Reduction in the number of repeated operations for the treatment of subacute and chronic subdural hematomas by placement of subdural drains


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Object. The aim of this study was to determine the influence of closed-system subdural drainage on repeated operation rates after burr hole evacuation of subacute and chronic subdural hematomas (SDHs).

Methods. Five hundred consecutive operations for the treatment of SDH via burr holes were performed between January 1, 1996, and April 15, 2002, at the Auckland Hospital. Hospital records were used to ascertain demographic data, operation, and repeated operation details. Rates of repeated surgeries were compared in patients with and without subdural drains.

Repeated operations were performed less frequently in patients with subdural drains, occurring in 31 (10%) of 310 cases involving drains and in 35 (19%) of 188 cases without drains (p < 0.01). Demographics between the two groups were not significantly different except for mean patient age, which was higher among patients with a subdural drain. A lower rate of repeated operation was observed in patients who had undergone drain placement, regardless of whether there was visible evidence of brain reexpansion.

Conclusions. Patients have lower rates of repeated surgeries if subdural drains are placed following evacuation of an SDH via a burr hole. To reach high clinical significance, 12 patients must undergo this simple intervention. If technically feasible, subdural drains should be inserted regardless of any occurrence of brain expansion during surgery.

KEY WORDS • chronic subdural hematoma • subacute subdural hematoma • subdural drainage • repeated surgery

Clinical Material and Methods

Study Methods

Departmental audit and hospital coding databases were used to identify all cases of SDH treated with burr hole surgery between January 1, 1996, and April 15, 2002. Hospital records of all patients were reviewed. Cases of SDH included both subacute (mixed density hemorrhage visualized on CT scanning) and chronic (isodense or hypodense hemorrhage demonstrated on CT scanning).

Surgery involved the drilling of one or two burr holes on the side of the SDH and irrigation of the subdural space with warmed clear fluids. In most cases drain placement was determined by the preexisting preference of the attending neurosurgeon rather than that of the operating surgeon. Two of five attending neurosurgeons preferred not to use a drain, and the remaining three used closed-system drainage. Assignment to the drain or no-drain group was thus dependent primarily on a rotating roster. In some situations, however, intraoperative features supervised, particularly the presence or absence of brain reexpansion. If a subdural drain was placed, it took the form of a Nelaton catheter, a ventricular catheter, or a pediatric feeding tube. Drains were all closed systems with no suction and were left in situ for 24 to 48 hours. Aside from routine drain care,
Reduction in the number of repeated surgeries for SDH

clinical management was the same in patients with or without subdural drains.

The use of subdural drains and the subsequent need for repeated surgery were recorded for all cases. Each patient’s age and sex, hematoma classification (chronic or subacute), number of burr holes, surgeon’s impression of brain reexpansion, presence of a coagulopathy, and complications such as empyema were also noted. Repeated operations included any reopening of burr holes, drilling of new burr holes, craniotomy, or surgery for subdural empyema, as long as these were performed within 35 days of the original surgery. This limit was based on an analysis of the distribution of times to repeated surgery. Coagulopathy was defined as the need for anticoagulant therapy, thrombolytic therapy, a hematological disorder with an increased risk of bleeding, hepatic failure, or hemodialysis. If bilateral SDHs were both evacuated, each side was counted as a separate hematoma. Repeated operations were entered as new cases of SDH if the operation dates fell within the study period and the diagnosis remained SDH.

**Patient Population**

Auckland Hospital provides the comprehensive regional neurosurgical care for adults in a population of 1.8 million. Five hundred consecutive cases of SDH in 407 patients were treated using a burr hole craniostomy at the Auckland Hospital during the study period. Operations were performed by residents and attending neurosurgeons within the Department of Neurosurgery.

All patients were older than 16 years and the mean age was 68 years. Among the patients with SDH 23% were women and 77% were men. On the basis of CT scanning studies, SDHs were classified as chronic in 59% of cases and as subacute in the remaining 41% of cases.

Of the 500 operations, 310 involved the placement of a subdural drain and 188 involved no drain; these numbers are consistent with the ratio of attending neurosurgeon preferences for drain insertion. Drain status was unknown in two patients.

**Statistical Analysis**

The two-tailed Fisher exact test was used to analyze brain reexpansion data and the Student t-test was used for continuous data. The chi-square test with a Yates correction coefficient was applied for all other statistical analyses. Statistical significance was assumed when the probability value was less than 0.05.

**Results**

Surgery was repeated less frequently in cases involving drains, that is, in 31 (10%) of 310 cases with drains and 35 (19%) of 188 cases without drains (Table 1). The difference in the rates of repeated surgeries between the two groups was statistically significant (p < 0.01). Repeated operations were defined as those performed within 35 days of the original procedure, a definition based on the paucity of repeated surgeries beyond this period. An analysis including all additional surgeries (up to 720 days) showed no significant difference in the rate from the 35-day figure. Patients who underwent placement of a drain were older than those who did not (mean 70 years compared with 66 years, respectively; p < 0.01). There was no significant difference in anticoagulant status, number of burr holes, or proportion of chronic to subacute SDH between patients with drains and those without. Five cases were complicated by subdural empyema; one of these occurred in a patient with a drain and four in patients with no drain. Five patients died while in the hospital, although there was no significant difference in mortality rates between the groups. The median length of stay was 4 days. Patients were then discharged home or transferred to other inpatient services.

Subgroup analysis of the chronic and subacute hematoma groups gave similar results. In cases of chronic SDH the repeated operation rate was 6% with drains and 18% without (p < 0.02). In cases of subacute SDH the values were 15% with drains and 23% without (not statistically significant).

In 117 cases the surgeon specified whether the patient’s brain had reexpanded during surgery. Of the 49 cases that did not involve brain expansion, the repeated operation rate was 10% in those with drains and 28% in those without drains. A similar trend was observed in the 68 cases that involved brain expansion (7% rate of repeated operation with drains and 15% without). These trends did not reach statistical significance.

**Discussion**

A number of authors have advocated the use of subdural drains after burr hole evacuation of an SDH. To date there have been two randomized trials and several observational studies in which burr holes with and those without closed-system drainage were compared. The first trial was conducted by Laumer, et al., who randomized 49 patients to closed-system drainage and 47 to no drainage after burr hole surgery. There was no significant difference between the groups, with a repeated operation rate of 27%. These authors did, however, find a lower rate of repeated surgery in a group of 48 patients randomized to implantation of a permanent subdural catheter attached to a Rickham reservoir. Tsutsumi, et al., randomized 90 patients, with only 41% entering the group without drains. These researchers showed a significantly lower rate of recurrence in the group with closed-system drainage (8.1 compared with 23%). Wakai, et al., undertook a prospective study of 38 patients

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**TABLE 1**

Comparison of demographic and surgical factors in patients with and without subdural drains

<table>
<thead>
<tr>
<th>Variable</th>
<th>Subdural Drain</th>
<th>No Subdural Drain</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>total no. of cases</td>
<td>310</td>
<td>188</td>
<td></td>
</tr>
<tr>
<td>mean age (yrs)</td>
<td>70</td>
<td>66</td>
<td>&lt;0.01†</td>
</tr>
<tr>
<td>M/F ratio</td>
<td>2.6</td>
<td>3.3</td>
<td>ns</td>
</tr>
<tr>
<td>chronic SDH/subacute SDH ratio</td>
<td>1.5</td>
<td>1.3</td>
<td>ns</td>
</tr>
<tr>
<td>no. of coagulopathies (%)</td>
<td>46 (18)</td>
<td>34 (15)</td>
<td>ns</td>
</tr>
<tr>
<td>double/single hole ratio</td>
<td>1.8</td>
<td>1.4</td>
<td>ns</td>
</tr>
<tr>
<td>no. of empyemas (%)</td>
<td>1 (0.0032)</td>
<td>4 (0.021)</td>
<td>ns‡</td>
</tr>
<tr>
<td>no. of repeated operations (%)</td>
<td>31 (10)</td>
<td>35 (19)</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

* ns = not significant.
† Student t-test.
‡ Fisher exact test.
whose recurrence rates were 5% in those with drains and 33% in those without. In a prospective study of 21 patients with drains, Markwalder, et al.,\(^4\) demonstrated a lower rate of early rebleeding but a similar long-term outcome compared with data from a historical series in which there was no closed-system drainage. Retrospective series in the era of CT scanning generally have been relatively small or have not included significant numbers of patients without drains for comparison.\(^2,5\) No data support the contention that outcomes are better without drains, although the practice of not using drains has had proponents.\(^7,8\)

Data from the present study indicate a statistically significant difference in repeated surgery rates for patients with and those without subdural drains. If drains were placed in all patients, one repeated operation would be saved for every 12 cases, making this also highly clinically significant. The data clearly favor drain placement.

Although this study is retrospective and thus subject to bias, we believe the groups are sufficiently similar and the results sufficiently consistent to allow for comparison.

As mentioned previously, placement of a drain depended primarily on a rotating roster of attending neurosurgeons. In some cases, however, drains were placed because the brain had not reexpanded; conversely, drains were not inserted because of good reexpansion. Brain reexpansion commonly was not noted, making it possible that the group with drains consisted of relatively more cases with poor reexpansion. Intuitively, patients with poor brain reexpansion would have a greater risk of repeated surgery. This makes the lower rate of second surgeries in the drain group even more striking and reinforces the conclusion based on the overall data. In addition, a subgroup analysis of those cases in which brain reexpansion had been noted showed a trend toward lower repeated operation rates in those with drains regardless of brain expansion. This again supports the results of the overall figures.

The group who underwent drain placement had a higher mean age. Because an older age tends to be associated with a poor outcome,\(^1\) it is likely that with more age-matched groups an even greater benefit for drain placement would be found. This conclusion is strengthened by its consistency with previous studies.

One cited complication for drain placement is subdural empyema. In this study the incidence of empyema was very small and indeed more frequent in the group with no drains (not statistically significant).

### Conclusions

There is a substantially lower risk of repeated operation if a subdural drain is placed after burr hole evacuation of an SDH. The number of cases needed to save one repeated surgery is 12. This is highly clinically significant. If technically feasible, subdural drains should be inserted in all cases.

### Disclaimer

We have no financial interest in any of the techniques discussed.

### References


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The results of this study were presented at the Neurosurgical Society of Australasia Annual Scientific Meeting held in Broome, Australia, in July 2002.

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