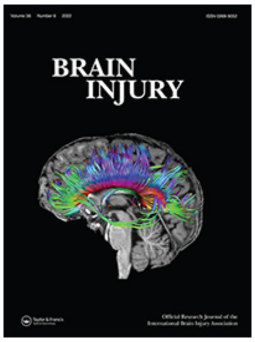

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Head injury among older adults and their clinical management: one year of emergency department attendances at a UK trauma center

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ABSTRACT

Objectives: Primary: describe characteristics of adults aged ≥65 attending the Emergency Department (ED) at one major trauma center. Secondary: examine co-morbidities and complications; identify use of anticoagulant/antiplatelet medication among older adults presenting with Head Injury (HI); assess clinical management against UK guidelines.
Methods: All ED admissions were screened prospectively to identify HI using case notes, hospital records and Trauma Audit Research Network data. Data were collected on demographics, cause and severity of injury, co-morbidities, anticoagulation/antiplatelet use, diagnostic imaging and discharge outcomes.
Results: Over 12 months, 697 patients aged ≥65 years attended the ED for HI, representing over a quarter of adult ED attendances for HI. Mean age was 78.5 years (range 65–106), 395 (56.7%) were female. Most HIs were mild (93.5%) and 86% caused by falls. Three-quarters were discharged without hospital admission. Most had a preexisting medical condition andtaking medications prior to HI. Of these 116 were taking anticoagulants/antiplatelets but only 37 (31.9%) received a head CT scan. Half the patients were given a written HI information sheet at ED discharge.
Conclusions: Care of HI in older adults is challenging due to comorbidities. Practising evidence-based clinical management and following guidelines is important, but strict adherence is not common practice.

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Older adults; head injury; falls; emergency care; traumatic brain injury; comorbidity

Introduction

Emergency Departments are under ever increasing pressure and the UK's aging population means that a growing proportion of admissions are by patients aged ≥65. In 2012–2013 there were 17.8 million Emergency Department (ED) attendances in England with 3.49 million (19.6%) of these attendances made by patients aged ≥65 (1). By 2019–20 these figures had risen to 21.99 million ED attendances with 22% of them (4.8 million) by patients aged ≥65 (2). A&E attendances are consistently twice as high for people living in the most deprived areas as in the least deprived (2). Head injury is among the top ten primary diagnoses presenting at English EDs across all age groups (2).

Approximately 95% of patients attending the ED with head trauma will have minor or mild head injuries and it is important to identify the small number who are at risk of serious acute intracranial complications (3).

Previous studies have found that patients aged ≥65 are at higher risk of poor outcomes after head injury, even when the mechanism of injury is of low severity (4–6). This can in part be attributed to a variety of physiological factors, such as preexisting chronic conditions, increased rates of cerebrovascular atherosclerosis and cerebral atrophy. Older patients are also more likely to have other medical conditions which can complicate recovery and extend hospital stay (7). Older patients are also at risk of higher mortality and morbidity after head injury (4), have more complications, and be less likely to receive neurosurgical care than younger patients (5,8). Age over 65 is also an independent risk factor for post-traumatic intracranial injury (6,9).

Patients taking anticoagulants are at particular risk of intracranial hemorrhage (9–13). The UK National Institute for Health and Care Excellence (NICE) estimates that annually 2.4% of the adult population of England are taking anticoagulation therapy, most commonly warfarin, and the majority of these patients are elderly (14). NICE also provides guidance for early management of head injury in adults and children including advice on when a CT head scan should be performed (Clinical Guideline issued 2014 and updated online June 2017 and again in October 2019) (15,16). The 2017 update made particular reference to anticoagulant therapy and the timing of CT head scans. The 2019 update made it clear that the advice relates to all anticoagulants, not only warfarin. They advise that patients who have sustained a head injury and are having anticoagulant treatment should have a CT head scan within eight hours of the injury, even if there are no other indications for a CT head scan. Also that a provisional written radiology report should be made available within one hour of the scan being performed. Similarly, the Scottish Intercollegiate Guidelines Network (SIGN) advises that any patients with a history of coagulopathy (e.g. warfarin use) should receive a CT head scan within eight hours irrespective of clinical

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features, and patients with history of coagulopathy and loss of consciousness or other neurological feature should have an immediate CT head scan (17).

In an attempt to provide evidence to inform the management of anticoagulated patients after head injury, a large UK multi-center observational study (AHEAD study) examined hospital records of 3534 patients aged 18 to 101 years who had sustained HI and were taking warfarin (18). The study concluded that warfarinised patients with at least one neurological symptom, such as headache or loss of consciousness after HI, were at greater risk of adverse outcome than those with GCS = 15 and no symptoms. Additionally, that risk is increased the lower the GCS and higher the number of neurological symptoms.

NICE and SIGN guidelines for the management of head injury also advise that at discharge from the ED all patients with HI should receive a written advice sheet to aid recovery which also provides a list of signs and symptoms that should trigger a return to the ED for further investigation.

Studies of the incidence of head injury typically use diagnostic coding to identify cases, however, this results in incomplete ascertainment (19,20). For example, in the UK in 2018 only 45% of all attendances at A&E had a valid diagnosis code (21). The use of hospital-coded records therefore significantly under-estimates the actual number of head injury presentations. In a study of ED presentations by children with head injury, based on searches of individual casualty cards, Hawley et al (2013) found 38% more cases of head injury than hospital records showed (22).

Head injury is a significant cause of presentation to hospital for older adults, but accurate epidemiological data is limited. The purpose of this study was to examine ED attendances for HI among older adults for a 12 month period at a large UK trauma center. Study objectives were to:

a) describe the characteristics of adults aged ≥65 attending one ED over a 12 month period

b) examine co-morbidities and complications in this age group

c) identify the use of anticoagulant medication among older adults presenting with HI

d) examine clinical management including appropriate CT scanning and discharge advice

Materials and methods

Ethical approval

The University of Warwick Biomedical Research Ethics Committee gave approval for this study (reference:63–07-2010).

Study population

The UHCW Emergency Department serves the population of Coventry and North Warwickshire. In 2013, Coventry and North Warwickshire had a population of 619,310 adults (age 16 and over) (23). Of these, 101,871 (16.4%) were aged ≥65 (46,016 men and 55,855 women). Additionally, UHCW is a Level 1 Trauma Center receiving patients with major trauma over a wider catchment area of over 1 million.

Study design

Head injury data were prospectively collected from emergency department cards at University Hospital Coventry & Warwickshire (UHCW) by medical students. All admissions by adults aged ≥65 years from 1st October 2012 until 30th September 2013 were reviewed regardless of the assigned departmental coding or presenting complaint. Data included ambulance and primary center referrals to the department. Cases were selected according to the head injury classification given in NICE guidelines, which defines head injury as any trauma to the head, other than superficial injuries to the face (24). Data were collected from triage documentation, departmental clerking and ambulance documentation where available. Additionally, admissions data were cross-checked with the UHCW Trauma Audit Research Network (TARN) records to ensure that severely injured patients who were transferred immediately from the ED and documented directly into the trauma chart (without a casualty card) were included. The hospital admissions database (HAD) was also cross-checked to ensure complete ascertainment of head injuries by including admissions where head injury was not the primary diagnosis, as well as all diagnosis of 'fall.'

To put the HI data into context, the number of all attendees at the adult ED aged ≥16 (for any cause) was identified retrospectively from HAD. Any duplicate records were identified and excluded.

Severity of head injury was classified using Glasgow Coma Scale (GCS) scores and the duration of witnessed loss of consciousness. GCS was recorded at ED attendance and by ambulance paramedics (if used). Where GCS scores were not recorded a description of 'alert' was classified as a minimal head injury equivalent to GCS 15. Injury severity was classified as mild HI (GCS 13–15), moderate (GCS 9–12) or severe (GCS 3–8).

Data were collected on age, gender, ethnicity, postal code, time & date of injury, location and mechanism of injury, other sustained injuries, mode of arrival to ED, accompanying persons to ED, living arrangements, hospital admission and discharge information. Ethnicity was coded according to the 2011 UK Census categories (25). Additional clinical information including CT and MRI scan data and brain injury details were collected from patient medical notes and electronic records. Information on co-morbidities, anticoagulant and antiplatelet (e.g. aspirin) medication usage were collected from patient medical notes where available. In the UK, warfarin is the most commonly used anticoagulant, although newer anticoagulants are increasingly being prescribed (26). Medical notes were checked for the recording of head injury advice leaflet distribution to patient or carers. Referral for CT scanning was checked for compliance with NICE guidelines for head injury in older adults (24).

Data analysis

Continuous data were converted to categorical data to facilitate analysis and interpretation. Age was divided into three groups (65–74, 75–84, 85+). Associations between categorical data were tested with Pearson's Chi-squared test. Descriptive statistics include mean, median, standard deviation (SD) and interquartile range (IQR). Statistical analysis was performed using SPSS Version 27.

The co-morbidities identified from patient medical notes were classified into nine categories by a consultant in Emergency Medicine (MS).

Where appropriate, analyses were performed on the total number of patients identified from both prospective hand searching and from HAD. However, the HAD does not provide all of the detailed data collected prospectively, so some sub-analyses include only prospectively identified patients.

Results

ED attendances for any diagnosis

The UHCW Emergency Department recorded 94,869 attendances by adults aged 16 to 106 (for any diagnosis) over the twelve-month period from 1st October 2012 to 30th September 2013. The 94,869 attendances represented 66,638 individual patients as 28,231 (29.8%) of the attendances were by patients visiting the ED more than once during the 12 month period. Older adults aged ≥65 years accounted for 29.2% of all adult ED visits: there were 27,710 attendances made by 17,735 individual patients aged ≥65 years, with 9,975 (36.0%) being repeat attendances, not necessarily for the same medical condition.

ED attendances for head injury

During the same twelve-month period, for all adults (age 16–106), the HAD contained 2,123 ED attendances involving HI which represents 2.2% of all adult ED attendances. The HAD contained 527 ED attendances involving HI among ≥65 year-olds forming 24.8% of all adult ED attendances for HI.

For this study, systematic data collection using all of the methods detailed below identified a total of 697 ED attendances for HI by ≥65 year-olds, 24.4% (170) more than those found using HAD alone. Consequently, the true figure for ≥65 year-olds attending for HI is higher than the 25% recorded on HAD alone.

The 697 HI attendances were identified as follows:

531 patients attending the ED found by hand-searching casualty cards (76.2% of the total).

128 further patients admitted to the ED with HI but documented directly into the trauma chart found by searching the TARN database (18.4%)

38 further patients found on the HAD who did not have casualty cards (5.5%).

Results below are presented for the 697 individual patients aged ≥65 years.

Of the 697 people attending with HI, 24 patients attended the hospital with HI twice during the twelve month period and one patient attended four times. There were 395 females (56.7%) and 302 males (43.3%), ages ranged from 65 to 106 years and the median age was 78 years (mean: 78.5, SD: 8.83, IQR: 15). Ethnicity was recorded for 552 (79.2%) of patients: White British: 495 (71%); Asian: 27 (3.9%); White Irish: 18 (2.6%); White Other: 8 (1.1%); Black British: 4 (0.6%).

Living arrangements

Details of living arrangements were extracted from the emergency department cards for 531 patients. There was a significant difference between age groups: $\chi^2 = 56.90$, df = 8, $p < 0.001$ (Table 1). However, the proportion of patients living at home alone was similar across age groups.

Distribution of head injury presentations throughout the twelve month period

Patients attended the ED for HI throughout the year, there were more presentations during winter, in particular October (83, 11.9%), November (61, 8.8%), December (72, 10.3%), and March (76, 10.9%). There were fewest ED presentations for HI in January (37, 5.3%). There were no significant differences between age groups (65–74; 75–84; 85+).

Mode of arrival

Most patients arrived by emergency transport (428, 61.4%), 417 by ambulance and 11 by helicopter. A quarter of patients (178, 25.5%) arrived at the ED by private or public transport or on foot (25.5%) and for 91 (13.1%) mode of arrival was not recorded.

Cause and severity of head injury

Falls accounted for 86.2% of head injuries (601). Fall severity (<2 or >2 meters) was recorded for 469 patients, most (411, 87.6%) were low level (<2 m) with no significant differences between age groups. Although the geographical location of HIs was not routinely recorded, case notes suggest that many of the falls took place in a domestic setting (home or garden) and included falling down stairs; falling out of bed; tripping over objects or pets. A fall associated with alcohol intoxication was recorded for 25 patients but may be an underestimate.

There were 12 assaults in total, 10 of these were to men. However, overall there was no significant difference in injury mechanism according to gender. There was a significant difference in injury mechanism between age groups ($\chi^2 = 21.44$, df = 8, $p < 0.01$), with a higher incidence of falls in older age groups. Table 2 shows mechanism of injury stratified by age.

Most head injuries were mild (652, 93.5%), 21 moderate (3%) and 24 severe (3.4%). Loss of consciousness (LOC) was recorded for 442, of these only 33 (7.5%) were reported to have lost consciousness. Head injury was the primary injury for 661 patients (94.8%). Ten patients had multiple injuries (1.4%). For 26 patients (3.7%) the primary injury was to other body areas: 12 chest, 7 spine and 7 limb.

Table 1. Living arrangements at time of injury (n 531).

Living arrangements at time of injury	65–74 years Number (%)	75–84 years Number (%)	≥85 years Number (%)	Total Number (%)
Alone	42 (19.2)	32 (18.9)	30 (21.0)	104 (19.6)
Home with spouse/ partner/family	55 (25.1)	46 (27.2)	25 (17.5)	126 (23.7)
Home with carers	8 (3.7)	9 (5.3)	14 (9.8)	31 (5.8)
Residential care	14 (6.4)	27 (16.0)	44 (30.8)	85 (16.0)
Not recorded	100 (45.7)	55 (32.5)	30 (21.0)	185 (34.8)
Total	219 (100)	169 (100)	143 (100)	531 (100)

Table 2. Injury mechanism by age group (n = 697).

Injury Mechanism	65–74 years Number (%)	75–84 years Number (%)	≥85 years Number (%)	Total Number (%)
Fall	222 (79.6)	189 (88.3)	190 (93.1)	601 (86.2)
<2 meters	*141 (50.5)*	*134 (62.6)*	*136 (66.7)*	*411 (59.0)*
>2 meters	*31 (11.1)*	*16 (7.5)*	*11 (5.4)*	*58 (8.3)*
unknown height	*50 (17.9)*	*39 (18.2)*	*43 (21.1)*	*132 (18.9)*
Head hit by object	18 (6.5)	7 (3.3)	3 (1.5)	28 (4.0)
Road traffic accident	14 (5.0)	6 (2.8)	2 (1.0)	22 (3.2)
Assault	7 (2.5)	2 (0.9)	3 (1.5)	12 (1.7)
Not recorded	18 (6.5%)	10 (4.7%)	6 (2.9%)	34 (4.9%)
Total	279 (100)	214 (100)	204 (100)	697 (100)

Other injuries were recorded for 172 patients (24.7%) most frequently to spine, ribs or limbs (Table 3). These other injuries were fractures (56 patients, 32.6%), lacerations/soft tissue injuries (60, 34.9%) and pain/tenderness (56, 32.6%). There was no significant difference between males and females receiving other injuries.

Comorbidities

Details of preexisting medical conditions were recorded for 441 (83.1%) of the 531 patients with casualty cards. Of the 441, only 28 patients (6.3%) had no preexisting medical condition (Table 4), and 291 (70.3%) had more than one comorbidity. There were no significant differences between age groups.

Medications

Details of medications prescribed prior to the HI were recorded for 369 (69.5%) of the 531 patients with casualty cards. Where details of medications were available, 40 patients (10.8%) were not taking any medications; 89 were prescribed aspirin (24.1%); 27 (7.3%) were taking warfarin, and 213 (57.7%) were taking other medications.

Table 3. Other injuries by gender (n = 172 with other injuries).

Other injury location	Female Number (%)	Male Number (%)
Chest	7 (6.9)	5 (7)
Face	6 (5.9)	5 (7)
Hand/wrist	15 (14.9)	14 (19.7)
Hip/pelvis	4 (4)	4 (5.6)
Lower limb	15 (14.9)	6 (8.5)
Multiple areas	9 (8.9)	5 (7)
Spine/ribs	32 (31.7)	23 (32.4)
Upper limb	13 (12.9)	9 (12.7)
Total	101 (100)	71 (100)

Clinical management

All 128 patients included in TARN received a head CT scan. Of these, 110 (85.9%) had abnormal imaging, and 54 (42.2%) had an intracranial hemorrhage (ICH) characterized by the extravascular accumulation of blood within different intracranial spaces.

Of the 531 patients identified from casualty cards 408 (76.8%) did not receive a head CT scan. Of the 123 patients who did receive a head CT, 35 (28.5%) had abnormal imaging but of these 20 (57.1%) showed only preexisting abnormalities. Only two of the 531 patients underwent neurosurgery.

For the 531 patients with casualty cards, 116 were taking warfarin or aspirin at the time of the head injury. Of these only 37 (31.9%) had a head CT scan, all had mild HI (GCS 15 = 102; GCS 14 = 8; GCS 13 = 1; not recorded = 5). For 11 patients the scan was abnormal (29.7%), of these 7 (63.5%) showed acute abnormalities but none showed evidence of intracranial hemorrhage. A head CT was performed for 21 of the 89 patients taking aspirin (23.6%), and for 16 of the 27 taking warfarin (59.3%). Although 54 of the patients identified by TARN had an intracranial hemorrhage, TARN does not contain information on pre-injury medications so it was not possible to link anticoagulant use with ICH.

Discharge outcome

All of the 128 patients recorded on TARN were admitted to the hospital, as admission is one of the inclusion criteria for TARN. Of the 531 patients with casualty cards, 486 (91.5%) were

Table 4. Documented comorbidities (n = 441).

Cormorbidities	Description	Number (Percent)
No comorbidities		28 (6.3%)
Cardiac	Ischemic heart disease, heart problems, angina, hypertension, myocardial infarction, arrhythmia, hypercholesterolemia, atrial fibrillation	213 (48.3%)
Musculoskeletal	rheumatology, arthritis, spondylosis, osteoporosis, balance problems, frozen shoulder, falls	78 (17.7%)
Psychological, Psychiatric, Alcohol	Anxiety, depression, mood abnormalities, schizophrenia	49 (11.1%)
Respiratory	Bronchitis, asthma, pneumonia, emphysema, chronic obstructive airway disease.	43 (9.8%)
Dementia	Including Alzheimer and all types of dementias	94 (21.3%)
Cancer	All types of cancers	30 (6.8%)
Endocrinology	Diabetes, hypothyroidism, hyperthyroidism	69 (15.6%)
Neurology	Epilepsy, seizures, other fits, vertigo, neuropathy, brain infarct, cerebrovascular accidents, tremors, Parkinsonism, excludes dementia	82 (18.6)%
Others	Anemia, eczema, irritable bowel syndrome, glaucoma, jaundice, cataract, chronic kidney disease, migraine, vitamin B12 deficiency.	138 (31.3%)

discharged from the ED on the same day as attendance without being admitted. Of these 531, 430 (93.7%) were discharged directly to their usual place of residence, 63 (11.9%) were discharged back to residential care, 36 (23.4%) were admitted to a hospital ward and 2 to a high dependency ward.

Of the total 697 patients with HI, 169 (24.2%) were admitted to a hospital ward. Of these, 19 went to a high dependency ward (11.2%), 65 to an observations unit (38.5%), and 85 to a hospital ward (50.3%). Of the 169 admitted patients, 45 (26.6%) stayed only one night, the range was 1 to 161 nights: median = 13 (mean = 25.95, SD = 31.03, IQR = 28). There was a significant difference in discharge outcome for the three age groups (Table 5), with older patients being more likely to be admitted or discharged to residential care ($\chi^2 = 38.69$, df = 4, $p < 0.001$).

Of the 697 patients with HI, 4 died on the Observation ward and a further 33 died following admission, a mortality rate of only 5.3%. Of the 37 who died, two thirds (67.6%) were aged ≥85 years, there was a significant difference between age groups ($\chi^2 = 27.69$, df = 2, $p < 0.001$). There was no significant difference in mortality for patients with or without injuries additional to the HI.

Discharge advice

For the 430 patients discharged home directly from the ED, 216 (50.2%) were given written discharge advice, 6 (1.4%) did not receive written advice, and for 208 (48.4%) there was no record of written discharge advice in the notes. For the 63 patients discharged to residential care, written discharge advice was provided for 26 patients (41.3%).

Discussion

We examined a full year of ED admissions for HI by adults aged ≥65 at a major UK trauma center. Hand searching of case notes identified a quarter more cases than using electronic hospital records alone. Most HIs were mild, and most were associated with falls, particularly low-level falls. Case-note data showed that 93% of patients had at least one preexisting medical condition, and most were taking medications, with 116 (17%) prescribed anticoagulant or antiplatelet medication. Despite UK guidance to perform head CT scans after HI for adults taking anticoagulants, 41% of eligible patients were not scanned. Almost half the study patients were not recorded as being given a written HI advice sheet. These findings reflect limited application and adherence to guidelines and suggest a lack of comprehensive documentation of advice given.

Falls

Falls were the most frequent form of injury, especially for the oldest age group of ≥85 years. This finding is consistent with other studies of older adults where low-level falls are most common (e.g. 27–29). The impact of falls in the elderly can be life-changing: reducing independence and mobility, increasing social isolation and the demand for healthcare (30).

Many falls among the elderly take place within the home, and we found that one in 5 patients were living at home alone before the HI, including those aged ≥85. With the growing elderly population, effective home safety and falls prevention strategies are urgently needed, especially for those living alone. The American College of Emergency Physicians (ACEP) recommends a home safety assessment and referral to community resources for fall prevention for patients aged ≥65 (31). Falls prevention using evidence-based interventions has been shown to be effective (32). In the ED of UHCW there is an active program of assessment and intervention led by the Rapid Emergency Assessment and Care Team (REACT). The REACT objective is to initiate multi-disciplinary assessment to ensure the early identification of patients' needs and onward referral for services in order to facilitate early safe return to a community setting. A similar but not identical form of intervention is available in most UK EDs.

Anticoagulants and intracranial hemorrhage

The use of anticoagulants to prevent and manage various medical conditions has increased in recent decades, particularly among older adults. The aging population therefore means growing numbers of people are taking anticoagulants. It is accepted that anticoagulant and antiplatelet therapy may negatively affect outcomes after HI, even minor HI, particularly in older adults (33,34). Although NICE HI guidelines recommend that patients prescribed anticoagulants receive a CT head scan after HI, in our study only 59% of eligible patients had one. For those that did, none showed evidence of intracranial bleeding.

There has been recent debate about the suitability of CT scanning low-risk patients (35). The AHEAD study concluded that the decision to recommend CT scanning in guidance should take into account the potential benefits, harms and costs of CT scanning (18).

Estimates vary for the incidence of clinically significant traumatic intracranial hemorrhage (tICH). In a cohort of older adults presenting to the ED following minor head trauma, O'Brien et al reported the incidence of clinically significant tICH as 6.4% (13). In a recent systematic review deWit et al examined 11 studies concluding that there is about a 5%

Table 5. Discharge destination from ED by age group (n = 697).

Discharge Outcome	65–74 years Number (%)	75–84 years Number (%)	≥85 years Number (%)	Total Number (%)
Admitted	61 (21.9)	48 (22.4)	66 (32.4)	175 (25.1)
Discharged to residential care	10 (3.6)	19 (8.9)	34 (16.7)	63 (9.0)
Discharged to usual place of residence	208 (74.6)	147 (68.7)	104 (51.0)	459 (65.9)
Total	279 (100)	214 (100)	204 (100)	697 (100)

incidence of intracranial bleeding in seniors attending the ED after a fall, but that high quality evidence was lacking (9). A study by Ganetsky et al reported a low incidence of clinically significant tICH after a ground-level fall in head trauma patients taking an anticoagulant or antiplatelet medication, and that aspirin (without other agents) had an tICH rate of 4.6% (95% CI = 3.2%–6.6%) (34). Conversely, Lampart and colleagues found no association between medication with anticoagulants or antiplatelet agents and intracranial hemorrhage in older patients after low-energy falls (36).

Comorbidities

Where comorbidities were noted on the casualty cards, 93% patients had at least one comorbidity and over two-thirds had multiple comorbidities. Furthermore, most patients were on at least one medication. This is not uncommon among older adults, but is very important when assessing the cause and impact of head injuries for patients in this age group. It is also important for clinical management of these patients who may need careful assessment of medications and dosage especially of anticoagulants.

A recent study of adults aged ≥55 attending the ED with mild TBI found that rates of preexisting conditions increased with greater age (37). However, our study found no differences between age groups for the presence of comorbidities. Some preexisting conditions, such as cerebrovascular disease, functional independence or depression, can be risk factors for TBI (38). The presence of comorbidities in patients with mild TBI can complicate recovery and lead to poor outcomes (37). It has been suggested that pre-injury health may be more useful in predicting outcome and response to treatment than age and TBI severity (39). The link between co morbidities and falls with or without HI should be further evaluated to prevent further falls and HIs in older adults.

Clinical management for older adults attending UK EDs

In the UK the British Geriatric Society (BGS) produced a Silver Book (2012, 40) and Silver Book II (2021, 41) to guide healthcare staff involved in delivering emergency care to meet the needs of older patients, including assessment and management of frail older people. The BGS identified five core threats to the health of older people in the urgent care setting: comorbidity disability; frailty; cognition; acuity; social (41). They advise that recognition of these threats, and common geriatric syndromes, will help ED staff to decide whether to admit or discharge. Many UK EDs have recently introduced a frailty assessment which is important in assessing the patient's ability to cope at home or direct them into the best facility, including hospital admission.

HI information advice

The distribution of written HI advice leaflets to patients or carers was recorded in 50% of patient notes. This is significantly lower than the 78% rate of leaflet distribution to parents of children attending the same Trauma center during the same period (22). It may be that an information sheet was deemed unnecessary for patients being discharged to residential care or for those with cognitive impairment. However, all patients with HI or their carers should receive written advice on discharge (NICE and SIGN) and this should be recorded in the notes for the safety of the patient and protection of the clinician.

Three-quarters (74%) of the 85 patients who were living in residential care at the time of their HI were discharged back to the same care facility. A head injury information sheet was provided for only 26 (41%) of those returning patients. These sheets give advice on red flag signs that necessitate return to hospital, so it is important that care home staff are aware of them.

Identification of HIs

In our study we hand-searched every ED record to identify all head injuries. Using this method we found a quarter more patients than if we had only used hospital-coded records. Hospital coding may be inaccurate because the diagnosis 'head injury' is not always used if the person suffered a fall, whereby the injury will have been coded simply as 'fall.' Because of this we checked the hospital records for all falls injuries for patients aged ≥65. Others have commented on how electronic hospital records underestimate numbers of head injuries. A previous study collected a year of ED admission data and compared these with the Health Authority database which used ICD-10 codes (42). Deb found distinct differences between the two systems and concluded that routinely coded data detects only a proportion of all head injury admissions. Many previous studies of head injury epidemiology were dependent on electronic records, and this is likely to have led to underestimates of incidence rates (19,20). As a result of the current study, information on the importance of accurate record keeping and the giving of patient information sheets is being added to the continuous teaching program for junior doctors, along with a check list for doctors to follow.

Study limitations and implications for future research

We were reliant on the accuracy of recording in the highly pressured environment of the ED. Most case notes were complete, but some lacked data on GCS, using the term 'alert' instead, similarly the recording of prescribed medications was not always complete. The electronic coding of notes was not always completely accurate, often due to a coding of 'fall' masking an associated head injury, thus necessitating hand searching. Although our data were collected some years ago, the findings remain valid as local systems have not changed greatly since 2013.

No follow-up was carried out on patients post hospital discharge so only short-term outcome data were available, mortality data was only available for patients who died whilst still in hospital.

Information on medications, including anticoagulants, and comorbidities were available only for the 531 patients with casualty cards. These variables are not recorded on the TARN and HAD databases so it was not possible to explore associations between intracranial bleeding and anticoagulant use for the TARN and HAD patients. Future research is needed to examine the risk of ICH among patients taking anticoagulants/antiplatelet medications using a multi-centered study with a large sample size.

The need for CT scanning in all older adults with HI as indicated in some guidelines is questionable. As in previous studies, we found only a small proportion of patients required neurosurgical intervention after attending the ED with HI. Further research is required to reduce unnecessary radiation and resource use.

Conclusions

Patients aged ≥65 years accounted for over a quarter of adult ED attendances for HI. Hospital coded records of ED attendances for HI significantly underestimate the size of the problem as electronic records are still developing and cannot provide fully comprehensive data.

Our study suggests that the care of HI in older adults needs careful assessment and management due to frequent co morbidities and medication use, especially anticoagulants. Head injury guidelines recommend that patients taking anticoagulants should receive a precautionary CT head scan, but this study found that many did not. Although most patients had good outcomes and only a small proportion of patients required hospital admission or neurological intervention after HI, clinical guidelines should be followed.

At discharge from the ED, almost half the patients were not recorded as receiving HI information advising on symptoms which necessitate a return to the ED. Full documentation and delivery of written advice is important and should be highlighted to all clinical staff who are dealing with patients in this age group.

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References

1. NHS Digital. Accident and emergency attendances in England - 2013-14. 2015. accessed 25th February 2020. https://digital.nhs.uk/data-and-information/publications/statistical/hospital-accident–emergency-activity/2013-14.
2. NHS Digital. Hospital accident and emergency activity. 2020. accessed 5th December 2021. https://digital.nhs.uk/data-and-information/publications/statistical/hospital-accident–emergency-activity/2019-20.
3. National Institute for Health and Care Excellence. Head injury: assessment and early management CG176. London: NICE. Published January 2014.
4. Susman M, DiRusso SM, Sullivan T, Risucci D, Nealon P, Cuff S, Haider A, Benzil D. Traumatic brain injury in the elderly: increased mortality and worse functional outcome at discharge despite lower injury severity. J Trauma-Injury, Infect Crit Care. 2002;53(2):219–24.doi:10.1097/00005373-200208000-00004.
5. Thompson HJ, McCormick WC, Kagan SH. Traumatic brain injury in older adults: epidemiology, outcomes, and future implications. J Am Geriatric So. 2006;54:1590–95.doi:10.1111/j.1532-5415.2006.00894.x.
6. Ibanez J, Arikan F, Pedraza S, Sanchez S, Poca MA, Rodriguez D, Rubio E. Reliability of clinical guidelines in the detection of patients at risk following mild head injury: results of a prospective study. J Neurosurg. 2004;100(5):825–34. doi:10.3171/jns.2004.100.5.0825.
7. Kumar RG, Juengst SB, Wang Z, Dams-O'Connor K, Dikmen SS, O'Neil-Pirozzi TM, Dahdah MN, Hammond FM, Felix ER, Arenth PM, et al.Epidemiology of comorbid conditions among adults 50 years and older with traumatic brain injury. J Head Trauma Rehabil. 2018;33(1):15–24.doi:10.1097/HTR.0000000000000273.
8. Munro PT, Smith RD, Park TR. Effect of patients' age on management of acute intracranial hematoma: a prospective national study. Br Med J. 2002;325:1001.doi:10.1136/bmj.325.7371.1001.
9. de Wit K, Merali Z, Kagoma Y, Mercier É. 2020. Incidence of intracranial bleeding in seniors presenting to the emergency department after a fall: a systematic review. Injury. 51(2):157–63. doi:10.1016/j.injury.2019.12.036
10. Li J, Brown J, Levine M. Mild head injury, anticoagulants, and risk of intracranial injury. Lancet. 2001;357:771–72. doi:10.1016/S0140-6736(00)04163-5.
11. Gittleman AM, Ortiz AO, Keating DP, Katz DS. Indications for CT in patients receiving anticoagulation after head trauma. AJNR Am J Neuroradiol. 2005;26:603–06.
12. Nishijima DK, Offerman SR, Ballard DW, Vinson DR, Chettipally UK, Rauchwerger AS, Reed ME, Holmes JF, et al. Immediate and delayed traumatic intracranial hemorrhage in patients with head trauma and preinjury warfarin or clopidogrel use. Ann Emerg Med. 2012;59:460–8.e7.
13. O'Brien T, Mitra B, Le Sage N, Tardif PA, Emond M, D'Astous M, Mercier E. Clinically significant traumatic intracranial hemorrhage following minor head trauma in older adults: a retrospective cohort study. Brain Inj. 2020 May 11;34(6):834–39. doi:10.1080/02699052.2020.1753242. Epub 2020 Apr 14. PMID: 32286890.
14. National Institute for Health and Care Excellence. Anticoagulation therapy commissioning guide (CG76). London: NICE; 2013. https://www.nice.org.uk/guidance/cg76/resources/guide-for-commissioners-anticoagulation-therapy-328998097861
15. National Institute for Health and Care Excellence. Head injury: assessment and early management CG176. Published January 2014, Updated June 2017. accessed December 2019. https://www.nice.org.uk/guidance/cg176/resources/head-injury-assessment-and-early-management-pdf-35109755595493.
16. National Institute for Health and Care Excellence. Head injury: assessment and early management CG176. Published January 2014, Updated September 2019. accessed December 2021. https://www.nice.org.uk/guidance/cg176.
17. Scottish Intercollegiate Guideline Network. Early management of patients with a head injury: a national clinical guideline: 110.2009.
18. Mason S, Kuczawski M, Teare MD, Stevenson M, Goodacre S, Ramlakhan S, Morris F, Rothwell J. AHEAD Study: an observational study of the management of anticoagulated patients who suffer head injury. BMJ Open. 2017;7:e014324. doi:10.1136/bmjopen-2016-014324.
19. Yates PJ, Williams WH, Harris A, Round A, Jenkins R. An epidemiological study of head injuries in a UK population attending an emergency department. J Neurol Neurosurg Psychiatry. 2006;77:699–701.doi:10.1136/jnnp.2005.081901.
20. Jager TE, Weiss HB, Coben JH, Pepe PE. Traumatic brain injuries evaluated in US emergency departments, 1992-1994. Acad Emerg Med. 2000;7:134–40.doi:10.1111/j.1553-2712.2000.tb00515.x.

21. NHS Digital. Hospital accident and emergency activity, 2017-18. 2018. accessed 25th February 2020. https://digital.nhs.uk/data-and-information/publications/statistical/hospital-accident–emergency-activity/2017-18.
22. Hawley C, Wilson J, Hickson C, Mills S, Ekeocha S, Sakr M. Epidemiology of paediatric minor head injury: comparison of injury characteristics with indices of multiple deprivation. Injury. 2013;44(12):1855–61.doi:10.1016/j.injury.2013.07.021.
23. Office for National Statistics. Population estimates of those aged 16 to 64; 65 and over; 85 and over; for local areas, UK, 1992 to 2014. 2017. accessed 10 December 2021. https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/adhocs/004835populationestimatesofthoseaged16to6465andover85andoverforlocalareasuk1992to2014.
24. National Institute for Health and Care Excellence. Head injury: assessment and early management CG176. accessed January 2014. https://www.nice.org.uk/guidance/cg176.
25. Office for National Statistics (ONS). (2012) 2011 Census. accessed December 2021. https://www.ons.gov.uk/census/2011census.
26. National Health Service (NHS). Anticoagulant medications. 2022. accessed March 2022. https://www.nhs.uk/conditions/anticoagulants/.
27. Hawley C, Sakr M, Scapinello S, Salvo J, Wrenn P. Traumatic brain injuries in older adults – six years of data for one UK trauma centre: retrospective analysis of prospectively collected data. Emerg Med J. 2017;34(8):emermed-2016–206506.doi:10.1136/emermed-2016-206506.
28. Sterling DA, O'Connor JA, Bonadies J. Geriatric falls: severity is high and disproportionate to mechanism. J Trauma. 2001;50:116–19.doi:10.1097/00005373-200101000-00021.
29. Thompson HJ, McCormick WC, Kagan SH. Traumatic brain injury in older adults: epidemiology, outcomes, and future implications. J Am Geriatr Soc. 2006;54:1590–95. doi:10.1111/j.1532-5415.2006.00894.x.
30. Boye NDA, Van Lieshout EMM, Van Beeck EF, Hartholt KA, Van der Camen TJM, Patka P. The impact of falls in the elderly. Trauma. 2012;15(1):29–35.doi:10.1177/1460408612463145.
31. American College of Emergency Physicians. Geriatric emergency department guidelines. Am Coll Emer Physicians; 2013. https://www.acep.org/globalassets/new-pdfs/policy-statements/geriatric-emergency-department-guidelines.pdf. (Accessed Dec 2021).
32. Tinetti ME, Baker DI, King M, Gottschalk M, Murphy TE, Acampora D, Carlin BP, Leo-Summers L, Allore HG. Effect of dissemination of evidence in reducing injuries from falls. N Engl J Med. 2008;359:252–61.
33. Smith K, Weeks S. The impact of pre-injury anticoagulation therapy in the older adult patient experiencing a traumatic brain injury: a systematic review. JBI Libr Syst Rev. 2012;10(58):4610–21. doi:10.11124/jbisrir-2012-429. PMID: 27820526.
34. Ganetsky M, Lopez G, Coreanu T, Novack V, Horng S, Shapiro NI, Bauer KA. 2017. Risk of intracranial hemorrhage in ground-level fall with antiplatelet or anticoagulant agents. Acad Emer Med. 24 (10):1258–66. doi:10.1111/acem.13217
35. Shih RD, Ouslander JG. Intracranial hemorrhage in older adults: implications for fall risk assessment and prevention. J Am Geriatr Soc. 2020 May;68(5):953–55. doi:10.1111/jgs.16399.
36. Lampart A, Kuster T, Nickel CH, Bingisser R, Pedersen V. Prevalence and severity of traumatic intracranial hemorrhage in older adults with low-energy falls. J Am Geriatr Soc. 2020 May;68 (5):977–82. doi:10.1111/jgs.16400. Epub 2020 Mar 6. PMID: 32142155.
37. Karr JE, Iverson GL, Isokuortti H, Kataja A, Brander A, Öhman J, Luoto TM. Preexisting conditions in older adults with mild traumatic brain injuries. Brain Inj. 2021 Sep;21:1–9. Epub ahead of print. PMID: 34546830. doi:10.1080/02699052.2021.1976419
38. Dams-O'Connor K, Gibbons LE, Landau A, Larson EB, Crane PK. 2016. Health problems precede traumatic brain injury in older adults. J Am Geriatr Soc. 64(4):844–48. doi:10.1111/jgs.14014
39. Gardner RC, Dams-O'Connor K, Morrissey MR, Manley GT. Geriatric traumatic brain injury: epidemiology, outcomes, knowledge gaps, and future directions. J Neurotrauma. 2018;35:889–906. doi:10.1089/neu.2017.5371.
40. British Geriatric Society. The silver book. 2012. https://www.bgs.org.uk/blog/the-silver-book-guidelines-for-the-emergency-care-of-older-people.
41. British Geriatric Society. The silver book II. 2021. https://www.bgs.org.uk/resources/resource-series/silver-book-ii.
42. Deb S. ICD-10 codes detect only a proportion of all head injury admissions. Brain Injury. 1999;13:369–73.doi:10.1080/026990599121557.