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MRI findings and Axis I and II psychiatric disorders after traumatic brain injury: A 30-year retrospective follow-up study

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Abstract

We studied the association between psychiatric disorders and the presence and location of traumatic lesions on magnetic resonance imaging (MRI) in 58 patients, on average, 30 years after traumatic brain injury. Axis I psychiatric disorders that had begun after the injury were assessed with the Schedules for Clinical Assessment in Neuropsychiatry (version 2.1), and Axis II disorders with the Structured Clinical Interview for DSM-III-R Personality Disorders. A 1.5-Tesla MRI scanner was used. One-third of the subjects had traumatic lesions visible on MRI. Only three psychiatric disorders, that is, delusional disorder, dementia, and the disinhibited type of organic personality syndrome, were significantly more common in subjects with contusions. Concerning the location of contusions, organic personality syndrome and its disinhibited subtype were associated with frontal lesions, and major depression was, surprisingly, inversely associated with temporal lesions. These results, which should be interpreted with caution due to the limited size of the study group, suggest that the majority of psychiatric disorders after traumatic brain injury are not closely related to the specific location or even the presence of contusions detectable with post-acute MRI.

Keywords: Brain injuries; Mental disorders; Magnetic resonance imaging

1. Introduction

As early as in the mid-19th century, the famous case of Phineas Gage brought to our knowledge the association between the specific location of traumatic brain injury (TBI) and the corresponding neuropsychiatric symptoms (O'Driscoll and Leach, 1998). However, there is a paucity of studies investigating the connection between the location of TBI and psychiatric disorders using modern neuroimaging methods and structured diagnostic interviews.

Psychoses after TBI have been associated with several brain regions. Hillbom (1960) determined the location of TBI in 359 individuals, and found temporal lesions, particularly left-sided ones, to be the most common in psychotic patients. Of more recent studies, Fujii and Ahmed (1996) used several alternative methods to locate brain injury in 15 patients with psychosis after TBI; they found right and left temporal and left frontal lesions to be the most prevalent. Sachdev et al.

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(2001) used computed tomography (CT) to examine 45 subjects with TBI and schizophrenia-like psychosis and 45 controls with TBI only, and reported left temporal and right parietal lesions to be common in psychotic patients.

Major depression was associated with reduced left prefrontal gray matter volumes on magnetic resonance imaging (MRI), particularly in the ventrolateral and dorsolateral regions, in a case–control study of 91 patients with TBI by Jorge et al. (2004). No significant differences were found in the frequency of focal or diffuse lesions, the location of lesions, or the volume of focal lesions between patients with and without depression. Jorge et al. (1993a) earlier used CT to study 66 patients with TBI, and reported a connection between depression and the lesions of the left dorsolateral frontal region and the left basal ganglia, but only during the first month after the injury.

In Alzheimer's disease, TBI has been suggested as a risk factor (Mayeux et al., 1995; Lye and Shores, 2000), although conflicting evidence has also been presented (Mehta et al., 1999). To our knowledge, there are no recent reports on the relation of dementia to the location of TBI.

Although personality change after TBI is a well-known phenomenon (Prigatano, 1992), there are only a few studies that have applied modern neuroimaging to study its relation to the location of injury. In 94 children and adolescents, Max et al. (2000) found personality change in 59% of patients with severe TBI, and in 5% of patients with mild/moderate TBI. When subjects with the labile, disinhibited, or aggressive type of personality change were compared with subjects without it, no significant differences were found with CT in the location of TBI. In the literature, three types of prefrontal syndrome have been illustrated: lesions of the dorsolateral circuit resulting in disturbances in executive functions, lesions of the orbitofrontal circuit resulting in disinhibition and lability, and lesions of the anterior cingulate circuit resulting in apathy (Tekin and Cummings, 2002). As far as we know, the association between the location of TBI and the occurrence of DSM or ICD personality disorders has not been studied.

We have previously reported a high occurrence of Axis I and II psychiatric disorders in 60 patients with TBI during a 30-year follow-up (Koponen et al., 2002). The two hypotheses of the present study were that, in the same study group, (1) psychiatric morbidity would be more common in the presence of traumatic lesions on MRI, and (2) lesions in a certain location would be associated with a specific type of psychopathology.

2. Methods

2.1. Subjects

The subjects were recruited from a group of 210 patients who had suffered a TBI between 1950 and 1971, and who had been referred for neuropsychological evaluation to Turku University Hospital (Turku, Finland) between 1966 and 1972. The reason for the referral was either a recent TBI or significant disability after an earlier TBI.

Of the original group of 210 patients, 76 had died. The inclusion criteria for the remaining 134 patients were (1) a head trauma severe enough to cause TBI and neurological symptoms (including headache and nausea) lasting at least 1 week, and (2) at least one of the following: loss of consciousness for at least 1 min, posttraumatic amnesia for at least 30 min, neurological symptoms (excluding headache and nausea) during the first 3 days after injury, or neuroradiological findings suggesting TBI (e.g. skull fracture, intracerebral hemorrhage). The exclusion criteria were (1) neurological illness before TBI, (2) clinical symptoms of a non-traumatic neurological illness that developed after TBI (excluding dementia), (3) insufficient cooperation, or (4) unavailability of medical records.

Of the 134 patients, 13 did not meet the inclusion criteria according to medical records, one patient was excluded because of neurological illness before TBI, and two patients did not have available medical records. The remaining 118 patients were contacted by mail, and 88 of them replied. Eighty-three patients met the inclusion criteria, but seven were excluded because of a non-traumatic neurological illness, and 16 refused to participate in the study. Two of the remaining 60 subjects were unable to undergo MRI examination because of claustrophobia, leaving 58 subjects for the present study group. Written informed consent was obtained after the procedure had been fully explained. The protocol was approved by the Ethics Committee of Turku University Hospital. The subjects were examined between January 1998 and April 1999.

Nineteen of the 58 subjects (32.8%) were female. The mean age was 60.7 years (S.D. 10.2), and the mean time from injury to current examination was 31.5 years (S.D. 4.5). The mean length of education was 9.3 years (S.D. 2.2). The cause of injury was a motor vehicle accident in 35 subjects (60.3%), a fall in 13 (22.4%), a falling object in four (6.9%), and other causes in six (10.3%). The severity of TBI was classified on the basis of the duration of posttraumatic amnesia as follows: <1 h = mild (15 subjects; 25.9%), 1–24 h = moderate (15; 25.9%), 1–7