



Risk factors for reoperation after initial burr hole trephination in chronic subdural hematomas



Falko Schwarz^{a,*}, Franz Loos^b, Pedro Dünisch^a, Yasser Sakr^c, Daa Al Safatli^d, Rolf Kalff^e, Christian Ewald^f

^a Resident, Department for Neurosurgery, Jena University Hospital – Friedrich Schiller University Jena, Germany

^b Student, Jena University Hospital – Friedrich Schiller University Jena, Germany

^c Consultant, Department for Anaesthesiology and Intensive Care, Jena University Hospital – Friedrich Schiller University Jena, Germany

^d Consultant, Department of Neurosurgery, Jena University Hospital – Friedrich Schiller University Jena, Germany

^e Professor, Department for Neurosurgery, Jena University Hospital – Friedrich Schiller University Jena, Germany

^f Consultant, Department of Neurosurgery, Jena University Hospital – Friedrich Schiller University Jena, Germany

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ABSTRACT

Background: The optimal management of chronic subdural hematomas remains a challenge. Twist drill craniotomy or burr hole trephination are considered optimal initial treatments, but the reoperation rate for hematoma recurrence and other complications is still high. Therefore, evaluation of possible risk factors for initial treatment failure is crucial. In this context, we performed a study to define a possible subpopulation that may benefit from a more invasive initial treatment regime.

Methods: We retrospectively reviewed the medical charts of 193 patients with 250 chronic subdural hematomas who had undergone burr hole trephination as first-line therapy in our institution between January 2005 and October 2012. To identify risk factors for reoperation, a multivariable logistic regression analysis was performed with reoperation as the dependent variable. Surgical complications, including acute rebleeding, infection and chronic hematoma recurrence, were analyzed separately using a logistic regression model.

Results: The mean age of the cohort was 71.4 years. The male/female ratio was 137:56. Reoperation was necessary in 56 cases (29%) for recurrent hematomas and surgical complications. Predictors for reoperation for surgical complications were midline shift (odds ratio [OR] (per mm) 1.16, 95% confidence interval [CI]: 1.05–1.29, $p=0.006$), arterial hypertension (OR 5.44, 95% CI: 1.45–20.41, $p=0.012$) and bilateral hematomas (OR 4.22, 95% CI: 1.22–14.58, $p=0.023$). There was a trend toward a higher risk of surgically-relevant hematoma recurrence in patients with prior treatment with vitamin K antagonists (OR 1.76, 95% CI: 0.75–4.13, $p=0.191$).

Conclusion: Burr hole trephination is the therapy of choice in most chronic subdural hematomas, but the rate of recurrent hematomas is high. Every hematoma should be treated individually especially in relation to midline-shift and pre-existing conditions. Further prospective studies evaluating types of treatment and hematoma density are needed.

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1. Introduction

Chronic subdural hematomas are one of the most frequent reasons for intracranial bleeding and represent a challenge in

daily neurosurgical practice [4,8,26,29]. The incidence of subdural hematoma is 8–18:100000/year in people older than 65 years, but because of demographic changes and the increasing use of anticoagulation, a doubling of this number is expected within the next 25 years [8]. “Minimally invasive” approaches, like burr hole trephination or the so-called twist drill craniotomy, are considered the initial treatment of choice in the vast majority of patients. However, a reoperation rate of up to 31.6% has been reported, with hematoma recurrence and surgical complications, such as wound infection and acute re-bleeding, representing the major problems. The optimal management of subdural hematoma is, therefore, still a matter of

* Corresponding author. Tel.: +49 36419323011; fax: +49 36419323012.

E-mail addresses: falko.schwarz@med.uni-jena.de (F. Schwarz),

franz.loos@uni-jena.de (F. Loos), pedro.duenisch@luks.ch

(P. Dünisch), yasser.sakr@med.uni-jena.de (Y. Sakr), daa.alsafatli@med.uni-jena.de

(D.A. Safatli), rolf.kalff@med.uni-jena.de (R. Kalff),

christian.ewald@med.uni-jena.de (C. Ewald).

debate. The term “recurrence” is often not clearly defined, and can include re-accumulation, persistence, postoperative re-bleeding or incomplete resolution of the operated hematoma [26,29].

There is a need to re-define possible risk factors for failure of the initial treatment in order to identify patients who may benefit from a more extensive initial intervention, such as craniotomy or even craniectomy.

There are numerous studies that have dealt with the recurrence rate of operated subdural hematomas. However, the conflicting results underline the heterogeneity of this condition, with numerous risk factors being described, including midline shift, alcohol abuse, seizures, older age, organized hematomas with membranes, anticoagulation therapy, bilateral hematomas, among others [1,4,7,14,20,25].

Against this background, we analyzed data from 193 patients who were treated with burr hole trephination as first-line therapy, in order to identify risk factors for reoperation for surgical complications or recurrent hematomas.

2. Patients and methods

2.1. Patient cohort

We retrospectively included 193 consecutive patients with 250 hematomas who were treated with burr hole trephination for chronic subdural hematoma in our institution between 01/2005 and 10/2013. Every subdural hematoma was counted as a single case, even when a patient sustained two hematomas. Inclusion criteria were a first-time diagnosis, radiologically-confirmed chronic subdural hematoma with iso- or hypodense space occupying bleeding, or, in cases of a slightly hyperdense lesion, a history of symptoms of at least 5 days.

Patients who had concomitant intracranial pathologies, such as subarachnoid hemorrhage, intracerebral bleeding or an ischemic insult, within the last 12 months were excluded from the study. The presence of hydrocephalus was also an exclusion criterion.

To define possible risk factors for reoperation we created a database including patient-specific variables (age, sex, medical history, type and duration of hematoma-associated symptoms, anticoagulation) and hematoma-specific factors (side thickness [measured on coronal CT scan], average density of hematoma [measured in three ROIs: frontal, parietal and temporal] intralesional membranes and midline shift). For all patients, complications and the need for a second surgical intervention within 90 days after the first surgery were also documented. We choose this cutoff deliberately, because according to our experience most reoperations were done in this period. Operations after 90 days mostly have other reasons like a second trauma or a new treatment with anticoagulants.

The standardized target for preoperative INR was 1.0. We corrected a higher INR with a prothrombin complex concentrate and vitamin K. Patients on antiplatelets got blood substitutes depending on their platelet function. If a patient took only one antiplatelet like acetyl salicylic acid, desmopressin was substituted. Patients with two antiplatelets got a thrombocyte transfusion additionally.

In our study, we differentiated between reoperation for surgical complications, comprising acute rebleeding, local infection and wound healing disturbances, and reoperation for hematoma recurrence, defined as surgically treated, space-occupying re-accumulation of an initially regressing hematoma.

2.2. Surgery and follow up

The operation was always carried out under general anesthesia in the supine position. The head was positioned to perform the trephination at the highest point of the skull. After burr hole

trephination and irrigation of the hematoma, a closed, non-suction drainage system was implanted. This drainage tube remained in situ for as long as there was outflow of hematoma fluid. It took in average of at least one day until drainage removal. Radiological follow up was scheduled according to a rigid institutional protocol with the first CT on the first postoperative day. Depending on the result the patients received a chemoprophylaxis with a low dose heparin. Further CT examinations followed one day before discharge and within 3, 6 and 12 weeks after the final operation.

2.3. Statistical analysis

Data were analyzed using SPSS 21.0 for Windows software (SPSS Inc, Chicago, IL). Discrete variables are expressed as counts (percentage) and continuous variables as means \pm standard deviation (SD) or median and interquartile range (IQR) unless stated otherwise.

A univariate analysis was performed to select data for the multivariable analysis and variables were considered in the multivariable model if the p -value was < 0.2 . To define possible risk factors for therapy failure, we performed a logistic regression multivariable analysis with the need for reoperation caused by surgical complications as the dependent variable. Another model was constructed with the need for reoperation caused by hematoma recurrence as the dependent variable. A Hosmer and Lemeshow test was used to assess the goodness of fit of the multivariable model. Covariates were retained in the model if $p < 0.2$ and odds ratios (OR) with 95% confidence of interval (CI) were computed.

All statistics were two-tailed and a p -value < 0.05 was considered as statistically significant. A trend was defined as a $p < 0.2$.

3. Results

3.1. Demography and comorbidities

The main characteristics of the patients are shown in Table 1. The most important concomitant diseases were preexisting, medically-treated arterial hypertension ($n = 131$), diabetes mellitus ($n = 57$) and alcohol abuse ($n = 9$). Preoperative anticoagulation therapy was being administered to 87 patients: anti-platelet agents ($n = 42$), vitamin K antagonists ($n = 36$), combination therapy ($n = 5$), idiopathic ($n = 3$) and factor Xa inhibitors ($n = 1$). The median follow up was 151 days (IQR 47–343).

3.2. Overall reoperation rate

Reoperation after initial burr hole trephination was performed in 56 patients (29%) for 70 hematomas (28%). Nineteen of these patients (9.8%) (20 hematomas [8%]) were operated on twice, 5 patients (2.6%) (5 hematomas [2%]) three times and 1 patient (0.5%) four times. The most frequent reason for reoperation was hematoma recurrence in 35 patients (18.1%). The median duration between initial burr hole and first reoperation was 10.5 days.

A midline shift between 6 and 10 millimeters was a significance risk factor for reoperation in univariate analysis ($p = 0.026$). A statistical tendency towards a higher rate of reoperation was present for arterial hypertension ($p = 0.093$), midline shift ($p = 0.077$) and intralesional membranes ($p = 0.109$).

After multivariable analysis with “reoperation” as the dependent variable, presence of a midline shift between 6 and 10 mm (OR, 2.69, 95%CI: 1.01–7.15, $p = 0.047$) remained a significant predictor (Table 2).

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