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Case report

Management of residual subdural hematoma after burr-hole evacuation. The role of fluid therapy and review of the literature

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ABSTRACT

A vast amount of literature has been published investigating the factors associated to the recurrence of a chronic subdural hematoma (SDH). However, little exists in the literature about the best medical management of the residual SDH in order to prevent the recurrence. Moreover only few studies quantitatively assess clinical and radiological outcomes of residual post-operative SDH. In this study, to our knowledge, we report the first series of chronic SDH with a quantitative outcomes analysis of the effects of fluid therapy on residual post-operative SDH. Moreover we discuss the pertinent literature. We reviewed clinical and outcome data of 39 patients (44 SDH; 12 F, 27 M) submitted to a burr-hole evacuation of a SDH. The mean age was 76.97 ± 7.77 years. All patients had a minimum 3-month follow-up (FU). Post-operatively, an intravenous saline solution was started in all cases (2000 ml in 24 h) and administered for 3 days. Then an oral hydration with 2 l per day of water was started and continued as outpatients. Glasgow Coma Scale (GCS), Karnofsky Performance Status (KPS), SDH volume and midline shift were evaluated pre-operatively, post-operatively and at FU. We found a statistically significant improvement of post-operative and at FU GCS and KPS compared to the pre-operative. SDH volume and midline shift were also statistically significant reduced in the post-operative and at FU. No complication occurred. Only 1 patient required a reoperation at 3 months FU for neurological worsening. Oral fluid therapy is a safe and effective treatment for residual SDH.

1. Introduction

Chronic subdural hematoma (SDH) is a common condition in the elderly and a lot of literature exists about its pathogenesis and treatment [1–5]. The incidence of chronic SDH is estimated at 1.7–18 cases/ 100,000/year, rising up to 58 cases/100,000/year in patients over 65 years [6]. The reported recurrence rate ranges from 11.7% to 28% of patients [6]. A vast amount of the literature has been published investigating the factors associated to the recurrence of a chronic SDH. Age greater than 70 years, bilateral SDH, preoperative width of hematoma greater than 20 mm, post-operative midline shift greater than 5 mm, high- and mixed- density shown on CT scan, pre-operative seizure, antiplatelet or anti-coagulant drugs and diabetes mellitus have all been reported as predictors of recurrence in chronic SDH [7–12]. Nonetheless, little exists in literature about the best medical management of the residual SDH in order to prevent the recurrence and there are only few studies quantitatively analyzing clinical and radiological outcomes of residual post-operative SDH [13–17]. The aim of our study was to perform a quantitative outcomes analysis of the effects of fluid therapy on residual post-operative SDH and to discuss the pertinent literature.

2. Materials and methods

We retrospectively reviewed the clinical and outcome data of 39 consecutive patients (44 subdural hematomas; 12 F, 27 M) submitted to a burr-hole evacuation of a subdural hematoma (SDH) from November 2013 to October 2016 at Institute of Neurosurgery, Catholic University, Rome. In all cases, a subdural drainage was placed. The mean age was 76.97 ± 7.77 years. All patients had a symptomatic subacute, chronic or mixed (acute and chronic components) SDH. Those with mixed density were candidates if the acute component was <50% of the overall hematoma volume. Multiple loculations were not a contraindication for the procedure. The coagulation parameters were normalized and the anticoagulants and antiplatelet medications were suspended before the intervention. In all cases, conscious sedation with local anesthetic was used. Patients were submitted to a CT scan immediately before the removal of the subdural drainage (generally 48 h after the

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operation) and at 3-month follow-up (FU). At that time patients were evaluated with additional visits up to 6 months if there was a persistent residual hematoma on the 3-month CT scan. Postoperatively, an intravenous saline solution was started in all cases (2000 ml in 24 h) and administered for 3 days. Then an oral hydration with 2 liters per day of water was started and continued as outpatients until SDH resolution was shown on FU CT scan. SDH dimensions were measured from CT scans and hematoma volumes were calculated using the modified $a \times b \times c/2$ method [18]. Midline shift was also calculated. Glasgow Coma Scale (GCS) and Karnofsky Performance Status (KPS) were evaluated preoperatively, post-operatively and at FU. All patients had a minimum 3-month FU. A literature search was performed in March 2017 aiming at identifying English literature directly addressing treatment of postsurgical residual of chronic or subacute SDH in which clinical and radiological parameters of patients with residual SDH were evaluated. PubMed and Cochrane databases were systematically searched to identify all relevant studies. The following keywords were searched: "subdural hematoma residual", "subdural hemorrhage residual", "subdural hematoma conservative", "subdural hemorrhage conservative", "subdural hematoma recurrence", "subdural hemorrhage recurrence", "subdural hemorrhage remnant", "subdural hematoma remnant". A total of 939 articles resulted from this preliminary search. Of them, 168 articles were excluded because not in English. Of the remaining 771 papers, 286 were not about chronic or subacute SDH. Of the remaining 485 articles, some were on pathophysiology, some on non-surgical treatment and on technical aspects of surgical evacuation. The reported surgical series analyzed the recurrence rate after surgical evacuation, but only 20 papers reported specifically about the treatment of postsurgical residual of SDH. Of them, only 5 papers used measurable clinical and radiological parameters to evaluate the clinical and radiological outcomes of residual SDH. Statistical comparison of continuous variables and ordinal variables was performed by the t-Student test and by the Wilcoxon signed rank test, as appropriate.

3. Results

Clinical and outcome data of patients are summarized in Table 1. We globally found a statistically significant improvement of post-operative and at FU GCS score compared to pre-operative (pre-operative 12.87 ± 2.34, post-operative 14.48 ± 0.79, at FU 14.97 ± 0.16; $p < 0.0001$ and $p = 0.0011$, respectively, Fig. 1). Post-operative and at FU KPS was also significantly improved compared to pre-operative (pre-operative 47.94 ± 14.72, post-operative 77.17 ± 9.16, at FU 92.56 ± 8.18; $p < 0.0001$ and $p < 0.0001$, respectively, Fig. 2). Considering the radiological parameters, we observed a statistically significant decrease of SDH volume at post-operative and at FU CT scan compared to pre-operative (cm^3; pre-operative 134.04 ± 37.20, post-operative 73.18 ± 27.11, at FU 10.13 ± 17.21; $p < 0.0001$ and $p < 0.0001$, respectively, Fig. 3). Midline shift was also statistically significant improved at

Table 1
Clinical and outcome data of 39 patients submitted to subdural hematoma evacuation, from November 2013 to November 2016, at Catholic University, Rome.

Patients	39
Sex (M/F)	27/12
Mean age (years)	76.97 ± 7.77
Glasgow Coma Scale	
Pre-operative	12.87 ± 2.34
Post-operative	14.48 ± 0.79
At follow-up	14.97 ± 0.16
Karnofsky Performance Status	
Pre-operative	47.94 ± 14.72
Post-operative	77.17 ± 9.16
At follow-up	92.56 ± 8.18

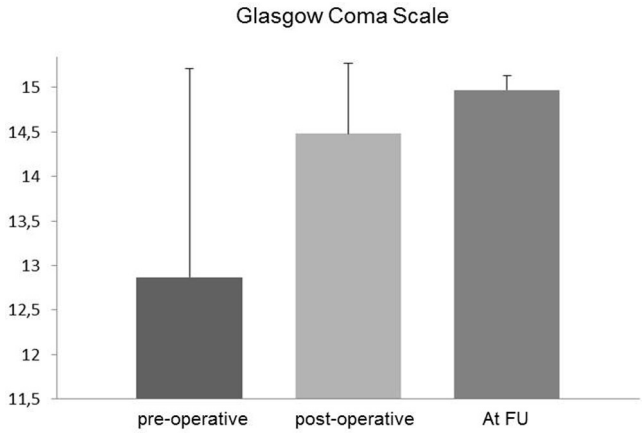

Fig. 1. Bar graph. Pre-operative, post-operative and follow-up (FU) GCS of 39 patients submitted to burr-hole evacuation of a SDH showing the statistically significant improvement of GCS. Error bars indicate deviation standard.

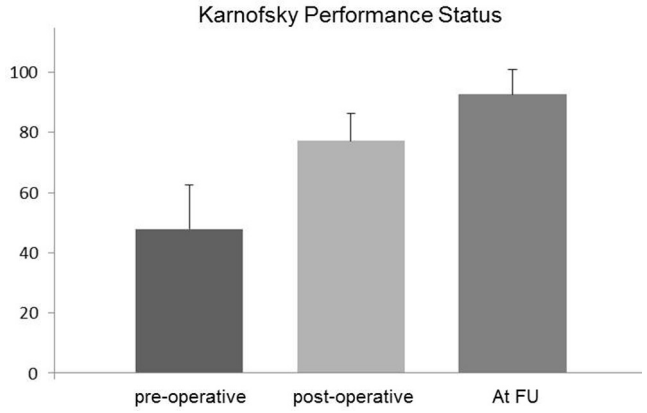

Fig. 2. Bar graph. Pre-operative, post-operative and follow-up (FU) KPS of 39 patients submitted to burr-hole evacuation of a SDH showing the statistically significant improvement of KPS. Error bars indicate deviation standard.

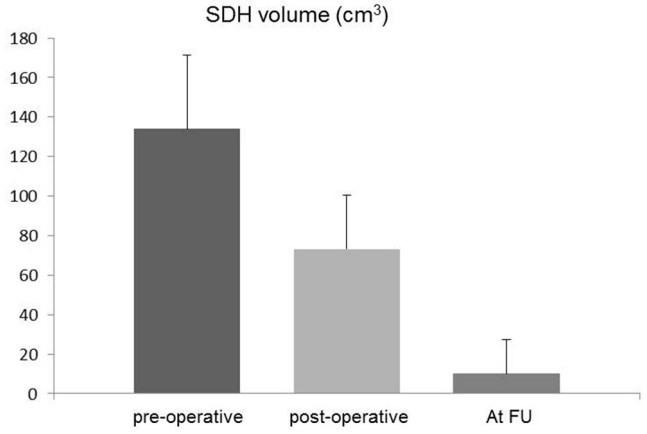

Fig. 3. Bar graph. Pre-operative, post-operative and follow-up (FU) volume of 44 SDH. A statistically significant reduction of volume was evident. Error bars indicate deviation standard.