

DISCUSSION

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Chronic subdural hematoma is an encapsulated collection of old blood, mostly or totally liquefied and located between the dura mater and arachnoid. Trauma has been recognized as an important factor in the development of CSDH. Adhiyaman estimated an incidence of 1.72/100,000 per year, the incidence increasing steeply with advancing age up to 7.35/100,000 per year in the age group 70–79. This incidence is expected to rise further due to the continuing growth of the older population, and thus highlights the importance of designing appropriate decision making tools. ^(89, 90)

The pathophysiology of CSDH development appears to be complex, and the related literature is controversial. Numerous risk factors for recurrence of CSDH have been reported, including bleeding tendency, intracranial hypotension, advanced age, brain atrophy, bilateral CSDH, internal architecture of the hematoma, hematoma type, DM, postoperative posture, surgical techniques, postoperative subdural air accumulation, inflammatory cytokines, alcohol abuse, and multiplicity of hematoma cavity. ^(58, 67-75)

Recurrence was defined as the occurrence of symptoms and signs attributable to an ipsilateral hematoma seen on a brain computed tomographic (CT) scan within 3 months of the original drainage procedure. ⁽⁶⁶⁾

Elderly patients with CSDH are considered vulnerable to postoperative complications, and repeated surgery will further increase chance of complication. Preventative effort that focuses not only on preventing complications in each surgery but also on reducing recurrence rate for elderly CSDH may contribute an improvement in their outcomes. ⁽⁹¹⁾

this study worked on the following assumed risk factors for recurrence of CSDH which are age, sex, bleeding tendency, preoperative GCS, Glasgow outcome scale score, postoperative position of the patient, internal architecture of the hematoma, width of the hematoma, post-operative midline shift, postoperative subdural air collection and bilateral CSDH. We found that oral anticoagulant, antiplatelet therapy, separate and laminar CSDH, width of the hematoma, postoperative midline shift, massive postoperative subdural air collection and bilateral CSDH are independent predictors for recurrence of CSDH.

Width of hematoma, postoperative midline shifting and postoperative subdural air collection

It has been stated that any factor leading to a prolonged postoperative widening of the hematoma cavity (brain atrophy, residual hematoma, massive subdural air collection,) may cause an impaired adhesion between the inner and outer neo-membranes and thus facilitate postoperative recurrence. ^(14, 44, 92)

Stanisic et al. found that a persistent large postoperative hematoma cavity and large amount of residual subdural air within four days post-surgery tended to correlate to a high PR rate of CSDH (21.1% and 24.2% respectively). ⁽⁹³⁾

Stanisic et al. also found that the recurrence rate was significantly higher when the postoperative midline displacement was more than 5 mm compared to less displacement. ⁽⁹³⁾

Chon et al. found that width of hematoma and persistence of postoperative midline shifting are independent risk factors for recurrence of CSDH. ⁽⁶⁶⁾

Chon et al. hypothesized that wider hematomas have increased tendency to recur because the subdural space is larger than a small lesion post-operatively. The intracranial pressure-volume function reflects the elastic properties of the brain parenchyma, the cerebrovascular bed, and the supporting dural structures within the rigid skull. Intracranial volume changes that result from the various mechanisms of spatial compensation are superimposed on the instantaneous pressure-volume function of brain elasticity. The elasticity function may be altered by disease such as hydrocephalus, advanced age, and brain atrophy. This study also demonstrated that persistence of the postoperative subdural cavity and residual air are risk factors for recurrence of CSDH. ⁽⁶⁶⁾

Chon et al. also stated that prolonged symptom duration, advanced age, brain atrophy, width of hematoma, hematoma volume, and increased brain elastance may influence the persistence of postoperative midline shifting. A prolonged postoperative midline shifting may cause impaired adhesion between the inner and outer neo-membranes and thus facilitate postoperative recurrence. ⁽⁶⁶⁾

Chon et al. stated that postoperative midline shift ≥ 5 mm and/or preoperative hematoma width ≥ 20 mm are risk factors of recurrence. ⁽⁶⁶⁾

Fukuhara et al. showed that advanced age, brain atrophy, large amount of hematoma, and prolonged compressed parenchyma influenced the brain elasticity. Brains with high elastance tend to re-expand poorly, and poor re-expansion of the brain may lead to persistence of postoperative midline shifting. Poor brain re-expansion is correlated with recurrence. ^(68, 74)

In the present study 5 patients out of 7 had a hematoma thickness more than 2 cm and 6 patients out of 7 had a mid-line shift more than 5 ml in the recurrence group. This indicates that width of the hematoma and post-operative mid-line shift are dependent predictors for recurrence of CSDH. Twelve patients out of 33 had a subdural air collection in the no-recurrence group and 5 patients out of 7 had a subdural air collection in the immediate post-operative CT brain scans. This indicated that subdural air collection in the post-operative CT brain is an dependent predictor for recurrence of CSDH. These findings are in agreement with those reported by Stanisic et al., Chon et al. and Fukuhara et al. ^(66, 74, 93)

Bleeding tendency

Considering the increasing number of aged patients who use antiplatelet and anticoagulant medications, attention should be focused on the possible risks of these treatments. Theoretically, it is plausible that the use of antiplatelet and anticoagulants has a positive influence on the recurrence of CSDH. ⁽⁷⁶⁾

Torihashi et al., Lindvall et al., and Konig et al. stated that the Use of AAA therapy and the risk of recurrence are disputed. ^(74, 76, 95, 96)

Konig et al. were unable to find any statistically significant relationship between the use of anticoagulants and/or AAA therapy with recurrence rate and for the time of recurrence. All patients on either anticoagulants or AAA therapy had additional diseases within the cardiovascular system and possible associations between therapy and recurrence might be directly confounded by the cardiovascular disease. ⁽⁹⁶⁾

In the previous studies, there was no association between medication with antiplatelet or anticoagulants and recurrence of CSDH.⁽⁷⁴⁻⁷⁶⁾

Chon et al. concluded that anticoagulant therapy is an independent risk factor for the recurrence of CSDH in a multivariate regression model. This finding could reflect the fact that their institution is a tertiary referral hospital and there are a lot of patients who have been taking anticoagulant for a long time.⁽⁶⁶⁾

Torihashi et al. reported that the role of antiplatelet and anticoagulant drugs failed to show a significant difference in recurrence of CSDH. They concluded that the reason for this finding may be that the patients were not adequately anti-coagulated, especially in the non-recurrence group.⁽⁷⁴⁾

Chon et al. concluded that in adequately anti-coagulated patients, anticoagulant therapy is an independent risk factor for the recurrence of CSDH. However, Cattaneo and his coworkers failed to show a significant difference between antiplatelet and the recurrence of CSDH.^(66, 94)

In the past few years, the problem of “aspirin resistance” has been largely emphasized in the medical literature. Although the prevalence of aspirin resistance remains uncertain, previous studies have reported that it may affect between 5 % and 45 % of the population.⁽⁹⁴⁾

Cattaneo et al. hypothesized that aspirin resistance plays an important role in the conflicting results related to antiplatelet therapy and the recurrence of CSDH. A larger sample size and presence of aspirin resistance could validate the association between antiplatelet therapy and CSDH recurrence.⁽⁹⁴⁾

In the present study 4 patients out of 7 patients were taking oral anticoagulants and 3 patients were taking antiplatelet therapy in the recurrence group which highlighted that bleeding tendency was a significant risk factor for recurrence. These findings are in agreement with those reported by Chon et al. and not in agreement with those reported by Konig et al.^(66, 96)

Internal architecture of hematoma

It has been shown that the pathophysiology of CSDH development is complex. It consists of a sequence of events which includes local inflammation, release of pro-inflammatory factors, angiogenesis, increased vaso-permeability, bleeding, and hyper-coagulative and hyperfibrinolytic activities. This leads to a self-enhancing vicious circle facilitating re-bleeding and enlargement of the CSDH.⁽⁹⁷⁻¹⁰³⁾

Nakaguchi et al. classified CSDH into the following four types based on the internal architecture and density of hematomas: homogeneous stage (stage 1), a separated or multilayered stage (stage 2), and a trabecular stage (stage 3). They suggested that CSDH originates as the homogeneous type and sometimes develops into the laminar type, and then matures as the separated type and is finally absorbed as the trabecular type. Among the internal architectures of CSDH, the separated type had the highest recurrence rate. In this study, the rate of recurrence was significantly lower in the homogeneous and the trabecular type than in other types and higher in the separated type than others. The findings of recent experimental studies have revealed that blood in the subdural space evokes an inflammatory reaction. They concluded that in the separated type, the concentrations of these cytokines were higher than those in the other groups, whereas in trabecular hematomas, the concentrations of cytokines were lower than those in the other groups.^(70, 97)

Nakamura et al. and Nomura et al discussed the variation of re-bleeding tendency in different hematoma stages. During the initial stage of hematoma development (homogeneous type on CT scans), the re-bleeding tendency is moderate because the balance between coagulative and fibrinolytic activities is maintained. In the two next chronological stages (laminar and separated types) the hyperfibrinolytic activity and tendency to re-bleed from the neo-membrane is high, but in the following stage (trabecular type) the risk of bleeding from the hematoma capsule is low because the neo-membrane has a large fibrous component. This re-bleeding tendency corresponds well with risk of recurrence.^(101, 104)

Stanisic et al. hypothesized that these findings are associated with the pathogenesis of CSDH. Therefore, when the inflammatory reaction is severe, such as with the separated type, the CSDH is more active with a higher recurrence rate and the levels of inflammatory markers are very high. On the other hand, in the very early (homogeneous type) or very late (trabecular type) stages, the CSDH is less active, with a lower recurrence rate and the levels of inflammatory markers are very low. They found that high re-bleeding tendency in laminar and separated hematomas is associated with a high risk of PR and the low re-bleeding tendency in homogeneous and trabecular hematomas is associated with a low risk of PR.⁽⁹³⁾

Stanisic et al. stated that the separated type of CSDH, which in several studies, including this, are associated with a high PR rate, and the treatment of these lesions may require special attention and need to be investigate. Avoidance of wrong timing of operation in the laminar type of CSDH can be useful.⁽⁹³⁾

In the present study seven patients had a recurrent CSDH. Three patients out of 7 had a CSDH of the laminar type and 4 patients had a CSDH of the separate type which indicate that homogenous and separate types were risk factors for recurrence. These findings are in agreement with those reported by Stanisic et al. and Nakaguchi et al.^(93, 97)

Post-operative position

Abouzari et al. reported that the incidence of recurrence at 2.3% was lower in the postoperative supine group in comparison to 19% in the postoperative sitting group. However, the median age of the enrolled patients in the aforementioned study was as young as 56.5 years, and they excluded patients with risk factors predisposing them to recurrence, including alcohol abuse, anticoagulant therapy, and bilateral cases, so that the data had limited role in generalization for clinical practice.⁽⁵⁸⁾

They stated that assuming a supine posture soon after burr-hole surgery was associated with a significantly decreased incidence of CSDH recurrence but not with a significant change in other position related postsurgical complications.⁽⁵⁸⁾

Theoretically, bed rest and appropriate fluid administration may prevent hematoma recurrence by facilitation of brain re-expansion.

Kurabe et al. showed that the number of patients with postoperative complications was significantly reduced in the early mobilized group in comparison to the delayed mobilized group after one burr-hole surgery for the elderly CSDH patients. This finding might be partially explained by an impaired compensatory mechanism for physical stress in elderly patients. Postoperative early mobilization may reduce the physical stress that can contribute to postoperative complications, and the benefits of early mobilization seems to be most clearly shown among elderly patients, whose low physical compensatory reserve is at greatest risk of being affected by postoperative physical stresses.⁽⁹¹⁾

Kurabe et al. and other researchers also showed that the rate of recurrence did not differ between the delayed mobilization and early mobilization groups. Early postoperative mobilization for CSDH has been controversial because it is thought to potentially interrupt brain re-expansion, which has been reported as a risk factor for recurrence. ^(58, 91, 105-108)

Nakajima et al. and Miele et al. reported a significant reduction in recurrence with supine postoperative positioning and thus advocated a delayed mobilization policy with the hope of better re-expansion of the brain after CSDH surgery. ^(107, 109)

Abouzari et al. also reported a significant reduction in recurrence with supine postoperative positioning. ⁽⁵⁸⁾

Kurabe et al. stated that similar re-expansion of the brain could be achieved using an early mobilization policy after surgery of CSDH. This result may also indicate that there was an unnecessary duration of supine position in the delayed mobilization group in comparison to the early mobilization group. They finally concluded that early mobilization after one burr-hole surgery for CSDH prevents postoperative complications without increasing the risk of recurrence. ⁽⁵⁸⁾

In the present study there was not significant importance between the two studied groups as regard the post-operative position. Post-operative position was not dependent risk factors for recurrence. In the non-recurrence group 18 patients were positioned in non-flat position in the post-operative period and 15 patients were kept in flat position. In the recurrence group 4 patients were kept in non-flat position and 3 patients were kept flat. . These findings are in agreement with those reported by Kurabe et al. and not in agreement with those reported by Abouzari et al. ^(58, 91)

Age and sex

In agreement with previous reports we found that age and sex are not dependent predictors for recurrence of chronic subdural hematoma. ^(26, 110)

Stansic et al. also stated that age and sex did not significantly influence the recurrence of CSDH. ⁽⁹³⁾

Oishi et al. found that age is not a risk factor for recurrence of CSDH. ⁽⁷¹⁾

On the other hand, Fukuhara et al. showed that advanced age and brain atrophy influenced the brain elasticity. Brains with high elastance tend to re-expand poorly, and poor re-expansion of the brain may lead to persistence of postoperative midline shifting. Poor brain re-expansion is correlated with recurrence. ^(68, 74)

These findings are in agreement with those reported by Stanisic et al. and Oishi et al. and not in agreement with those reported by Fukuhara et al. ^(71, 68, 93)

Bilateral chronic subdural hematoma

Although the pathophysiology of bilateral CSDH is not well understood, like that of unilateral CSDH, it is postulated that traumatic injury to the bridging veins leads to subdural hemorrhage. ⁽⁷¹⁾

Several risk factors for bilateral CSDH have been identified, and they include age (more than 75 years), coagulopathy, use of antiplatelet or anticoagulation medications and hemodialysis. ^(77, 78)

Torihashi et al. reviewed 343 cases of CSDH, including 61 patients who had a recurrence. Univariate and multivariate analyses show that a bilateral CSDH was an independent predictor for the recurrence of CSDH. ⁽⁷⁴⁾

Robinson et al. and Tsutsumi et al. also concluded that bilateral CSDH was a risk factor for recurrence. ^(51, 111)

Huang et al. also stated that a bilateral CSDH is an independent predictor risk factor for recurrence. ⁽¹¹²⁾

In addition, Omayya et al. also reported that bilateral CSDH occurred more frequently in patients with prolonged coagulation time and many studies showed that coagulopathy or other types of bleeding tendency predisposes to the higher recurrent rate. ⁽⁷⁸⁾

In our study five patients out of 33 had bilateral CSDH in the no-recurrence group and 4 patients out of 7 had a bilateral hematoma in the recurrence group. We found that bilateral hematoma is a dependent predictor for recurrence. These findings are in agreement with those reported by Torihashi et al. and Huang et al. ^(74, 112)

Further studies are required to evaluate the association between recurrence and bilateral CSDH. There is a remarkable variability in the reported recurrence rate of CSDHs. Even though, this study provides some information of factors affecting the recurrence rate, there may well be other unaccounted for variables which could affect the recurrence rate.

Preoperative Glasgow coma scale and postoperative Glasgow outcome scale score

Amirjamshidi et al. stated that a low Glasgow coma scale score at time of admission is a risk factor for recurrence. ⁽¹¹³⁾

Abouzari et al. confirmed this finding in their study and concluded that a low GCS is a dependent predictor for recurrence of CSDH. ⁽¹¹⁴⁾

In our study we did not find an association between preoperative Glasgow coma scale score at admission and recurrence of CSDH. We also found that Glasgow outcome scale score is not a dependent predictor for recurrence of CSDH.

SUMMARY

SUMMARY

Chronic subdural hematoma is a localized accumulation of blood in the subdural space which manifests itself from three weeks to several months after injury. The recurrence rate of CSDH is reported to range from 2.3% to 33 %.

Previous studies have reported several factors that are associated with the recurrence of CSDH, including age, internal architecture of the hematoma, hematoma density, width of the hematoma, postoperative midline displacement, postoperative subdural air collection, bilateral CSDH, postoperative position, Glasgow Coma Scale score, and Glasgow Outcome Scale score.

This study is a Prospective study on all patients (40 patients) operated for chronic subdural hematoma evacuation in Alexandria university hospital within one year starting from 1/9/2013 to 31/8/2014.

Main diagnostic tool is CT brain to for all patients. All hematomas were classified into four types according to internal architecture, which corresponded to possible stages in the natural history of CSDH: homogeneous, laminar, separated, and trabecular types. The surgical procedure was burr hole drainage under general or local anesthesia according to the cardiac risk of the patient and other co-morbidities with irrigation and subcutaneous closed system drainage. Radiologic measures of the CSDH, including width of hematoma, mid-line shift, hematoma side, and hematoma type were taken before and after the procedure. We treated bilateral hematoma as one case, and both sides received the same treatment.

Recurrence was defined as the occurrence of symptoms and signs attributable to an ipsilateral hematoma seen on a brain computed tomographic (CT) scan within 3 months of the original drainage procedure. Reoperation was indicated if the original neurological deficit increased, recurred, or did not improve, or a new neurological deficit arose that needed further surgery.

This study worked on the following assumed risk factors for recurrence of CSDH which are age, sex, bleeding tendency, preoperative GCS, Glasgow outcome scale score, postoperative position of the patient, hematoma density, width of the hematoma, postoperative midline shift, postoperative subdural air collection and bilateral CSDH.

In patients operated for CSDH evacuation; postoperative midline shifting (≥ 5 mm), preoperative width of hematoma (≥ 20 mm) and bilateral CSDH were dependent predictors for the recurrence of CSDH. Larger amounts of residual air in the postoperative hematoma cavity were associated with high rates of recurrence. In adequately anti-coagulated patients, anticoagulant therapy is a dependent risk factor for recurrence.

Rate of recurrence was significantly lower in the homogeneous and the trabecular type than the in the laminar and separated type and thus in case of separate and laminar types of CSDH on CT scan, the surgery can be delayed unless severe symptoms are present.

Post-operative position, age, sex, pre-operative Glasgow Coma Scale and post-operative outcome scale score are not risk factors for recurrence of CSDH.