ORIGINAL RESEARCH PAPER

Neurosurgery

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A RETROSPECTIVE ANALYSIS OF CHRONIC SUBDURAL HEMATOMA DRAINAGE TECHNIQUES AND EFFECTS OF ANTITHROMBOTIC THERAPY IN THE OUTCOME OF PATIENTS IN A PERIPHERAL TERTIARY CARE CENTER.

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INTRODUCTION

Surgical treatment strategies, and decisions on how and when to perform an operation, have historically largely been based on traditions and the surgeon's own personal experience and preference. Having reached low mortality rates in neurosurgery, focus has discretely shifted towards patient-reported outcomes, such as functional scores and health related quality of life . Surgical patriarchs are being challenged by patient involvement, i.e. shared decision-making, which relies highly on correct preoperative risk-benefit assessments. The need for clinicians to keep updated - critically evaluating and embracing quality research, continuously asking questions about own practice, is essential. In 2018 "the human factor" in surgery and patient treatment is still as crucial as in Cushing's time, and the need for quality assessment of clinical practice sustains.

Safe surgery procedures and increased focus on patient safety has become a natural part of our everyday surgical work, and routines for aberrations and constant improvement in patient care is more streamlined than only a decade ago.

In this study the perioperative time period is defined as the 24 hours before surgery and the first 30 days postoperatively. A decision to perform or undergo brain surgery is different than many other types of surgical decisions, simply because this organ can be non-forgiving if even the smallest mistake is made.

As neurosurgeons, we are regularly confronted with complications, and constantly reminded to stay alert throughout working hours both in the operation theater and in outpatient clinics where crucial decisions are made. Considering the high demands of treatment quality, evidence-based guidelines for neurosurgical treatment and perioperative quality handling are still surprisingly scarce

Chronic SDH

Evacuation of chronic subdural hematoma is one of the most common neurosurgical procedures. It is most often encountered in the elderly . The number of CSDH patients is expected to increase as the oldest segment of the population continues to grow. According to the prognosis for 2030, CSDH is expected to be the most common intracranial neurosurgical condition in India. Incident rates for surgical intervention is reported 10- 20/100.000 per year in different materials.

Pathophysiology

The pathophysiology is still debated and not fully understood . What we do know, is that rupture of bridging veins running from the cortical surface into the dura and greater venous intracranial sinuses leads to accumulation of blood in the subdural space. Cerebral atrophy, which comes naturally with age, contributes to "stretching" of the veins - making them prone to rupture with only minor trauma. One supplemental theory is that hyperangiogenesis and micro bleedings in the so-called neomembrane might play a role in the development of, and especially in the recurrence of, CSDH.

Arbitrarily divided into 3 stages. i.e. Acute SDH-1 to 3 days from injury; Sub acute SDH- 4 to 21 days of injury; Chronic SDH -after 3 weeks of injury.

Treatment is technically not very demanding. However, the patients are often old and carry comorbidity. There is practically no upper age limit for going through surgery for CSDH - left untreated the hematoma often cause severe neurological damage and death. The surgery is mini-invasive, mostly done under local anesthesia in combination with sedation. After a 3-4 cm skin incision, a small burr hole in the skull is made. The surgeon then enters the subdural space which is easily reached through the dura mater, and the blood is washed out. The procedure typically takes 20-30 minutes, and the overall outcome is generally good, and the morbidity and mortality rates related to the surgical procedure is low. The use of postoperative drainage systems for the first postoperative hours is common.

Aim and Objective

Retrospective study done from August 2016 to January 2019 (30 months)

To compare recurrences after chronic subdural hematoma burr-hole surgery using three different postoperative drainage techniques.

To establish the risk of recurrence in patients with chronic subdural hematoma on antithrombotic treatment, and explore if timing of resumption of antithrombotic treatment influence the occurrence of thromboembolism and hematoma recurrence

Materials and methods

This retrospective study is based on the collected experience of 270 patients who were managed for chronic subdural hematoma with Burr hole evacuation at Thanjavur Medical college Hospital, which caters neurotrauma care for nearly six districts in its vincity.

Data collected from our neurotrauma registry (August 2016 – January 2019) has been used for the analysis. A total of 270 patients were included in the study. Patients who died post operatively due to systemic complications were excluded from the study. All patients included in the study were adults (age 27 years or older)

To ensure high-quality data for primary endpoints which now focused on antithrombotic therapy and the timing of resumption of AT medication as potential factors influencing recurrence rate and complications. 177 patients were included.

Once patients presenting to our emergency department or referred from other supporting departments, we have had their cardiopulmonary status assessed, they have a rapid and directed neurologic examination and appropriate imaging. In our facility, patients with chronic subdural hematoma with more than 5 mm of shift proceed to the operating room, irrespective of the GCS, unless brain-dead. Trauma registry data are prospectively recorded by the treating doctors during routine clinical care. Trained clinical data specialists abstract additional data from the medical record for review and reporting purposes. Data are composed of demographic information, medical history, and detailed information on presentation to the hospital and the course of

treatment

- Data collected includes
- the age of the patient,
- history of injury/ trivial trauma in the past,
- interval between the time of trauma and time of admission to the hospital,
- neurological and hemodynamic status at the time of admission,
- co-morbidities
- Anti-thrombotic therapy (type and duration)
- Anti-epileptic (type and duration)
- other associated injuries,
- respiratory efforts,
- imaging results,
- Necessity for post-operative ventilator support and post-op care.

Recurrence of chronic subdural hematoma :
We defined the index operation as the first surgical procedure on the affected side. Bilateral hematomas were registered as one index operation is both sides were treated as part of the same procedure. A recurrent CSDH was defined as same-sided CSDH recurrence treated with surgery within 6 months of the index operation. In the cases in which a one-sided indexoperation was followed by a bilateral recurrent procedure (i.e., one recurrent side and one untreated side), the patient was still registered as having only one index operation and one reoperation.

Clinically relevant postoperative hematoma :
A clinically relevant postoperative hematoma was defined as radiologically detected hematoma having any possible association with postoperative course/events, including prolonged observation in intensive care unit, delayed mobilization, possibly related neurological deficits including transient deficits, or more severe related events like impaired consciousness or death. All reoperations for postoperative hematomas were obviously registered as such, being one of the secondary end points.

Venous thromboembolic events:
The first-line diagnosis of DVT and PE is lower extremity ultrasonography and contrast-enhanced chest computed tomography, respectively. We did not performed VTE screening in asymptomatic patients.

Observations
Summary of Results:
Assessment of drainage techniques for evacuation of chronic subdural hematoma Recurrence in need of surgery was observed in 10.8% in the continuous irrigation and drainage cohort (CID), in 20.0% in the passive drainage cohort (PD), and in 11.1% in the active drainage cohort (AD)($p<0.001$). Complications were more common in the CID cohort (14.5%) compared with the PD (7.3%) and AD cohorts ($p=0.019$). Perioperative mortality rates were similar between cohorts ($p=0.621$). After adjusting for differences in baseline and treatment characteristics in a regression model, the drainage techniques were still significantly associated with clinical outcome ($p<0.001$ for recurrence, $p=0.017$ for complications).
Although one cannot exclude unmeasured confounding factors when comparing centers, active subgaleal drainage seems to be superior to the more common passive drainage - and safer than continuous irrigation.

Role of antithrombotic therapy in the risk of hematoma recurrence and thromboembolism after chronic subdural hematoma evacuation

There was no difference in CSDH recurrence within 3 months (11.0% vs. 12.0%, $p=0.69$), nor was there any difference in perioperative mortality (4.0 % vs. 2.0%, $p=0.16$) between those using antithrombotic therapy (AT) compared to those who were not. Perioperative morbidity was more common in the AT group compared to no-AT group (10.7% vs. 5.1%, p30 days) AT resumption, there was no difference with respect to recurrence (7.0% vs. 13.9%, $p=0.08$), but more thromboembolism in the late AT resumption group (2.0% vs 7.0%, $p<0.01$).

In clinical practice, CSDH patients on AT therapy at the time of diagnosis have similar recurrence rates and mortality compared to those without AT therapy, but with higher morbidity. Early resumption was not associated with more recurrence, but with lower thromboembolic frequency. Early AT resumption seems favorable.

Strengths and limitations
The chronic subdural hematoma studies, we found that AD and CID were associated with a lower chance of reoperation due to CSDH recurrence compared with only PD postoperatively. More complications were observed in patients treated with CID. The differences in outcomes across cohorts remained following adjustments for baseline characteristics.

The major strength of this study is a very high compliance with treatment strategy in combination with the population-based approach. The study included large number of patients with low rates of missing data. Comparative effectiveness research is prone to confounding factors. To minimize the risk of confounding, registration of data included variables known to potentially influence primary endpoint, such as the indication for repeat surgery. However, we did not use propensity score matching or other advanced statistical methods in further attempts to control confounding.

Limitations inherent to retrospective assessment are present in this study. The difference in outcomes may be at least in part due to the fact that each type of procedure was performed at different hospitals and by different surgical teams. Differences in general postoperative management is a concern, and the way it could contribute to differences between groups. These differences are difficult to control, especially in retrospect, and are complex and dependent on other non-controllable factors like available hospital beds and the constant need for patient turn-over in highly specialized regional centers.

We cannot exclude the possibility that observer/consultant differences in treatment indications, follow-up routine, or indications for reoperations may have affected our findings. In the PD cohort, patients were routinely screened 4 weeks postoperatively with a visit in the outpatient clinic and a CT scan, while radiology controls were performed based on clinical symptoms in the CID and AD cohort. The risk of detection bias is present, but the indications for reoperations showed not to be different between cohorts based on our retrospective review, as patients had to present with relevant clinical symptoms in addition to radiological findings. The difference in recurrences between cohorts was large, and although the above mentioned may have influenced our results, given the magnitude of recurrence rate, bias alone is unlikely to fully explain the observed difference.

Safety around continuous inflow-and outflow irrigation has always been a concern. We did find increased morbidity in the CID cohort. However, in this cohort a higher percentage of the patients had general anesthesia, and in some cases, there was also delayed mobilization. Two recent studies reported that general anesthesia was associated with higher morbidity and longer hospital stays that sedation combined with local anesthesia.

This CID cohort was also more frequent users of antithrombotic treatment, which theoretically could explain the higher morbidity rate as well as the fact that the recurrence rate in this time period was surprisingly higher than reported in the Hennig article in 1999 that 37 described a residual rate of remarkably low 2,6%. The results from Anthithrombotic therapy group however, dismisses this theory as perioperative morbidity was the same in both groups and AT treatment did not affect recurrence rates. We have no good explanation as to why the current CID cohort performed worse than the earlier series except the design of the 1999 study which can be questioned concerning power and setup. The CID

technique was introduced only a few years before the publication. If looking at the IDEAL framework for surgical innovation, early adopters and pioneers tend to be extra enthusiastic of techniques. Patients may therefore be treated in expert hand with enthusiastic team. However, with dissemination to other caregivers, external validity increases and results usually drop.

In AT group, we found that in clinical practice, CSDH patients on AT therapy at the time of diagnosis have similar recurrence rates and mortality compared to those without AT therapy, but with higher morbidity.

Early resumption was not associated with more recurrence, but with lower thromboembolic frequency. Early AT resumption seems favorable. Some of the limitations in this group are similar to previous group because of its retrospective assessment. The data on CSDH recurrence and postoperative thromboembolism frequency after pausing antithrombotic treatment remain indisputable, but a limitation exists in the lack of long-term follow-up data. The validity of the study is limited by the surgeons often subjective decision on when to resume AT therapy. Resumption may be confounded by indication since AT may be withheld in presumed high-risk patients for reasons we cannot control in retrospect despite having comparable baseline characteristics.

The external validity is limited in the sense that "early" resumption on AT therapy is defined as within 30 days. Even if the median number of days post surgery in the early group for resumption was 16, one could still debate whether this finding could change clinical policy. However, the findings justify an RCT that can push the borders for resuming AT therapy even earlier – as one now knows that there is an increased risk of VTE with late resumption at the same time there was no increased recurrence rate if early resumed.

Practical implications of this study:

We have changed drainage technique for evacuating CSDH from continuous irrigation and drainage and from passive subdural drainage to active subgaleal drainage. There is ongoing quality control.

Early resumption (<30 days) of antithrombotic therapy after surgery for CSDH seems beneficial, and a RCT is justified and planned for further clarification as to how early this can be done safely.

For further refinement, comparative effectiveness research such as the scientific work we have presented, can provide the necessary basis for conducting future RCTs. Pushing the borders is easier when you stand on rock and not in swamp. We now suggest a large-scale RCT for establishment of optimal timely resumption of antithrombotic medication in CSDH patients after undergoing surgery.

To better illuminate perioperative risks and benefits associated with neurosurgical procedures, we also need sensitive and reliable outcome measures. New validated neurosurgical classifications tools should be sought. Avoidance of complications starts by risk-benefit assessment prior to decision to perform surgery, and identifying important predictors for complications is crucial for keeping morbidity and mortality rates at a low.

The bridge between academic research and surgery needs to become more obvious, it will encourage young neurosurgeons to incorporate scientific work into their everyday workload. As the American physicist Lisa Randall (1962-) stated: "Scientific research involves going beyond the well-trodden and well-tested ideas and theories that form the core of scientific knowledge. During the time scientists are working things out, some results will be right, and others will be wrong. Over time, the right results will emerge.

CONCLUSION:

This study investigated several perioperative strategies for the treatment of common neurosurgical conditions.

The following conclusions can be drawn:

- Active subgaleal drainage for 24 hours after surgery seems to be the most efficient and safest treatment strategy for chronic subdural hematoma.

- Patients with CSDH on antithrombotic therapy at the time of diagnosis, have similar recurrence rates and mortality compared to those without antithrombotic therapy. Early resumption is not associated with more recurrence, but with lower thromboembolic frequency.

Abbreviations

AD = Active subgaleal drainage
AT = Antithrombotic treatment (antiplatelets and anticoagulants)
CID = Continuous irrigation and drainage
CSDH = Chronic subdural hematoma
CT = Computer Tomography
DVT = Deep vein thrombosis
ICU = Intensive care unit
MRI = Magnetic Resonance Imaging
PD = Passive drainage
PE = Pulmonary embolus
RCT = Randomized controlled study
VTE = Venous thromboembolism

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