Int J Med Rev 2016;3(4):497-500

doi 10.15171/ijmr.2016.09

INTERNATIONAL JOURNAL OF MEDICAL REVIEWS

Mini Review

Survey of Available Literature and Meta-Analyses on Chronic Subdural Hematoma

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Received October 19, 2016; **Accepted** November 14, 2016; **Online Published** December 24, 2016

Abstract

Chronic subdural hematoma (CSDH) is an encapsulated collection of blood and fluid on the surface of the brain. It is a common condition, especially in elderly patients, with an incidence of 58 cases per 100 000 people per year in patients over 65 years of age, a mortality rate of about 2%, and a recurrence rate ranging from 11.7% to 28% despite surgical and medical treatments. Due to the high incidence of CSDH, a vast amount of literature exists on the various medical and surgical aspects. Moreover, the literature contains meta-analyses analyzing different techniques, medical therapies, and factors associated with prognoses. Herein, the available literature and meta-analyses on different aspects of CSDH are reviewed in order to provide a rapid review of the best evidence regarding this condition. Twelve meta-analyses comparing the effects of different surgical and/or medical treatments on various different clinical outcomes were analyzed. Strong evidence was found that: (1) burr-hole craniostomy and twist-drill craniostomy are both efficacious in treating CSDH; (2) drainage placement is associated with better clinical outcomes and significantly lower recurrence rates; (3) antithrombotic drugs are significantly associated with a higher recurrence rate; and (4) in case of need of reoperation, open craniotomy is associated with better outcomes compared with minimally invasive procedures. Further studies are needed to clarify the role of corticosteroids and the best timing of the resumption of antithrombotic drugs after CSDH evacuation.

Keywords: Chronic Subdural Hematoma, Surgery, Drug Therapy, Meta-Analysis, Review

Citation: Montano N, Ioannoni E, Caricato A, Olivi A. Survey of available literature and meta-analyses on chronic subdural hematoma. Int J Med Rev. 2016;3(4):497-500. doi:10.15171/ijmr.2016.09.

Introduction

A chronic subdural hematoma (CSDH) is an encapsulated collection of blood and fluid on the surface of the brain. It is a common condition with an incidence rate estimated at 1.7-18 cases/100 000/year, rising up to 58 cases per 100 000 people per year in patients over 65 years. Extensive literature exists about the pathogenesis of CSDH.[1-3] It is well known that brain atrophy, stretching the bridging veins which connect the brain surface with the dura mater, is a risk factor for the onset of CSDH.[4-7] In fact, the traumatic tearing of these vessels is classically considered as the main factor for the formation of CSDH.[8] Nonetheless, in many cases trauma may be absent or very minor and may not explain the progressive, chronic course of this condition. Thus, it has been hypothesized that more complex mechanisms such as angiogenesis, fibrinolysis, and inflammation can be key processes involved in CSDH development.[9] Previous studies have identified the membranes surrounding a CSDH as a source of fluid exudation and angiogenic stimuli leading to the creation of new fragile blood vessels within the membranes walls. Moreover, fibrinolytic processes prevent clot formation which results in continued hemorrhage, while inflammatory cells within the membranes are likely to contribute to propagating an inflammatory response which stimulates ongoing membranes growth and fluid accumulation.[9] From a clinical point of view, the risk factors for CSDH formation include long-term heavy alcohol use; long-term use of aspirin, anti-inflammatory drugs, or anticoagulant medication; and diseases associated with reduced blood clotting, head injury, and old age.[10] Surgery is considered the treatment of choice in most symptomatic CSDHs, but patients with small asymptomatic CSDHs using antiplatelet/anticoagulant drugs can be managed conservatively.[10] Burr-hole surgery with drainage under local anesthesia is the most common surgical procedure, although other techniques such as twist-drill craniostomy and open craniotomy have been reported.[11] The mortality rate in CSDH is about 2%,[10] and the reported recurrence rate in patients ranges from 11.7% to 28%.[12] Age greater than 70 years, bilateral CSDH, preoperative width of hematoma greater than 20 mm, postoperative midline shift greater than 5 mm, high- and mixed-density shown on CT scan, preoperative seizure, antiplatelet or anticoagulant drugs, and diabetes mellitus have all been reported as predictors of CSDH recurrence.[7] On account of the high incidence of this condition, a vast amount of literature has been published on CSDH. Nonetheless, the first and earliest principle of evidence-based medicine indicated that a hierarchy of evidence exists. Various versions of the evidence pyramid have been described, but all of them have focused on showing weaker study designs at the bottom (basic science and case series), case–control and cohort studies in the middle, followed by randomized controlled trials (RCTs), and then, at the very top, systematic reviews and meta-analyses.[13] The current study aimed to review meta-analyses available in the literature on different aspects of CSDH in order to provide a rapid review of the best evidence on this condition.

Methods

A literature search was conducted in the PubMed database and Cochrane Library using the search terms "chronic subdural hematoma", "review", and "meta-analysis". All articles written in languages other than English were excluded. In total, 421 articles were screened, and 12 meta-analyses comparing the effects of different surgical and/or medical treatments on various clinical outcomes were identified.[14-25]

Results

This study analyzed 12 meta-analyses.[14-25] The meta-analyses that compared different surgical treatments for CSDH are shown in Table 1, while those that focused on medical treatments for CSDH are shown in Table 2. Overall, 7 meta-analyses compared different surgical treatments in CSDH. The total number of patients included in these meta-analyses was 42 080. More specifically, Belkhair and Pickett analyzed 631 patients,[14] Alcalá-Cerra et al,[15] 628, Almenawer et al,[16] 34 829, Liu et al,[17] 1503, Peng et al,[18] 968, Xu et al,[19] 1494, and Xu et al,[20] 2027. Five meta-analyses focused on the medical aspects of CSDH for a total of 25 751 patients. Bakheet et al analyzed 23 136 patients,[21] Poon et al,[22] 937, Phan et al,[23] 899, Wang et al,[24] 256, and Yao et al,[25] 523.

The main results regarding surgical treatment of CSDH were:

1. no differences in outcome between burr-hole craniostomy and twist-drill craniostomy,[16,20] and
2. better outcomes with the placement of a subdural drain.[15-19]

The main results concerning the medical aspects of CSDH were:

1. the use of antiplatelet drugs is associated with a worse outcome,[21,22,24] and

Table 1. Meta-Analyses on Chronic Subdural Hematoma: Surgical Aspects

Author, Year	Purpose	Main Results	OR (95% CI)
Belkhair et al,[14] 2013	To compare the revision rates after single burr hole craniostomy versus double burr hole craniostomy	No significant difference	0.62 (0.26-1.46)
Alcalá-Cerra et al,[15] 2014	To determine the effect of a subdural drain after burr-hole evacuation on symptomatic recurrence, reoperation, poor functional outcome, mortality, and post-operative complications	Statistically significant reduction in the risk of symptomatic recurrence, reoperation, and poor functional outcome	Symptomatic recurrence: 0.51 (0.36-0.75) reoperation: 0.5 (0.34-0.74) poor functional outcome: 0.61 (0.39-0.98)
Almenawer et al,[16] 2014	To compare the efficacy and safety of multiple treatment modalities for the management of CSDH patients	No significant difference in mortality, morbidity, cure, or recurrence rates between percutaneous bedside drainage and operating room burr-hole evacuation. Higher morbidity with adjuvant use of corticosteroids with no significant improvement in recurrence or cure rates. The use of drains following CSDH drainage resulted in a significant decrease in recurrences. Craniotomy was associated with higher complication rates if considered initially. Craniotomy was superior to minimally invasive procedures in the management of recurrences.	Mortality: 0.69 (0.46–1.05) morbidity: 0.45 (0.2–1.01) cure: 1.05 (0.98–1.11) recurrence rate: 1 (0.66–1.52) 1.97 (1.54–2.45) 0.46 (0.27–0.76) 1.39 (1.04–1.74) 0.22 (0.05–0.85)
Liu et al,[17] 2014	To compare results of different surgical procedures for CSDH	The use of postoperative drainage is associated with better results.	0.36 (0.21–0.60)
Peng et al,[18] 2016	To assess the effects and safety of the use of external drains versus no drains after burr-hole evacuation for the treatment of CSDH	Significant reduction in the risk of recurrence with subdural drains. No increase in complications No increase in mortality No increase in poor functional outcome	0.45 (0.32-0.61) 1.15 (0.77-1.72) 0.78 (0.45-1.33) 0.68 (0.44-1.05)
Xu et al,[19] 2016	To evaluate the incidence of revision surgery for CSDH after treatment with burr-hole craniostomy with/without irrigation or with/without drainage	Significant higher recurrence without drainage	0.44 (0.31-0.62)
Xu et al,[20] 2017	To compare burr-hole craniostomy and twist-drill craniostomy	No differences in mortality. No differences in recurrence rates. Twist-drill craniostomy had a significantly higher operative failure rate. Patients treated by twist-drill craniostomy tended to achieve a better neurological outcome.	1.25 (0.83-1.87) 1.29 (0.87-1.92) 0.35 (0.15-0.83) 0.92 (0.86-0.99)

Table 2. Meta-Analyses on Chronic Subdural Hematoma: Medical Aspects

Bakheet et al,[21] 2015	To quantify the risk of subdural hematoma associated with dual antiplatelet therapy with clopidogrel plus aspirin	Clopidogrel plus aspirin was associated with a significantly increased risk of subdural hematoma compared with aspirin alone.	2.0 (1.0-3.8)
Poon et al,[22] 2017	To quantify the risk of antithrombotic therapy on CSDH recurrence	The association between antithrombotic drug use and CSDH recurrence was significant for antiplatelet drug use, but marginally significant for anticoagulant drug use.	Antiplatelet drug use: 1.36 (1.05-1.75) Anticoagulant drug use: 1.38 (1.00-1.91)
Phan et al,[23] 2017	To assess the incidence of hemorrhagic and thromboembolic events following the resumption or non-resumption of antithrombotic agents postoperatively in CSDH patients already on these agents before the operation	The rate of thromboembolism was statistically lower in patients who resumed antithrombotic agents.	0.029 (0.014-0.059)
Wang et al,[24] 2017	To assess the association between antithrombotic agents, including anticoagulants and antiplatelets and CSDH recurrence. To assess the association between the resumption of antithrombotic agents and postoperative complications	The use of antithrombotic agents, both anticoagulants and antiplatelets increased the recurrence rate.	Anticoagulants: 2.20 (1.45-3.33) antiplatelets: 1.64 (1.17-2.30)
Yao et al,[25] 2017	To assess the effect of dexamethasone for CSDH	Dexamethasone (alone or adjuvant) resulted in a lower recurrence rate.	0.54 (0.33-0.88)

2. the use of anticoagulant drugs is associated with a worse outcome.[22,24]

Discussion

Extensive literature has been published on the different aspects of CSDH. In the current study, the available meta-analyses comparing different surgical and/or medical treatments and the influence of various treatments on outcomes were reviewed.

Surgical Treatments

Various surgical treatments have been proposed for the management of CSDH. Burr-hole craniostomy has been reported as an efficient choice for surgical drainage of uncomplicated CSDH and has been associated with low recurrence and complication rates.[10] Moreover, burr-hole irrigation and a closed-system drainage are used by many surgeons to improve the clinical outcome of their patients.[26] Nonetheless, surgeons differ in their choices regarding the usage of one or two burr holes.[27,28] Twist-drill craniostomy has been reported for high-risk surgical candidates in non-septated CSDH. This procedure can be performed bedside and is effective in treating CSDH.[29] The main advantage of this procedure is that it can be considered a minimally invasive procedure; the main shortcomings are inadequate drainage, the possibility of brain penetration, and catheter folding.[30] Open craniotomy has been reported as a good choice for multiloculated CSDH and CSDH with significant membranes, while a small craniotomy with irrigation and closed-system drainage is considered by many surgeons as an alternative to burr-hole craniostomy.[10]

In a large meta-analysis comparing multiple surgical procedures, Almenawer et al found no differences in mortality, morbidity, recurrence, or cure rates between the burr-hole craniostomy and the twist-drill craniostomy.[16] Moreover, no differences in mortality or recurrence rates between these two techniques were found by Xu et al, who specifically addressed the differences in outcomes between these two procedures in their meta-analysis.[20] Notwithstanding these results, they also showed that the twist-drill craniostomy was associated with a significantly higher number of operative failures compared with the burr-hole craniostomy, although patients submitted to a twist-drill craniostomy tended to achieve a higher cure rate.[20] This last result could be explained by a bias in the selection of patients; it is probable that the twist-drill craniostomy is preferred for easier cases such as non-septated CSDH, which would result in an overall better neurological prognosis for this subgroup of patients. While no significant differences were found between single burr-hole craniostomy and double burr-hole craniostomy,[14] several meta-analyses provide strong evidence that the placement of a subdural drain is associated with a significantly lower recurrence rate[15,16,18,19] and a better functional outcome[15,17,18] without an increase in operative complications or mortality.[18] Finally, considering the treatment of the recurrences of CSDH, there is evidence that open craniotomy is superior to minimally invasive procedures, even though it is associated with more complications if considered as the first treatment.[16]

Medical Aspects

The majority of the meta-analyses evaluated in the current study focused on the recurrence risk of CSDH in patients using antithrombotic drugs (antiplatelet therapy and/or anticoagulant therapy). A meta-analyses review revealed strong evidence that antiplatelet drugs are associated with a higher recurrence rate after CSDH evacuation.[22,24] This risk is increased in patients taking two antiplatelet drugs.[21] A higher recurrence rate is also associated with the use of an anticoagulant drug,[22,24] although it has been evidenced that the rate of thromboembolic events is lower in patients who resumed antithrombotic agents after CSDH evacuation.[23] Two meta-analyses addressed the role of corticosteroids in CSDH with conflicting results.[16,25] In fact, while Yao et al. found that dexamethasone was associated with a lower recurrence rate,[25] Almenawer et al in their large meta-analysis on 34 829 patients found higher morbidity with the adjuvant use of corticosteroids with no significant improvement in recurrence or cure rates.[16]

Conclusion

CSDH is a common pathology, but it is difficult to treat both from surgical and medical points of view. While a substantial agreement was found among the evaluated meta-analyses that burr-hole craniostomy and twist-drill craniostomy are both efficacious in treating CSDH, strong evidence was also found that drainage placement is associated with better clinical outcomes and significantly lower recurrence rates. Nonetheless, a majority of patients use antithrombotic drugs when CSDH is diagnosed. These drugs are clearly unfavorable prognostic factors in terms of recurrence. In case of need for reoperation, open craniotomy is associated with better outcomes compared with minimally invasive procedures. Further studies are needed to clarify the role of corticosteroids and the best timing for the resumption of antithrombotic drugs after CSDH evacuation.

Authors' Contributions

All authors contributed equally to this research.

Conflict of Interest Disclosures

None.

Ethical Approval

Not applicable.

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