

Technical Notes & Surgical Techniques

The outcome after surgical vs nonsurgical treatment of chronic subdural hematoma with dexamethasone



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ABSTRACT

Background: To determine the patient outcomes of retrospectively collected data between surgical versus non-surgical treatment of chronic subdural hematoma (CSDH) with Dexamethasone (DX).

Methods: This was a retrospective study of 171 patients with chronic subdural hematoma between January 2012 and December 2016 and was derived into three groups: Group A: burr-hole craniostomy (BHC) with DX as an adjunct to surgery; Group B: BHC surgery without DX; and Group C: conservative treatment with DX monotherapy.

Results: There were 120 males (70.1%) with mean age 76.4 ± 9.3 years (range 63 years, 33–96). In Group A [n = 24 (14.0%)], there were 20 males (80%) and the mean age was 75.5 ± 8.6 years. In Group B [n = 136 (80.1%)], there were 92 males (67.6%) with mean age 76.9 ± 11.3 years and in Group C [n = 10 (5.8%)], there were 8 males (80%) with mean age 70.0 ± 10.6 years.

The incidence of recurrence in Group A was 1 case (4%) compared with Group B 10 cases (7.3%), and Group C 3 cases (30%) and there were a statistical significant difference between groups ($P = 0.030$).

Conclusion: Patients with CSDHs have better outcome when treated with BHC and corticosteroids among other therapeutic options. Between BHC with DX and BHC without use of corticosteroids in surgical management of CSDHs, the combination therapy should be considered a first-choice.

1. Introduction

Chronic subdural hematoma (CSDH) is one of the most common neurological entities, with high morbidity among elderly population [1].

The management of CSDH may consist of surgery burr-hole craniostomy (BHC), a temporary high dose of corticosteroids as monotherapy or as an adjunct to surgery, or watchful waiting. Surgical treatment is considered the gold standard for symptomatic CSDH [2].

There is no consensus on optimal CSDH treatment, because none of the available treatment modalities has been evaluated in comparative randomized clinical trials. The fact that its pathophysiologic mechanism has not been fully elucidated further complicates the matter [3].

However, the reported differences between the most important outcomes, including the recurrence rate and the mortality, were not significantly different for CSDH patients [1,4]. On the other hand, the treatment of CSDH is associated with serious morbidity, mortality, and recurrence rates [5–8].

Steroids might be an option in the nonsurgical treatment of CSDH. Dexamethasone (DX) is known to be antiinflammatory and has anti-angiogenic effects. Moreover, it is able to inhibit the formation of new blood vessels [3]. DX is a noninvasive treatment and might significantly reduce mortality and lead to a better outcome [9].

Also, in some patients, this treatment led to shorter hospitalization. Thotakura and Marabathina identified several variables (female sex, limited midline shift and hematoma thickness, and lower Computer Tomography (CT) attenuation values) that are associated with a good

Abbreviations: CSDH, Chronic subdural hematoma; BHC, burr-hole craniostomy; DX, Dexamethasone; CT, Computer Tomography; GCS, Glasgow Coma Scale; INR, International Normalized Ratio; \pm SD, Standard Deviation; SPSS, Statistical Product and Service Solutions; OR, Odd Ratio; CI, Confidence Interval; ROC, Receiver Operating Characteristic; AUC(SE), Area Under Curve Standard Error

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outcome after conservative treatment with DX [10]. Zhang et al. conclude that in patients with recurrent CSDH, DX treatment might avoid reoperation [11].

Thus, the aim of the present study was to determine the patient outcomes of retrospectively collected data between BHC with DX as an adjunct to surgery, BHC surgery without DX and conservative treatment with DX monotherapy, in order to optimize treatment for any individual patient. In addition in this study presented possible predictor factors associated with recurrence of the CSDH and thus may help in its better outcome.

2. Materials and methods

This was a retrospective study, affecting CSDH cases attending to our hospital, between January 2012 and December 2016 (46 months duration). Were included the symptomatic CSDHs of 171 patients who had follow-up periods of > 3 months. These patients were derived into three groups; Group A: BHC with DX as an adjunct to surgery; Group B: BHC surgery without DX; and Group C: conservative treatment with DX monotherapy. DX dose was 8 mg 3 times per day for 1 week, and then gradually was been reduced every 2–3 days and discontinued over 5–7 days. The choice of procedural methods for treating the CSDHs was simplified by using BHC. In all cases were collected information about age, gender, Glasgow Coma Scale (GCS) preoperative & postoperative, length of hospital stay, number of sides (one sided or bilateral), preoperative and postoperative residual neurological symptoms (headache, Barre sign, dizziness, aphasia, gait instability, amnesia, seizures, drop attacks and vomit), anticoagulant therapy, type of anesthesia, International Normalized Ratio (INR) value on admission and postoperative, CT findings preoperatively (shift of middle line, hematoma volume, distance from the convexity), and CT findings postoperatively (residual clots and air presence). In all cases were performed CT scan pre and postoperative.

Table 1
Baseline characteristics of participants.

	Group A n = 25(14.6%)	Group B n = 136(79.5%)	Group C n = 10(5.8%)	P value
Age, years	75.5 ± 8.6	76.9 ± 11.3	70.0 ± 10.6	0.201
Sex (male), n(%)	20(80)	92(67.6)	8(80)	0.362
Length of hospital stay, days	7.7 ± 3.2	7.1 ± 4.9	3.5 ± 2.0	0.002
GCS preoperative	14 ± 1	14 ± 1	14 ± 1	0.218
Bilateral, n(%)	2(8)	23(16.9)	1(10)	0.482
Preoperative neurological symptoms				
- Headache, n(%)	14(56)	63(46.3)	5(50)	0.667
- Barre sign, n(%)	11(44)	59(43.3)	4(40)	0.975
- Dizziness, n(%)	8(32)	40(29.4)	3(30)	0.967
- Aphasia, n(%)	1(4)	7(5.1)	1(10)	0.766
- Gait instability, n(%)	8(32)	42(30.8)	5(50)	0.458
- Amnesia, n(%)	3(12)	11(8.0)	1(10)	0.809
- Seizures, n(%)	1(4)	5(3.6)	1(10)	0.622
- Drop attacks, n(%)	1(4)	8(5.8)	2(20)	0.185
- Vomit, n(%)	2(8)	10(7.3)	2(20)	0.371
Anticoagulant, n(%)	14(56)	78(57.3)	5(50)	0.900
Anesthesia				
- General, n(%)	18(72)	98(72.0)	9(90)	0.462
INR value on admission	1.3 ± 0.9	1.2 ± 0.7	1.5 ± 1.1	0.584
INR value postoperative	1.1 ± 0.1	1.1 ± 0.2	1.1 ± 0.3	0.976
Preoperative CT scan				
- Shift of middle line, mm	6.4 ± 4.6	8.0 ± 4.3	8.0 ± 5.7	0.320
- Hematoma volume, cc	175.1 ± 99.5	134.6 ± 48.5	99.9 ± 42.7	0.024
- Distance from convexity, mm	20.7 ± 7.0	20.5 ± 7.0	18.9 ± 4.4	0.652
Postoperative CT scan				
- Residual clot, n(%)	1(4)	60(44.1)	5(50)	0.001
- Air presence, n(%)	25(100)	120(88.2)	7(70)	0.033
Postoperative GCS	14 ± 1	13 ± 1.6	15 ± 0.0	0.388

Data are presented as mean ± SD, otherwise is indicated. Abbreviations: Glasgow Coma Scale (GCS), International Normalized Ratio (INR), Computer Tomography (CT).

2.1. Surgical procedures

In BHC surgical procedure that it was performed in the present study, was marked on the scalp, hematoma thickness was easily determined using a brain CT scan and after scalp preparation with alcohol and a povidone-iodine solution, a solution of 2% lidocaine was applied, and a stab incision approximately 5 mm in length was made with a No. 15 scalpel at the entry point. First, the skull and dura were penetrated in a perpendicular manner with a hand drill to avoid the twist-drill's slipping down the skull and separating the dura from the skull. Then, after the dura coagulation using bipolar, cross-shaped opened the dura was made with a No. 11 scalpel. A standard ventriculostomy catheter (No. 5) was introduced into the subdural cavity at a depth of approximately 5 cm, and the contents were allowed to flow freely. Irrigation of the subdural cavity was performed via the catheter using approximately 200 ml normal salina. The enlargement of burr hole (mini craniectomy) was made with the use of kerrison about 2.5 cm × 2.5 cm size.

2.2. Statistical analysis

Data are expressed as mean Standard Deviation (± SD). Data were assessed for normality using the Shapiro-Wilkes test. Nominal data were analyzed using the Fisher's exact test. Continuous data were analyzed using the Student's *t*-test or the Mann-Whitney *U* test as appropriate. Variables significantly associated with in univariate analysis were then entered in a multivariable analysis model. A P value < 0.05 was considered as statistically significant. Statistical analyses were performed with the use of Statistical Product and Service Solutions (SPSS) software, version 15 (SPSS Inc., Chicago, IL, USA).

3. Results

One-hundred and seventy one (171) patients were included in this study (Table 1). There were 120 males (70.1%) with mean age 76.4 ± 9.3 years (range 63 years, 33–96). In Group A [n = 24

Table 2
Patients' outcomes.

	Group A: n = 24(14.0%)	Group B n = 137(80.1%)	Group C: n = 10(5.8%)	P value	Sum
Recurrence, n(%)	1(4)	10(7.3)	3(30)	0.030	14
Mortality, n(%)	1(4)	8(5.8)	0(0)	0.691	9

Data are presented as mean ± SD, otherwise is indicated.

(14.0%], there were 20 males (80%) and the mean age was 75.5 ± 8.6 years. In Group B [n = 136 (80.1%)], there were 92 males (67.6%) with mean age 76.9 ± 11.3 years and in Group C [n = 10 (5.8%)], there were 8 males (80%) with mean age 70.0 ± 10.6 years. Baseline characteristics of study participants are shown in Table 1. The Length of hospital stay was 7.7 ± 3.2 days, 7.1 ± 4.9 days and 3.5 ± 2.0 days for Groups A, B and C respectively, and was found a statistical difference between groups (P = 0.002). The hematoma volume in preoperative CT, the presence of air and the residual clot in postoperative CT scan, were found with statistical significant difference between groups (P = 0.024, P = 0.001, P = 0.033 respectively) (Table 1).

4. Outcomes

Clinical outcomes are shown in Table 2. The incidence of recurrence in Group A was 1 case (4%) compared with Group B 10 cases (7.3%), and Group C 3 cases (30%) and there were a statistical significant difference between groups (P = 0.030). Mortality in Group A was 1 case (4%) compared with Group B 8 cases (5.8%) and 0% in Group C, with no statistical difference between groups (P = 0.691).

Univariate analysis revealed that gait instability, Shift of middle line and hematoma volume in preoperative CT scan, as well as postoperative GCS, were associated with recurrence (Table 3). Multivariate analysis revealed that only hematoma volume in preoperative CT scan, as well as postoperative GCS, were independent predictors for recurrence Odd Ratio (OR) [95% Confidence Interval (CI)] 1.012 (1,021–1,003) and 0.709 (0.824–0.609) (Table 5).

Receiver Operating Characteristic (ROC) analysis showed that Shift of middle line presented the best performance to identify recurrence with an Area Under Curve Standard Error [AUC(SE)] of 0.744 (0.043), P = 0.002; whereas a shift of middle line value of > 8.0 mm presented with 86% sensitivity and 60% specificity (Table 4; Fig. 1). In addition, ROC analysis revealed that preoperative hematoma volume at the preoperative CT scan assessed with an Area Under Curve Standard Error [AUC(SE)] of 0.748 (0.081), P = 0.002; and a value of > 170.3 cc presented with 78% sensitivity and 83% specificity. Notably also, ROC analysis exposed that Postoperative GCS assessed with an Area Under Curve Standard Error [AUC(SE)] of 0.727(0.088), P = 0.005; a GCS value of < 12 presented with 98% sensitivity and 50% specificity (Table 4; Fig. 1).

5. Discussion

This study suggests that in patients with CSDHs the recurrence rate was smaller when treated with BHC + or – DX and with poorer outcome in conservative treatment with DX monotherapy. (Table 2); Between BHC with DX and no DX the combination technique should be considered a first-choice (recurrence was 4%); Furthermore, the recurrence rate associates well with the shift of middle line and hematoma volume in preoperative CT scan, and with postoperative GCS. Values > 8.0 mm, > 170.3 cc and < 12 respectively have the best performance to identify recurrence and beyond these cutoffs the recurrence seems to be more frequent; The amount of preoperative hematoma volume as well as postoperative GCS, are independent predictors for recurrence of CSDH.

Various surgical treatments have been proposed for the treatment of

Table 3
Univariate analysis for recurrence.

Parameters	Recurrence, n = 14	No recurrence, n = 157	P value
Age, years	77.5 ± 13.0	76.5 ± 10.8	0.406
Sex (male), n(%)	8(57.1)	112(71.3)	0.266
Length of hospital stay, days	8.8 ± 7.5	6.8 ± 4.3	0.451
GCS preoperative	13 ± 2	14 ± 1	0.652
Preoperative neurological symptoms			
- Headache, n(%)	8(57.1)	74(47.1)	0.473
- Barre sign, n(%)	8(57.1)	66(42.0)	0.274
- Dizziness, n(%)	4(28.5)	47(29.9)	0.915
- Aphasia, n(%)	2(14.2)	7(4.4)	0.115
- Gait instability, n(%)	2(14.2)	54(34.3)	0.059
- Amnesia, n(%)	0(0)	15(9.5)	0.235
- Seizures, n(%)	1(7.1)	7(4.4)	0.622
- Drop attacks, n(%)	0(0)	12(7.6)	0.293
- Vomit, n(%)	2(14.2)	12(7.6)	0.357
Anticoagulant, n(%)	11(78.7)	89(56.6)	0.083
Anesthesia			
- General, n(%)	10(71.4)	116(73.8)	0.983
INR value on admission	1.0 ± 0.1	1.3 ± 0.7	0.118
INR value postoperative	1.0 ± 0.1	1.1 ± 0.2	0.296
Preoperative CT scan			
- Shift of middle line, mm	10.7 ± 2.1	7.3 ± 4.6	0.002
- Hematoma volume, cc	180.2 ± 59.8	132.1 ± 59.9	0.002
- Distance from convexity, mm	19.6 ± 5.3	20.4 ± 6.9	0.472
Postoperative CT scan			
- Residual clot, n(%)	7(50)	59(37.5)	0.305
- Air presence, n(%)	12(85.7)	141(89.8)	0.934
Postoperative GCS	9 ± 6.2	14 ± 1	0.001

Data are presented as mean ± SD, otherwise is indicated.

Abbreviations: Glasgow Coma Scale (GCS), International Normalized Ratio (INR), Computer Tomography (CT).

Table 4
statistical findings for ROC.

	Area	Std error	P value
Residual neurological symptoms - recurrence			
- Gait instability, n(%)	0.594	0.072	0.243
Preoperative CT scan - recurrence			
- Shift of middle line, mm	0.744	0.043	0.002
- Hematoma volume, cc	0.748	0.081	0.002
Postoperative GCS - recurrence	0.727	0.088	0.005

Abbreviations: Glasgow Coma Scale (GCS), Standard (Std), Receiver Operating Characteristic (ROC), Computer Tomography (CT).

CSDH [4]. Concerning surgery, a single burr hole craniostomy is a comparatively less invasive procedure, and is the preferential treatment method for symptomatic CSDHs and theoretically proffer the best chance to reduce mortality after surgery [12–14]. The use of a postoperative continuous closed-system drainage also, gives considerable advantages for the treatment of CSDHs by allowing the brain to sufficiently re-expand, fill the subdural space [15] and reduces the possibility of a recurrence of the hematoma [16–18]. In our study the re-accumulation of a hematoma frequently occurred after BHC with DX treatment in 1 case (4%). Among the other three therapy options that were performed in this study, the BHC plus DX treatment offers the best

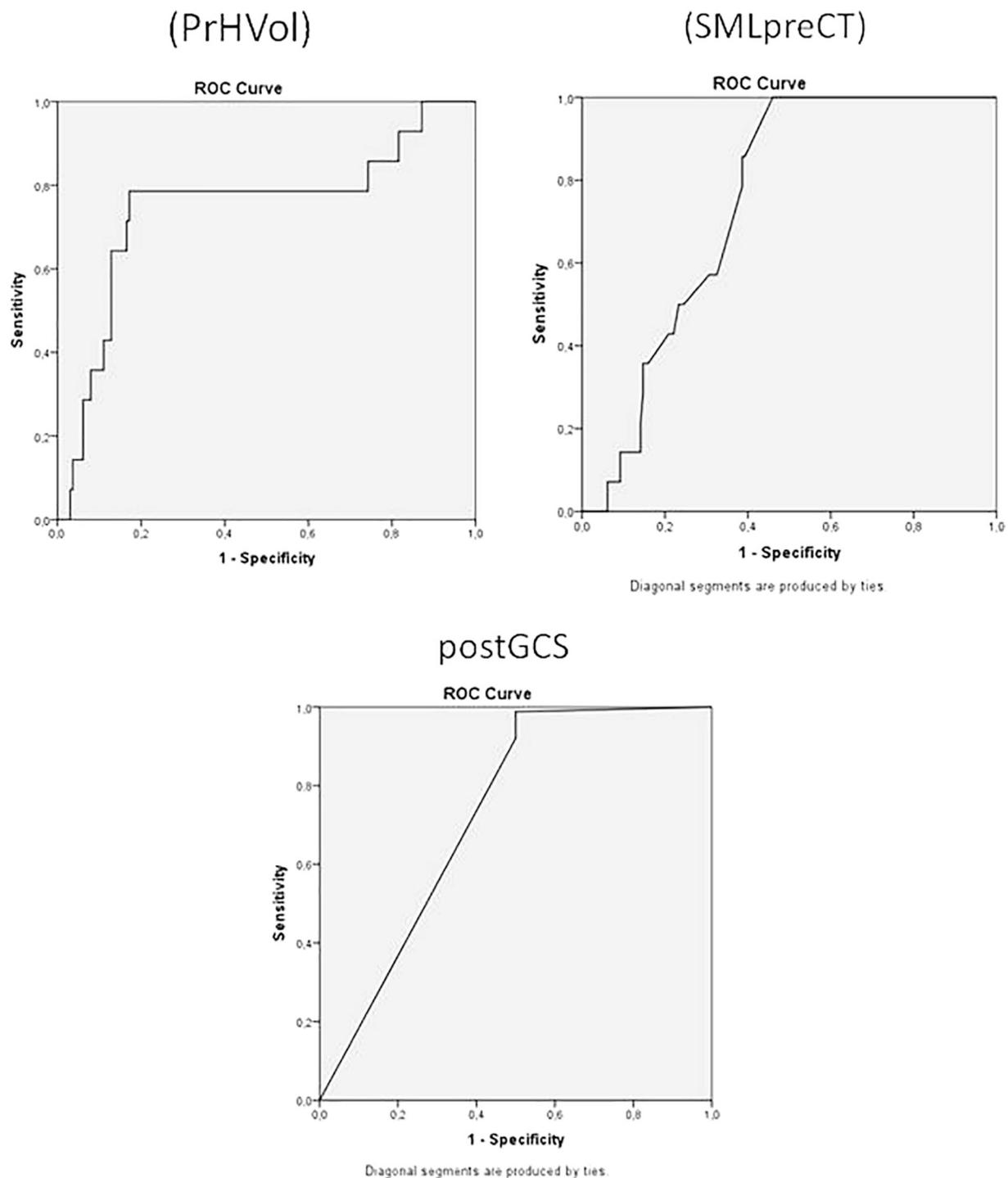


Fig. 1. ROC analysis for Shift of middle line at preoperative CT scan, preoperative hematoma volume and Postoperative GCS.

outcome (Table 2). The incidence of recurrence has been reported in many studies that it is between 5 and 33% after surgery [19–21]. Late recurrences are more common in the aged patients. In our data the incidence of recurrence was 14 cases (8.1%).

Many studies report that the incomplete removal of hematoma increases the possibility of recurrence and depend on surgical technique that it has been chosen [12,13]. In our data the presence of the postoperative residual clots depended on surgical technique ($P = 0.001$ in Table 1) and with only 4% incidence in BHD with DX therapy cases, but without any statistical significant difference for recurrence ($P = 0.305$ in Table 3). Notably, the length of hospital stay and the air presence in postoperative CT scan showed statistical difference between groups

($P = 0.002$, $P = 0.033$ - respectively) (Table 1), but there wasn't any association with recurrence (Table 3).

Indeed, multivariate analysis between groups (Table 4) illustrated that hematoma volume in preoperative CT scan, as well as postoperative GCS, were independent predictors for recurrence ($P = 0.012$ and $P = 0.001$ respectively) (Table 5).

Although CSDHs are generally considered benign, many elderly patients suffer from this disorder and exhibit a high mortality rate for up to 1 year after their diagnosis [22–24]. In our study the mortality was high in Group B (8 cases-5.8%) compared with Group A (1 cases-4%) and Group C 0%, but with no statistical significant difference between groups ($P = 0.691$) (Table 2).

Table 5
Multivariable analysis (OR CI 95%).

Name	OR	CI	P
Preoperative CT scan			
1. Shift of middle line	1.158	1.383–0.969	0.107
2. Hematoma volume	1.012	1,021–1,003	0.012
3. Postoperative GCS	0.709	0.824–0.609	0.001

Abbreviations: Glasgow Coma Scale (GCS), Computer Tomography (CT), (OR) Odd Ratio, (CI) Confidence Interval, (P) value for the difference between groups.

There are studies reports that DX treatment might avoid reoperation [11]. In our study of 10 cases (5.8%) that treated with DX monotherapy the recurrence was 30% (3 cases). But the number of cases was sort and may more studies needed for more secure results.

ROC analysis showed that a value of > 8.0 mm at shift of middle line and a value of > 170.3 cc in hematoma at the preoperative CT scan, as well as a postoperative GCS value of < 12, had the best performance among other factors for predicting the recurrence in CSDH surgical treatment. Thus, this data suggest that the recurrence rate associates with shift of middle line and hematoma volume at the preoperative CT scan, as well as the with postoperative GCS; and beyond these values the recurrence seems to be more frequent.

There are several points of our study that have to be considered when interpreting its results. Firstly, data were retrospectively collected and in this respect most sources of error due to confounding and bias are more common compared to a randomized study. In this respect, definitive conclusion is hard to be drawn. Another point that should be clarified is the relationship between recurrence assessed and different characteristics of each surgical technique, as well as the different amount of participants to each group. In order to clarify this point we introduced in analyses variables that describe different clinical parameters i.e. length of hospital stay, preoperative neurological symptoms, anticoagulant therapy. In addition, it should be pointed out that this is a one centre study and the population studied was small.

6. Conclusion

In conclusion, patients with CSDHs have better outcome when treated with BHC plus DX, as the majority of them in the present study were effectively treated with a low incidence of recurrence; between BHC with DX as an adjunct to surgery and without use of DX, the combination of steroids and surgery technique should be considered a first-choice. Values > 8.0 mm for the shift of middle line in preoperative CT scan, > 170.3 cc for the preoperative hematoma volume and postoperative GCS < 12, correlate well with the outcome-recurrence and further than these cutoffs the recurrence seems to be more frequent. Indeed the amount of preoperative hematoma volume as well as postoperative GCS, are independent predictors for recurrence of CSDH.

Conflict of interest statement

The authors declare that the article content was composed in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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