were statistically significant associated with the increase of the mortality rate. The use of OAT had the most significant association. From all patients studied, 14 had a use of OAT and 28% of them had a fatal outcome ($p = 0.001$). Those CSDHs that showed areas of rebleeding/septations on the admission CT scan (heterogeneous density), were also associated with mortality ($p = 0.018$). This finding is remarkable in our study. We believe that this could be explained by the presence of clots that could not be drained in the first operation through a traditional burr hole. Finally, the history of TBI was also associated with an increased mortality in patients operated for a CSDH ($p = 0.047$), which is one of the main causes of this entity and that is usually not analyzed when assessing global risk in the treatment of CSDHs.

Recurrence and Mortality Rates of CSDH in LMICs

In some studies, from HICs such as the US and Sweden, the CSDH recurrence rate has varied widely, between 3% and 37%, (Kolias et al., 2014, Mellergard and Wisten, 1996, Traynelis, 1991) while mortality rates have been reported as 30% in 1-year. (Bin Zahid et al., 2018) On the other hand, in some African countries like Uganda the recurrence rates have been reported around 0.9% and mortality close to 9%, (Kitya et al., 2018) while in Ghana, Dakurah et al. reported recurrence and death rates of 2.1% and 2.1%, respectively. (Dakurah et al., 2005) These wide range of percentages among populations is based on multiple factors including the rapid and effective access to adequate neurological and radiological evaluation in LMICs, while in HICs could be associated with the patients' age.

Other important factors that could also affect the recurrence and mortality rates is that neurosurgeons represent a small minority of physicians in most LMICs, and the access to CT scanners and diagnostic centers are only available in urban areas.(Kitya et al., 2018, Akbar, 2004, Park, 2016) These reports are also incomplete, especially in Latin America, the language limitation and the research education is still limited to university hospitals in reference centers.(Ordonez-Rubiano et al., 2019) We found only 2 reports of Colombian groups in the literature in Spanish language, but none in the English literature.(Chater Cure et al., 2010, Moreno Huertas et al., 2019) Moreno Huertas C et al. reported 8% recurrence in their series, they also found that the following variables could be associated with the hematoma recurrence: pneumocephalus odds ratio (OR) 3.74 [confidence interval (CI) 95% (3.68-4.9)], obliterated basal cisterns OR1.37 [CI 95% (1.13- 4.84)], trabeculated architecture OR 1.19 [CI 95% (1.18- 9.03)], midline shift >10 mm OR 1.10 [CI 95% (1.02- 5.93)], and the preoperative hematoma volume OR 1.01 [IC 95% (1.00- 1.02)]. They reported a mortality rate of 6.4%. (Moreno Huertas et al., 2019) In a different series Chater Cure G et al. reported 11. % Of recurrence, but they do not report mortality rate in their study. (Chater Cure et al., 2010) Both series are lacking of analysis of risk factors for mortality. Our series demonstrated 10.3% of recurrence rate and 5.5% of mortality rate. In general, Colombian recurrence rates are higher compared with the Ghana series.

We believe this could be explained by their higher traumatic etiology of the hematoma (~70%), as most of them occurred as a result of motor vehicle collisions, while in our series this etiology was only ~50%. Additionally, in Colombia the use of aspirin as well as the use of OAT for cardiovascular diseases have been increasing in the last decades. The use of aspirin in Colombia is between 19.4-34.8% and the use of OAT is ~10%, while in Uganda there is no use of these medications reported in the literature. (Kitya et al., 2018) With this study we aim to promote research of multiple neurosurgical entities in Latin American LMICs and report these rates in the English literature as well. This data can be underestimated or not included for additional analyses as they are reported in regional non-indexed journals. Neurosurgical care needs to be better distributed around the world, with a major focus on LMICs. (Servadei et al., 2018)

Study limitations

There are several clinical and methodological limitations to this study. First is the limited number of patients. The low- and middle-income economies of developing countries limit research. As a retrospective study, the collection and analysis of data is also limited. Given the health system structure in Colombia, patients can be redirected to different institutions for follow-ups depending on their insurance company and consequently this can limit the accuracy of data reported.

Conclusions

The use of OAT, the history of TBI, and the heterogeneous density of the hematoma in the CT scan were found to be significant predictors for mortality, while none of the analyzed variables were statistically significant predictors for recurrence in patients who underwent surgical evacuation of CSDH in our institutions. CSDH evacuation through a burr hole or craniotomy remains a safe strategy, especially in LMICs. Surgical technique depends on multiple factors, most importantly on clinical and radiological features of CSDH and the surgeon's experience.

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