Chronic subdural hematoma in the elderly: not a benign disease

Clinical article

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Object. Chronic subdural hematoma (CSDH) is perceived to be a “benign,” easily treated condition in the elderly, but reported follow-up periods are brief, usually limited to acute hospitalization.

Methods. The authors conducted a retrospective review of data obtained in a prospectively identified consecutive series of adult patients admitted to their institution between September 2000 and February 2008 and in whom there was a CT diagnosis of CSDH. Survival data were compared to life-table data.

Results. Of the 209 cases analyzed, 63% were men and the mean age was 80.6 years (range 65–96 years). Primary surgical interventions performed were bur holes in 21 patients, twist-drill closed-system drainage in 44, and craniotomies in 72. An additional 72 patients were simply observed. Reoperations were recorded in 5 patients—4 who had previously undergone twist-drill drainage and 1 who had previously undergone a bur hole procedure (p = 0.41, chi-square analysis). Thirty-five patients (16.7%) died in hospital, 130 were discharged to rehabilitation or a skilled care facility, and 44 returned home. The follow-up period extended to a maximum of 8.3 years (median 1.45 years). Six-month and 1-year mortality rates were 26.3% and 32%, respectively.

In the multivariate analysis (step-wise logistic regression), the sole factor that predicted in-hospital death was neurological status on admission (OR 2.1, p = 0.02, for each step). Following discharge, the median survival in the remaining cohort was 4.4 years. In the Cox proportional hazards model, only age (hazard ratio [HR] 1.06/year, p = 0.02) and discharge to home (HR 0.24, p = 0.01) were related to survival, whereas the type of intervention, whether surgery was performed, size of subdural hematoma, amount of shift, bilateral subdural hematomas, and anticoagulant agent use did not affect the long- or short-term mortality rate.

Comparison of postdischarge survival and anticipated actuarial survival demonstrated a markedly increased mortality rate in the CSDH group (median survival 4.4 vs 6 years, respectively; HR 1.94, p = 0.0002, log-rank test). This excess mortality rate was also observed at 6 months postdischarge with evidence of normalization only at 1 year.

Conclusions. In this first report of the long-term outcome of elderly patients with CSDH the authors observed persistent excess mortality up to 1 year beyond diagnosis. This belies the notion that CSDH is a benign disease and indicates it is a marker of other underlying chronic diseases similar to hip fracture.

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Key Words • chronic subdural hematoma • outcome • elderly • actuarial survival

CHRONIC subdural hematoma is a relatively common affliction, especially among the elderly in whom the incidence is estimated at 7.4/100,000.4 The majority of the neurosurgical literature concerning this disease is devoted to various methods of acute treatment. Initially craniotomy was favored, but over time this has been supplanted by less invasive techniques of bur hole or twist-drill drainage. Although a recent review article, which summarized the data from 48 publications, indicted a modest average mortality rate of 2.8% and an 80% “cure” rate, the follow-up duration was not specified.21 Short follow-up would seem reasonable for a simple problem that frequently resolves on scanning within 1 or 2 months. It has recently become the impression of the senior author (M.R.Q.), however, that many of these patients ultimately fare poorly, despite the “normal” scan obtained at follow-up. We therefore undertook an examination of the long-term mortality rate in patients admitted to hospital with CSDH.

Methods

The study was a retrospective review of all hospital and clinic records of patients identified as having CSDH via a query of a prospectively maintained database of all adult intensive care admissions to the Allegheny General Hospital neurosurgical service. This database has been in place since September 2000. The diagnosis was made by inspecting the CT scans, and the type of CSDH was classified as mixed density containing some acute blood,

Abbreviations used in this paper: CSDH = chronic subdural hematoma; HR = hazard ratio.
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isodense to the brain, or hypodense to the brain. Clot volume was approximated by multiplying the maximum extent in each of 3 orthogonal views and dividing by 2. The side with the larger clot was designated the primary one in bilateral cases. Neurological status on admission was a simplification of the Markwalder classification, with normal or mild symptoms being a score of 1, drowsiness or without focal findings being 2, and all else being 3. The type of surgical intervention and whether patient underwent one at all was at the discretion of the treating neurosurgeon based on size of subdural hematoma, shift, and clinical signs.

Twist-drill drains were placed in the standard manner at bedside and using a local anesthetic and sedation. Bur holes were made after induction of general anesthesia and irrigation was performed through 2 bur holes. If a procedure took place, drains were routinely used and left in place for 24–72 hours until drainage was clear and the CT scan–based picture improved. Reoperation by craniotomy was undertaken if scans were unimproved or worsened by treatment. All patients were scheduled for follow-up in clinic with head CT scanning 1 month post-discharge.

Long-term follow-up was performed by reference to the online Social Security Death Index (http://ssdi.rootsweb.ancestry.com) supplemented with phone contact if the patient was recorded as not dead. Anticipated survival was performed by age and sex, matching each patient discharged from hospital with the most recently available Centers for Disease Control and Prevention data (United States Life Tables 2004, http://www.cdc.gov/nchs/products/life_tables.htm). These calculations were performed at 6-month intervals out to 7 years, which provided appropriate comparatives for all surviving patients. Survival and HRs were estimated by the method of Kaplan-Meier. Statistical analysis was performed with MedCalc 11.0 for PC with specific procedures used and their corresponding p values stated in the results section.

Results

There were 209 patients admitted with the diagnosis of CSDH between September 2000 and September 2008. There were 132 men (63%) and the patients’ average age was 80.6 years (range 65–96 years). Despite the apparent “skew” toward an elderly population, this represents all admissions during the stated time frame without an arbitrary age cutoff. Thirty-two patients originated from a skilled nursing facility; 48 were receiving antiplatelet agents, 31 were receiving Coumadin, and 2 were receiving both. Neurological status on admission was normal in 166, drowsy with mild deficits in 31, and comatose in 12. The median thickness of the primary subdural hematoma was 1.6 cm (range 0.4–4.5 cm), median shift 5 mm (range 0–21 mm), and median volume 76 ml (range 3.5–450 ml). Subdural hematomas were bilateral in 55 cases (26.3%). Computed tomography–based characteristics of the primary subdural hematomas were mixed density in 60, isodense in 19, and low density in the balance.

The primary surgical interventions were bur holes in 21 patients, twist-drill closed-system drainage in 44, and craniotomies in 72. An additional 72 patients were simply observed. Patients were observed if, in the opinion of the surgeon, the patient was neurologically normal and the subdural bleed small enough to resorb spontaneously. Reoperations were recorded in 5 patients: in 4 who previously underwent twist-drill procedures and in 1 who previously underwent a prior bur hole procedure (p = 0.41, chi-square test). The likelihood of recurrence was not influenced by bilateral subdural hematomas (p = 0.41, chi-square test) or premorbid anticoagulant use (p = 0.63, chi-square test).

Thirty-five patients (16.7%) died in hospital, 130 were discharged to rehabilitation or a skilled care facility, and 44 returned home. One hundred forty-five (83%) returned to clinic at 1 month, and brain CT scans were obtained and considered as either stable or improved status. Long-term follow-up extended to a maximum of 8.3 years (median 1.45 years). Six-month and 1-year mortality rates were 26.3% and 32%, respectively.

Survival was not related to the type of surgical intervention or whether surgery was performed or not (Fig. 1) (p = 0.38, log-rank test). The modest apparent advantage toward bur hole drainage was due to its disproportionate use in neurologically healthy patients (19 of 21). The volume of the subdural collection trended toward larger amounts in those treated compared with those observed (111.6 vs 92.3 ml, p = 0.11, Student t-test).

In the multivariate analysis (step-wise logistic regression), the sole factor that predicted in-hospital death was neurological status on admission (OR 2.1, p = 0.02, for each step). Following discharge, the median survival for the remaining cohort was 4.4 years. In the Cox proportional hazards model, only age (HR 1.06/year, p = 0.02) (Fig. 2) and discharge to home (HR 0.24, p = 0.01) were related to survival, whereas type of intervention, whether surgery was performed, size of the subdural hematoma, amount of shift, bilateral subdural hematomas, and anticoagulant use did not affect the long- or short-term mortality rate.

Comparison of postdischarge survival and anticipated actuarial survival demonstrated a markedly increased mortality rate in the CSDH group (median survival 4.4 years vs 6 years, HR 1.94, p = 0.0002, log-rank test) (Fig. 3). This excess mortality was also observed at 6 months postdischarge with evidence of normalization only at 1 year (Table 1). The 1-year mark corresponds to the inflection point in the CSDH group beyond which the actual survival curve parallels the actuarial estimation. In addition, the HR of observed compared with actuarial survival demonstrates marked differences among the various age epochs (Table 2), with the counterintuitive finding that the HR diminishes with increasing age.

Discussion

Chronic subdural hematoma is a frequently encountered problem in neurosurgical practice. As Gelabert-Gonzalez et al. have stated, CSDHs are perceived as “common lesions that are easily treated with a minimum [sic] morbidity and mortality.” The neurosurgical litera-
ture primarily focuses therefore on the choice of surgical treatment offered,\textsuperscript{3,8,13} the effect of anticoagulants,\textsuperscript{6,13,18,20} and whether drains should be left in place.\textsuperscript{15,21}

In general, the short-term results of our report conform to the extant literature. The in-hospital mortality rate of 16.7\% modestly exceeds the reported range of 0–15.6\%,\textsuperscript{1,5,8,13,14,16–18} but many of the more sanguine reports included children,\textsuperscript{1,5,14,16} and with a mean age of 80 years, our population is the oldest cohort yet to be reported in the literature. The detrimental effect of diminished mental status at the time of admission on outcome has been previously noted by Gelabert-Gonzalez et al.\textsuperscript{5} and Rozzelle et al.\textsuperscript{18}

The type of surgical intervention did not impact either the long- or short-term survival, as has also been noted by many authors.\textsuperscript{3,8,18,21} Although the authors of some reports have advocated the use of bur hole drainage over craniotomy, these arguments are based on the bur holes causing less morbidity as opposed to conferring a survival advantage.\textsuperscript{3,21}

Our recurrence rate of 3.6\% compares favorably with the balance of the literature. In their evidence-based review of 48 publications detailing treatment of CSDH, Weigel et al.\textsuperscript{21} tabulated a composite recurrence rate of 14.6\% for all treatment modalities combined. In addition, we also found no relation between premorbid anticoagulant use and the likelihood of lesion recurrence\textsuperscript{6,13,18,20} nor the presence of bilateral subdurals as suggested by others.\textsuperscript{20}

In keeping with the perception that CSDH is a readily treated condition, the bulk of the neurosurgical literature features only short-term outcome analysis. Mori and Maeda\textsuperscript{14} do specify their outcome measure at 1 month, whereas a host of other publications do not specify the follow-up interval at all, suggesting the analysis was restricted to the acute hospitalization period.\textsuperscript{1,5,8,13,18,19} The sole outlier we could discover was Ramachandran and Hegde,\textsuperscript{16} who indicate a 1-year follow-up that was accomplished in 94\% of the cases. Their study of 647 cases includes all age groups but with only 31\% (203 of 647) being older than age of 60 years, making comparisons with our elderly population tenuous.

Jones and Kafetz\textsuperscript{9} were the first to imply that CSDH is a marker of other “chronic” diseases in their study of 43 patients age 75 years or older. They reported a 6-month mortality rate of 31\% but noted that 6 deaths were related to the CSDH itself and the rest were due to “underlying” disease. Our report represents, to the best of our knowledge, the first long-term analysis of CSDH in an elderly population and has a median follow-up of nearly 18 months. We find that whereas the in-hospital mortality rate was 16.7\%, 6-month and 1-year mortality rates
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### TABLE 1: Summary of survival rates stratified by time point

<table>
<thead>
<tr>
<th>Time Point</th>
<th>No. of Patients at Risk</th>
<th>Median Survival</th>
<th>HR</th>
<th>p Value</th>
<th>HR*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Actual</td>
<td>Actuarial</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>on hospital discharge</td>
<td>174</td>
<td>4.47</td>
<td>6.0</td>
<td>1.94</td>
<td>0.0002*</td>
</tr>
<tr>
<td>6 mos</td>
<td>141</td>
<td>5.1</td>
<td>6.5</td>
<td>1.6</td>
<td>0.02*</td>
</tr>
<tr>
<td>1 yr</td>
<td>117</td>
<td>5.6</td>
<td>6.5</td>
<td>1.4</td>
<td>0.12</td>
</tr>
<tr>
<td>2 yrs</td>
<td>87</td>
<td>6.0</td>
<td>7.0</td>
<td>1.4</td>
<td>0.16</td>
</tr>
</tbody>
</table>

* Significant by log-rank comparison.

continue to climb to 26.3% and 32%, respectively, with the likelihood of death related to increasing age and discharge to another nursing facility. Comparison with life-table matched actuarial survival indicates that the presence of a CSDH confers significant excess mortality for up to 1 year beyond hospital discharge.

The phenomenon of continued excess mortality following apparently successful treatment of the underlying condition has been widely reported for another surgical disease, hip fracture. In their study of 571 patients over 50 years of age with hip fracture, Hannan et al. noted a 1.6% in-hospital mortality rate, which had increased to 13.5% at 6 months. Pitto found a 6% in-hospital mortality rate, but the 6-month mortality rate was 23% in 143 hip fracture repair cases in which the average patient age was 81 years. Pitto also calculated that those surviving to 6 months had an life expectancy equivalent to the general population. This time frame also matches that found by Magaziner et al.

We can only speculate as to why patients with CSDH continue to die at an accelerated rate for up to 1 year following hospital discharge. Like hip fracture, CSDH, we assume, unmask underlying medical conditions and exacerbate them. Presumably, if all patient comorbidities could be tabulated and adjustments made, much of the survival discrepancy might disappear. Such statistical “adjustments” are difficult to perform as no standard medically adjusted life tables exist. We propose that the presence of a subdural hematoma in some manner becomes a surrogate for this adjustment. Of note is the finding of an increased HR of actual versus actuarial survival among the youngest patients. We can only surmise that if a subdural hematoma is indeed a “marker” of underlying chronic disease, the younger you manifest this problem, the more compromised you are compared with your age cohort.

Our study suffers from a number of shortcomings, the most obvious being that it is retrospective and treatments were assigned at the discretion of the attending neurosurgeon. This led to extensive use of craniotomy, which can only be ascribed to surgeon preference. Although this disproportionate allocation of treatment type might bias the outcome of one treatment over another, it is unlikely to alter the main conclusion of the paper, which is that following discharge these patients fare much worse than if they had never had a subdural hematoma.

We believe that knowledge of the long-term outcome of this disease ought to provide more realistic expectations for physicians and families alike concerning this “benign” disease.

### Conclusions

The first review of the long-term outcome following treatment of CSDH in the elderly is reported. The in-hospital mortality rate was solely related to presenting neurological condition whereas the postdischarge mortality rate was related to age and discharge to another nursing facility (as opposed to home). Overall the mortality rates at 6 months and 1 year were 26.3% and 32%, respectively. Comparison with actuarial life-table survival indicates that elderly patients with CSDH continue to exhibit excess mortality for up to 1 year beyond their original diagnosis.

### Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author contributions to the study and manuscript preparation include the following. Conception and design: Quigley, Braxton. Acquisition of data: Miranda, Braxton, Hobbs. Analysis and interpretation of data: Quigley. Drafting the article: Quigley, Miranda. Critically revising the article: Quigley. Reviewed final version of the manuscript and approved it for submission: Quigley, Braxton, Hobbs. Statistical analysis: Quigley. Study supervision: Quigley.

### References


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