Neuropsychiatric sequelae one year after a minor head injury

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Abstract

Objective—To assess neuropsychiatric sequelae 1 year after minor head injury in a cross sectional study using home interviews with patients and their relatives at 1 year after head injury.

Methods—The study cohort included 148 adults who were admitted to hospital after a minor head injury between 1 July 1994 and 30 June 1995 and showed clinical or radiological evidence of brain injury. Main outcome measures used in the study were the Glasgow outcome scale, Edinburgh rehabilitation status scale, Barthel index, clinical interview schedule-revised, mini mental state examination, and assessment of symptoms of postconcussional syndrome.

Results—At one year follow up, four (2.9%) patients had a severe disability, 35 (25.5%) had a moderate disability, and 95 (69.3%) had no disability according to the Glasgow outcome scale. A slightly higher proportion (33.3%, n=45) showed disability according to the Edinburgh rehabilitation status scale. Thirty one patients (23.1%) scored < 24 in the mini mental state examination. These were mostly patients over the age of 65. Twenty three patients (17.2%) were diagnosed as psychiatric cases according to the clinical interview schedule-revised scale. Seventy four (55.2%) patients showed one of the symptoms of postconcussional syndrome. The most commonly shown neurobehavioural problems were irritability (30%), sleep disturbance (29%), and impatience (27%).

Conclusion—One year after a minor head injury, a substantial proportion of patients showed neuropsychiatric sequelae.

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Keywords: minor head injury; neuropsychiatric sequelae

There have been many outcome studies of patients with severe head injury.^{1,2} Recently, there have also been outcome studies of patients with minor head injury.^{3–8} One of the problems in this area is that of case definition and subsequent case ascertainment. When studying the sequelae of minor head injury, it becomes difficult to evaluate the relative impact of the consequences of psychological effect of having a trauma and those of the effect of direct brain injury. In the past, emphasis was on the detection of specific neuropsychological deficits after minor head injury.^{4–6} Patients were

not necessarily collected from a defined geographical area. We thus decided to undertake a comprehensive assessment of neuropsychiatric sequelae 1 year after minor head injury in patients admitted to hospital who showed clinical or radiological evidence of brain injury.

Methods

The study cohort comprised 148 adults over age 17 who were admitted to hospital after a minor head injury between 1 July 1994 and 30 June 1995. All of these patients had a known address in the South Glamorgan Health District. The inclusion criteria were a Glasgow coma scale score between 13–15⁹ and either a history of a period of lost consciousness after the head injury or radiological (evidence of fracture on skull radiography, or cerebral haemorrhage, or contusion on CT or MRI) or clinical evidence (focal neurological signs) of brain injury. The list was collected from the Health Authority's central data base by using the international classification of diseases-ninth revision (ICD-9) codes¹⁰ and scrutinising medical case notes.

Patients were invited by post to take part in the study. Those who did not respond initially received a reminder letter within 6 weeks, and again within 12 weeks of receiving the initial letter. In some cases, the patients were contacted by telephone or through their general practitioners (GPs). Consultants under whose care the patients were admitted allowed research staff to examine patients' medical case notes. The study was approved by the local district ethics committee and all patients who took part in the study signed a consent form, a copy of which was sent to their GPs.

A purpose designed questionnaire was devised based on the recently developed head injury evaluation chart (first and second part) produced by the European Brain Injury Society¹¹ for the purpose of collecting data from patients and their relatives. The data for the questionnaire were collected from patients' case notes and also from a face to face interview with patients and their relatives primarily in their home settings. Two research staff (IL and CK) interviewed the patients and their relatives about 1 year after the head injury. Data were collected on the following areas: patient's age, sex, date of interview, date of head injury, and an estimate of current alcohol intake.

Overall outcome at 1 year after head injury was assessed according to the Glasgow outcome scale¹² and Edinburgh rehabilitation status scale (ERSS).¹³ The patients' overall cognitive state was assessed using the score of the

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Table 1 Comparison of patients (n (%)) showing disability according to Glasgow outcome scale and MMSE in different age and sex groups

	Age			Male	Female
	18–40	41–65	>65		
Dead (n=3)	0	1 (3.6)	2 (5.1)	1 (1.1)	2 (4.4)
PVS (n=0)	0	0	0	0	0
Severe disability (n=4)	1 (1.4)	2 (7.1)	1 (2.6)	3 (3.3)	1 (2.2)
Moderate disability (n=35)	17 (24.3)	6 (21.4)	12 (30.8)	27 (29.3)	8 (17.8)
No disability (n=95)	52 (74.3)	19 (67.9)	24 (61.5)	61 (66.3)	34 (75.6)
MMSE score <24 (n=31)	*4 (5.7)	4 (14.8)	23 (62.2)	20 (22.2)	11 (25)

* $p < 0.0001$ $\chi^2 = 44.689$, $df = 2$. PVS = persistent vegetative state, MMSE = mini mental state examination.

mini mental state examination (MMSE).¹⁴ Premorbid IQ was assessed by the national adult reading test (NART).¹⁵ The patients' overall physical disability was assessed with the Barthel index.¹⁶ The clinical interview schedule-revised (CIS-R)¹⁷ along with the psychosis screening questionnaire (PSQ)¹⁸ were administered to assess psychiatric status. A six point behaviour rating scale was used to measure the symptoms of postconcussional syndrome.

The ERSS has four subsections; ERSS 1 or the "support scale" measures the frequency and extent to which the patient relies on others for self care; the ERSS 2 or the "inactivity scale" assesses the ability to initiate, sustain, and effectively perform daily living activities; the ERSS 3 or the "social integration/isolation scale" measures patient's involvement in roles, relationships, a social network and in communication; and the ERSS 4 or the "effects of current symptoms scale" assesses the extent to which the severity and constancy of symptoms and impairments affect the patient's lifestyle. A score of 0–7 is possible for these subscales and for our study we took an arbitrary cut off score >2 to define significant disability in each subsection and the overall ERSS. The same cut off score was used by McClelland *et al* in their Belfast Study¹⁹ (R J McClelland, personal communication).

A score <24 in the MMSE was taken as an evidence of overall cognitive deficit. A maximum score of 20 in the Barthel index indicates the absence of any physical disability. A score <20 was taken in this study as evidence of the presence of physical disability. The CIS-R and PSQ were used in a recent Office of Population Censuses and Survey (OPCS)²⁰ study and were shown to be reliable screening instruments for the detection of psychiatric cases in a general adult population. Those who scored ≥ 12 according to the CIS-R criteria or scored positively on any of the eight psychotic symptoms according to the PSQ were diagnosed as psychiatric cases. The following behaviours were rated on a 1–6 point scale to assess the symptoms of postconcussional syndrome: mood swings, impatience, sleep problem, safety hazard, eating problem, socialisation problem, inappropriate or disinhibited behaviour, depressed mood, verbal outbursts, poor memory, dependence, irritability, lack of initiative, slowness in thinking, inability to plan or make a decision, tiredness, and lack of insight. A score ≤ 4 in any of these categories was taken as evidence of presence of that particular behaviour.

The data were analysed using an SPSS for windows statistical package²¹ on a personal computer equipped with a 75 Pentium processor. The analysis involved estimation of percentages with 95% confidence intervals. A χ^2 analysis was used to compare the frequencies of certain variables between groups. A regression analysis of the factors affecting various outcome measures was also carried out.

Results

Three patients were deceased at 1 year follow up. The cause of their deaths were not known but not necessarily related to the head injury. Eleven patients could not be contacted for an interview. Some data from medical notes were available on 140 patients, and 134 patients had a face to face interview. Patient's ages ranged between 18–93 years (median 39.5; quartile=27). There were 72 patients between the ages of 18 and 40 (51.4%), 28 between 41 and 65 (20%), and 40 were over 65 (28.6%). Ninety three (66.4%) patients were men and 47 (33.6%) were women. The younger age group predominantly consisted of men and the older age group of women.

According to the Glasgow outcome scale, Four patients (2.9%) were severely disabled, 35 (25.5%) were moderately disabled, and 95 (69.3%) had no disability at 1 year follow up. According to the overall ERSS score, 45 patients (33.3%, 95% confidence interval (95% CI) 25.6%–42%) showed disability. According to the subscales of the ERSS, 15 (10.7%) showed disability according to the ERSS 1 (support subscale), 21 (15.6%) according to the ERSS 2 (inactivity scale), 24 (17.8%) according to the ERSS 3 (social integration/Isolation scale), and 26 (19.3%) according to the ERSS 4 (effects of current symptoms scale). According to the Barthel index, 17 patients (12.6%, 95% CI 7.7%–19.6%) scored <20.

Thirty one patients (23%, 95% CI 16.5%–31%) scored <24 according to the MMSE. Twenty three (17.2%, 95% CI 11.4%–24.8%) patients were diagnosed as psychiatric cases according to CIS-R and PSQ. Seventy four (55.2%, 95% CI 46.4%–63.7%) manifested any one of the symptoms of postconcussional syndrome according to the behaviour rating questionnaire. Common behavioural problems were noted as follows: 30% showed irritability, 29% sleep problems, 27% impatience, 25% mood swings, 22% tiredness, 15% slowness in thinking. The rate of different outcomes according to the age and sex groups are shown in tables 1 and 2.

Table 2 Comparison of patients (n (%)) showing disability according to Edinburgh rehabilitation scale score (ERSS; total and subscales), clinical interview scale-revised (CIS-R), and postconcussional syndrome (PCS) in different age and sex groups

	Age			Male	Female
	18–40	41–65	>65		
ERSS (total) (>2) (n=45)	18 (25.7)	9 (33.3)	18 (47.4)	32 (35.2)	13 (29.5)
ERSS1 (>2) (n=15)	†2 (2.9)	2 (7.4)	11 (28.9)	10 (11)	5 (11.4)
ERSS2 (>2) (n=21)	‡4 (5.7)	5 (18.5)	12 (31.6)	16 (17.6)	5 (11.4)
ERSS3 (>2) (n=24)	*7 (10)	6 (22.2)	11 (28.9)	19 (20.9)	5 (11.4)
ERSS4 (>2) (n=26)	9 (12.9)	6 (22.2)	11 (28.9)	21 (23.1)	5 (11.4)
CIS-R (>11) (n=23)	15 (21.4)	6 (22.2)	2 (5.4)	16 (17.8)	7 (15.9)
PCS (n=74)	37 (52.9)	16 (59.3)	21 (56.8)	51 (56)	23 (53.5)

* $p=0.039$, $\chi^2=6.51$, $df=2$; † $p=0.001$, $\chi^2=12.77$, $df=2$; ‡ $p=0.000$, $\chi^2=17.44$, $df=2$.

A regression analysis was carried out by using the total ERSS score as a dependent variable and the following factors as covariates: age, sex, average current weekly alcohol consumption, Glasgow coma scale score, NART score, history of a previous head injury, and MMSE score. A significant negative correlation between the MMSE score and ERSS score was detected ($p < 0.0001$). However, when MMSE was excluded from the regression analysis, a positively significant correlation between age and ERSS score was detected ($p < 0.0001$).

Discussion

Of the 300 000 adult (>17 years) population of South Glamorgan Health District, about 3172 (1%) attend the accident and emergency department each year with a diagnosis of head injury. Of them, about 442 (14%) are admitted to a hospital, of whom 70% ($n=309$) are expected to have a minor head injury (Glasgow coma score 15–13).²² Our cohort included 48% ($n=148$) of all the expected patients with mild head injury who were admitted to a hospital. It is also likely that by using the ICD-9 code to access the central data base, we have received an incomplete list of all those patients who were admitted to a hospital.

By including those patients with mild head injury who were admitted to hospital and had a period of lost consciousness we collected a subgroup of patients with mild head injury who came into the severe end of the range. Therefore it would be expected that the proportion of the total population of patients with mild head injury showing disability after 1 year of their injury would be smaller than that found in our study. In a cross sectional study it is always difficult to examine the natural history of symptoms over a period of time. For example, it has been suggested that the symptoms of postconcussional syndrome may recur in up to 30% of patients after an initial period of remission.²³

Both organic and environmental factors can be responsible for the neuropsychiatric sequelae after a head injury. The relative impact of these individual factors are difficult to determine. By including those patients who showed indirect evidence of brain insult at the time of the head injury we tried to emphasise more the effect of organic factors.

With a few exceptions, most previous outcome studies in this area concentrated on patients with a severe to moderate degree of head injury.²⁴ A few studies which included

patients with mild head injury examined the patients after a few weeks to a few months of the injury.^{3–8} One study reported symptoms 1 year after minor head injury.²⁵ So far the emphasis has been on specific neuropsychological deficits and behavioural problems. Between 25% to 30% of patients with mild head injury showed deficits according to neuropsychological tests at 6 weeks to 3 months after injury.^{5–6}

Studies in the past primarily included patients between the ages of 16 and 65 years.^{3–6} By including patients over the age of 65 years in our study cohort, we may have increased the possibility of detecting more disability in the patient population. We deliberately used two different global outcome measures—namely, the Glasgow outcome scale and ERSS—because we tried to maximise the scope of detection of disability in the cohort. The ERSS is particularly useful in this context because it asks detailed questions on specific psychosocial problems in the patient, whereas the Glasgow outcome scale is much more subjective and non-specific in its approach. This was reflected in our finding that the ERSS has detected a slightly higher proportion of patients with disability compared with the Glasgow outcome scale. Elderly patients showed a higher prevalence of disability according to ERSS subscales, some of which may have existed before the injury. Besides, neurobehavioural symptoms such as irritability (30.6%–42.9%) tiredness (27.6%–34.7%) and impatience (42.3%–49%), could also be commonly found among adults without a head injury.²⁶

It is not known why certain patients after a minor head injury develop long lasting sequelae which are debilitating. Our pursuit of trying to find an answer to that question by using a regression analysis of various risk factors did not throw much light on the issue. It was interesting to find no significant effects of average weekly alcohol consumption rate or initial Glasgow coma score on the ultimate outcome. Similar findings were noted in a previous study.⁵ Whatever seems to be the reason for these lasting disabilities, both the patients and their relatives who are caring for them are under considerable strain, particularly as most of these patients are not known to the service providers.

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