Head Injury in the Elderly: What Are the Outcomes of Neurosurgical Care?

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BACKGROUND: **Epidemiologic studies show that an increasing proportion of those presenting with head trauma are elderly. This study details the outcomes of elderly patients with head trauma admitted to a regional United Kingdom neurosurgical unit.**

METHODS: **The notes and imaging were reviewed of all patients with head injury aged ≥75 years, admitted from 1 January 2007 to 31 December 2010, including mortality data up to at least 2 years after discharge. Outcomes comprised death as an inpatient, by 30 days and 1 year after discharge; Glasgow Outcome Score; discharge Glasgow Coma Scale (GCS) score; recurrence; readmission; reoperation; and complication.**

RESULTS: **A total of 263 patients were admitted: 26 with acute subdural hematoma (ASDH); 175 with chronic subdural hematoma (CSDH); and 46 with mixed subdural collections (ACSDH). Sixteen patients had other head injury diagnoses.**

Patients with ASDH had a significantly lower survival rate than did those with CSDH or ACSDH: the odds of inpatient death for patients with ASDH was 15.38 (vs. those with CSDH). For all subdural hematomas (SDHs), low American Society of Anesthesiologists score was an independent predictor of early death.

Death at 1 year was predicted by head injury severity measured by admission GCS score ($P = 0.028$), long anesthetic ($P = 0.002$), and the presence of bilateral SDH ($P = 0.002$).

Unfavorable Glasgow Outcome Scale score (1–3) was predicted by age greater than 85 years ($P = 0.029$); larger depth of subdural ($P < 0.001$); and presence of any complication ($P = 0.003$). Those aged greater than 90 years with presentation GCS score lower than 10 all had poor outcomes.

CONCLUSIONS: **Most elderly patients admitted under neurosurgery after head injury have SDHs. Our results are better than many previously reported; however, the rate of death for those with ASDH is still high.**

INTRODUCTION

The population of the world is ageing, with estimates that there will be almost 2 billion people older than 60 years by 2050.[1] The consequences of this situation challenge health care systems worldwide. Two-thirds of acute hospital admissions in the United Kingdom are older than 65 years,[2] and serious head injury among patients aged 70 years and older is associated with high mortality.[3] Acute subdural hematomas (ASDHs) are 4 times larger in the elderly and produce twice the mass effect, compared with younger patients.[4] Ritchie et al.[5] reported that there were no favorable outcomes after head injury in patients older than 80 years with an initial Glasgow Coma Scale (GCS) score lower than 13, and that all those with an initial GCS score lower than 11 were either dead, vegetative, or required full nursing care on discharge. However, with the unprecedented

Key words
- Aged
- Elderly
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- Neurosurgery
- Subdural hematoma

Abbreviations and Acronyms
ASA: American Society of Anesthesiologists
ASDH: Acute subdural hematoma
CI: Confidence interval
CT: Computed tomography
GCS: Glasgow Coma Scale
GOS: Glasgow Outcome Scale
OR: Odds ratio
SDH: Subdural hematoma

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increase in people living in good health into their 90s, it is increasingly difficult for the neurosurgeon to know when the benefits of intervention are outweighed by the harms of disability, prolonged hospital stay, and death in those who have a short life expectancy. We have an ethical duty to provide appropriate care to these patients, whose neurosurgical and rehabilitation care requires considerable resources. To inform this process and aid decision making, contemporaneous outcome studies for elderly patients with head injury are required to evaluate beneficence. We aimed to describe the demographics, risk factors, and outcomes of elderly patients with head injury admitted to a regional neurosurgical unit.

Our region covers Cornwall and most of Devon, in the southwest of the United Kingdom, which is a haven for the retired population; 19.6% of the population is 75 years old or older.[6] Because of the stability of the local population, our unit is well placed for the study of regional referrals, with secure prospects of obtaining accurate and near complete outcome data. This, and the demographics of all elderly patients admitted to our neurosurgery unit, was further discussed in a previous study.[7]

The term "elderly" is variably defined in the literature, but for the purposes of this study, a cutoff age of 75 years was used.

METHODS

A retrospective review was undertaken of the medical records and imaging of all patients aged 75 years and older, admitted for at least 1 night to the South West Neurosurgery Centre, United Kingdom, from 1 January 2007 to 31 December 2010. A minimum of 2 years' mortality data, up to 31 December 2012, were extracted from the Demographics Batch Service and the National Health Service Spine database. A description of the methods used and data collected for the entire cohort has previously been presented.[6] Patients were included in this study if they were admitted to the regional unit as a tertiary-care admission with a head injury, as determined by history, physical examination, or radiologic examination. The unit does not provide overnight admission for minor head injury cases. Diagnoses were categorized into the principal radiologic finding on initial imaging. In 8 cases in which the imaging could not be reviewed, the diagnosis documented by the admitting neurosurgeon was used. Scans were reviewed and measurements made by the primary author (K.W.). Variables comprised gender, age, preliminary diagnosis, admission GCS score (categorized as "mild head injury" for GCS score 13–15, "moderate" 9–12, and "severe" 3–8), duration of anesthetic for those who underwent operation, type of operation, American Society of Anesthesiologists (ASA) score (dichotomized into groups 1–3 and 4 and 5), smoking status, side of space-occupying lesion, use of anticoagulant medication, maximum depth of hematoma (measured as the maximum depth on axial computed tomography [CT]), and midline shift (measured as the maximum distance of the falx cerebri from a line joining the internal occipital protuberance and the frontal crest).

Outcomes included discharge GCS score (categorized as severe, moderate, and mild, as discussed earlier), Glasgow Outcome Scale (GOS) score (with unfavorable outcome classified as GOS score 1, 2, or 3 and favorable as 4 or 5), death as inpatient, death by 30 days, death by 1 year after admission, clinically significant recurrence, readmission, reoperation, and complication. For normally distributed data, mean and standard deviation were used for descriptive purposes; for data that were not normally distributed, medians and ranges were used. Statistical significance was set at 5%. Statistical analysis was performed using IBM SPSS Statistics for Windows, version 22.0 (IBM Corp., Armonk, New York, USA).[8]

To compare characteristics, χ^2 tests were used. To find which independent variables predicted outcomes, multiple logistic regression was used.

RESULTS

Patient Characteristics

A total of 886 patients aged 75 years and older were admitted during the 4-year study period, of whom 877 had medical records that were available to review. The characteristics of the whole cohort have previously been reported.[7] A total of 263 patients were admitted after a head injury, a rate of 66 cases per annum. Of these patients, scans were available for review in 255 and diagnoses confirmed; for the remaining 8 patients, the diagnoses documented in the notes were relied upon. The median age at admission was 82 years (range, 75–97 years). Eighty-one patients were female and 182 were male. **Figure 1** shows the ages of all patients included in this study.

Diagnostic Categories

Patients were divided into 8 categories, based on the initial CT scan findings. Twenty-six patients were admitted with ASDH, 175 with chronic subdural hematoma (SDH), and 46 with mixed subdural collections or acute-on-chronic SDHs. Other diseases comprised 6 patients with predominantly contusional brain injury, 2 with skull fractures and no associated hematoma, 4 with traumatic subarachnoid bleeds, 2 with extradural hematomas, and 2 with penetrating head injuries.

SDHs

SDH was by far the most common diagnosis of all the head injuries in this cohort of patients. **Table 1** summarizes the clinical characteristics and radiologic findings of those with SDHs, and **Table 2** summarizes the outcomes. Those presenting with ASDHs were more likely to have left-sided ASDH ($P = 0.005$) but were not significantly more likely to be on an anticoagulant or antiplatelet medication ($P = 0.212$). However, 69.2% of those with ASDH were on some form of anticoagulation or antiplatelet medication.

Death. No patient older than 90 years with ASDH survived admission ($n = 3$). Of 8 patients with ASDH who were admitted with a GCS score lower than 10, only 1 survived. Those with ASDH had a significantly lower survival rate ($P < 0.001$) compared with other types of SDH, as shown in the Kaplan-Meier curve in **Figure 2**. The odds of inpatient death for patients with ASDHs was 15.38 times higher (95% confidence interval [CI], 1.53–166.67; $P = 0.02$) than in those with chronic SDHs, and 16.39 higher (95% CI, 1.24–200; $P = 0.034$) than in those with mixed SDHs.

For all SDHs combined, death by 1 year was predicted by moderate/severe admission GCS score (compared with mild GCS score [odds ratio [OR], 3.80; 95% CI, 1.15–12.8; $P = 0.028$]),