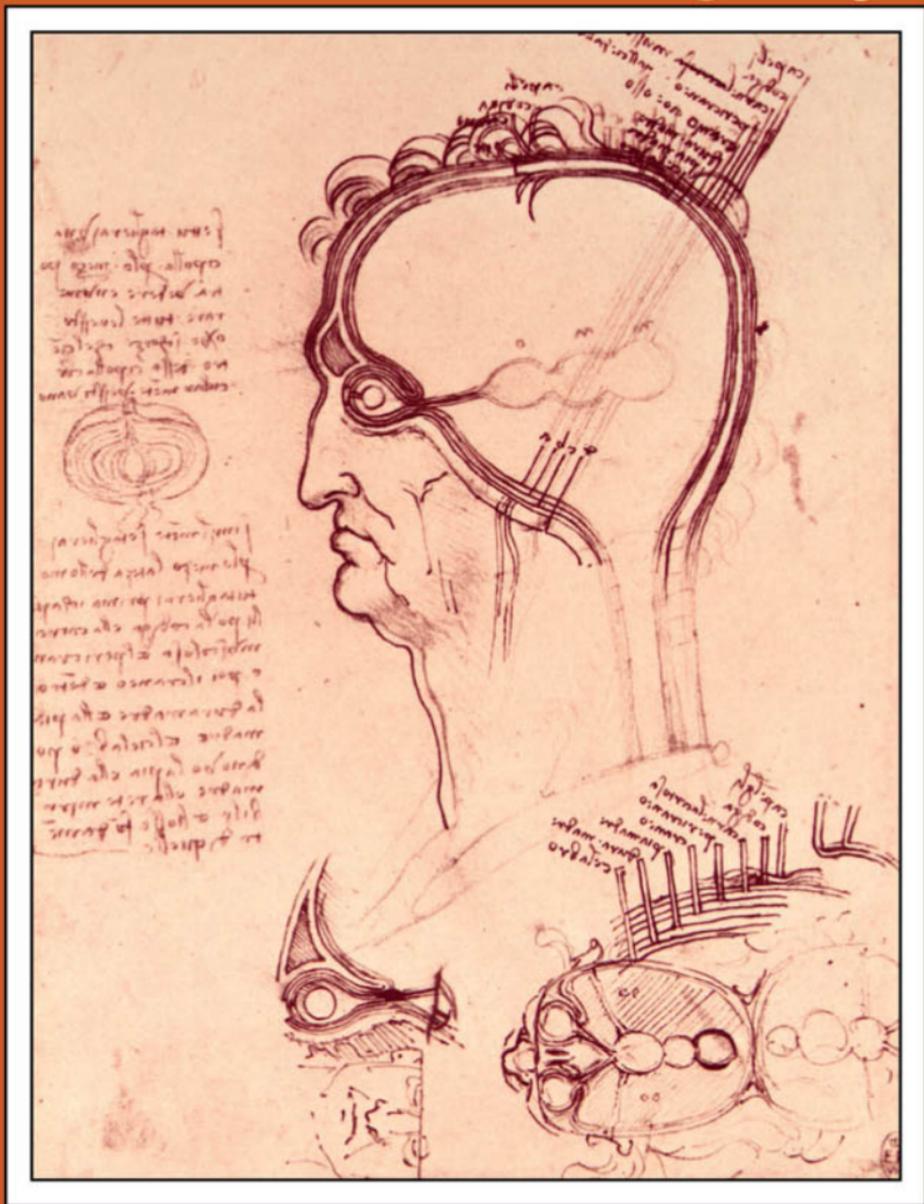


Mild Head Injury



Edited by **Harvey S. Levin**

Howard M. Eisenberg · Arthur L. Benton

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Preface

Despite the extensive documentation of postconcussion symptoms following apparently mild head injury in clinical reports and other publications during the period of industrialization in Western countries which is described in Benton's historical sketch (Chapter 1), the full magnitude of the problem in terms of medical care and social costs has only recently been appreciated. The prospective collection of population-based epidemiological data reviewed by Kraus and Nourjah (Chapter 2) has disclosed that mild head injury accounts for about two-thirds to three-fourths of all hospital admissions for head trauma. Extrapolation to the U.S. population of 250 million from the overall incidence of 130.8 patients per 100,000 population reported by these authors leads to an estimate of more than 325,000 new cases of mild head injury annually. Given the number of individuals hospitalized for mild head injury, the cost of their medical care, the burden on health services, and the social and economic consequences of their relatively brief periods of disability are enormous. Moreover, as Jennett (Chapter 3) points out, approximately five cases of mild head injury are treated on an outpatient basis in emergency rooms for every one that is admitted to a hospital.

As discussed by Benton and Rutherford in Chapters 1 and 14, respectively, definitions of mild head injury require further clarification despite recent efforts using the Glasgow Coma Scale. Although the Glasgow Coma Scale is unquestionably useful and represents the state-of-the-art for monitoring the clinical course and prognosticating survival after severe head injury, it was designed primarily to evaluate depth of coma rather than to quantitate relatively mild disturbance of consciousness and manifestations of posttraumatic amnesia following mild injuries. Loss of consciousness is typically brief in mild head injury, and measuring its duration often depends on information obtained from untrained observers. Mild head injury is not synonymous with mild brain injury nor is it clear whether either term implies concussion. The relationship of neurological deficit and postconcussion symptoms during the early stages of recovery to long-term sequelae is discussed by Rutherford in Chapter 14.

Advances in the neurosurgical management of mild head injury have enabled us to identify patients at high risk for neurological deterioration after an apparently mild head injury. Dacey (Chapter 6) reports a major prospective study of hospital admissions for apparent mild head injury that characterizes the clinical features of patients whose delayed deterioration often requires

urgent neurosurgical intervention. He also compares the relative costs and efficiency of different approaches to neurosurgical management of mild head injury including the use of skull x-rays and computed tomography (CT). An international perspective on the clinical management of mild head injury is provided by Jennett (Chapter 3) who discusses differences between European and American centers with regard to outpatient treatment in the emergency room as opposed to hospital admission. General surgeons and other medical specialists are involved in the management of mild head injury in Britain and other European countries, in contrast to the predominant role of neurosurgeons in the care of these patients in North America. Eisenberg and Levin (Chapter 8) describe recent studies on the use of magnetic resonance imaging (MRI) in patients sustaining mild to moderate injury that indicate the presence of parenchymal abnormalities in most cases with normal CT scans. However, MRI revealed that most of these intracranial lesions or edematous areas resolved over a period of one to three months in parallel with marked improvement in neurobehavioral functioning. Preliminary findings described by Eisenberg and Levin indicate that the localization of parenchymal abnormalities by MRI is related to the early pattern of neurobehavioral deficits in patients with mild to moderate head injury. Similarly, Schoenhuber and Gentilini (Chapter 9) describe neurophysiological abnormalities (e.g., evoked potentials) detected initially after mild head injury which tend to resolve over the first three months.

Experimental models of head injury described by Povlishock and Hayes and their co-workers (Chapters 4 and 5) have elucidated the neuropathological and neurochemical alterations produced by mild head injury. The microscopic changes in the parenchyma produced by the fluid percussion model are remarkably similar to the neuropathological findings in published reports of patients sustaining mild head injury who died from other causes. Recent experimental studies by Povlishock and co-workers indicate that early intervention may prevent complete tearing of partially injured axons. Using the fluid percussion model, Hayes and his coauthors describe alterations in the cholinergic system following injury. These results support the view that neurotransmitter changes may mediate the impairment of consciousness and neurobehavioral sequelae of mild head injury. It is possible that pharmacological therapy involving receptor blockade or other manipulation of neurotransmitters may prevent neurological deterioration and reduce morbidity in those patients who suffer acute mild head injury. Further studies with varied dosages, timing of intervention, and end-point measures are needed to evaluate the efficacy of drug therapy. It is clear from the work by Povlishock, Hayes, and their colleagues that experimental models of head injury have considerable potential for improving the treatment of patients who suffer mild head injury.

Neurobehavioral sequelae, postconcussional symptoms, and the stress associated with increased mental effort constitute the major source of disability and of secondary problems (e.g., depression) in most patients sustaining mild head injury. Differentiating the effects of primary neurological injury from secondary psychosocial problems is often difficult for clinicians and engenders controversy. Given the unremarkable physical appearance of many patients

after recently sustaining a mild head injury and their typically normal findings on conventional neurological examination, the basis of their persistent postconcussional complaints is often disputed. This enigma is especially apparent when medicolegal issues arise in cases of mild head injury in which equivocal neurological findings are difficult to reconcile with persistent complaints.

Attention and efficiency of information processing are typically impaired during the initial hospitalization and early weeks of convalescence after mild head injury, but substantial recovery is found by the end of the first month. Findings on the Paced Auditory Serial Addition Test (PASAT) are reported by Gronwall (Chapter 10), whereas Gentilini and co-workers (Chapter 11) describe other recently developed measures of attention that appear to be highly sensitive to sequelae of mild head injury as compared with conventional neuropsychological assessment techniques. Moreover, Gronwall has documented slower recovery of information processing on the PASAT following a second mild head injury, which suggests that the effects are cumulative. Although Ruff and his colleagues (Chapter 12) describe impairment of memory for verbal information and geometric designs in patients studied within one week of mild head injury at three university hospitals, these patients improved to a level of performance similar to that of uninjured comparison subjects over a period of one to three months. Dikmen and co-workers (Chapter 15) confirm substantial neurobehavioral recovery by one month in patients with uncomplicated mild head injury; yet their preliminary data indicate that concomitant multiple trauma can prolong disability and cognitive deficit.

Perhaps the most impressive evidence for resolution of cognitive impairment and postconcussional complaints derives from the study of concussed college football players reported by Barth et al. (Chapter 17). The opportunity to evaluate these players before and after sustaining a mild head injury and to compare the results with data obtained from their uninjured teammates provides strong documentation of neurobehavioral recovery within two weeks. Whether the findings from these sports injuries are strictly comparable to those from injuries sustained in motor vehicle accidents and other situations remains to be seen.

The overall incidence of head injury in the pediatric age range (i.e., 185 for boys and 132 for girls per 100,000 population) closely approximates the annual number of new cases in adults (see Chapter 13 by Levin, Ewing-Cobbs, and Fletcher). Similarly, mild head injury accounts for more than 80% of head trauma admissions in children and adolescents. Notwithstanding the implications of these incidence data for child development, education, and health, few studies have serially examined children after mild head injury in any systematic way. Snoek (Chapter 7) presents a detailed and insightful discussion of the assessment and management of apparently mild head injury in children, its clinical manifestations, and the problem of delayed deterioration. Maturation issues, including the possibility that delayed effects of mild head injury depend upon the developmental level of specific cognitive skills at the time of injury, are discussed by Levin, Ewing-Cobbs, and Fletcher (Chapter 13). Although the available evidence supports a generally good prognosis for neurobehavioral recovery from mild head injury in children, the possibility of

increased risk for a second injury suggests that subtle, remote consequences may not be detected by neurobehavioral assessment techniques in current use. An alternative interpretation is that accident-prone children tend to have multiple injuries.

Education of the patient and family concerning the stages of recovery from mild head injury and the importance of gradual resumption of activities is increasingly recognized as part of the postacute management to mitigate distress and facilitate the resolution of postconcussional symptoms. In Chapter 16, Wrightson discusses interventions such as patient groups and counseling of selected patients at risk for persistent sequelae. He also describes the organization and management of a postconcussion clinic. Finally, Marshall and Ruff (Chapter 18) remind us of the limitations of currently employed neurobehavioral methods designed to characterize the outcome of mild head injury. Patients report cognitive and emotional difficulties in coping with occupational and educational situations that require attention to two or more tasks under sustained pressure for rapid performance, a condition that might not be adequately simulated by currently employed assessment techniques. The dissociation between improved scores on conventional neuropsychological tests and some persistent postconcussion complaints (see Chapter 15 by Dikmen et al. and Chapter 18 by Marshall and Ruff) remains an enigma. Although investigators and clinicians have advanced understanding and treatment of mild head injury, further research and dissemination of information are needed for society to fully appreciate the consequences, mitigate the sequelae, and improve prevention.

In summary, this volume presents detailed observations that reflect the advances made in recent years in the understanding, treatment and management of mild head injury. At the same time, it calls attention to the serious gaps in our knowledge and to the questions that future investigation must address if continued progress is to be achieved. We hope that our effort will prove to be of value both to practicing clinicians and to researchers.

H.S.L.
H.M.E.
A.L.B.

October, 1988

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History and Epidemiology

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1

Historical Notes on the Postconcussion Syndrome

ARTHUR L. BENTON

To begin with, perhaps a capsule definition of the postconcussion syndrome is in order. It is generally understood to refer to a condition in which a person who has sustained a concussion complains of a variety of somatic, cognitive, emotional, motor, or sensory disabilities which he or she ascribes to the concussion. At the same time, convincing historical and clinical evidence of significant brain injury cannot be elicited. The typical history indicates that at the time of the accident and shortly thereafter, the person was comatose for only a very brief period if at all, and showed practically no retrograde amnesia and very little posttraumatic amnesia. After examination and treatment at the emergency unit, the patient may be sent home unless there are complicating factors such as drunkenness or limb fracture, in which case he or she may be hospitalized for a day or two.

Weeks or months after the accident, the patient will voice one or more complaints which, in their totality, have come to be called the *posttraumatic symptom-complex* or *syndrome*. Prominent features of the syndrome include headache, impairment in attention and concentration, poor memory, depression and emotional instability, lowered tolerance of frustration, sleep disturbances, loss of sexual drive, and intolerance to alcohol (Benton, 1979; Binder, 1986; Levin, Benton, and Grossman, 1982). The net effect of these impairments often (but by no means always) is to render the person significantly handicapped from a social and economic standpoint. However, at this time, clinical examination discloses very little cognitive, motor, or sensory deficit that can be reasonably ascribed to brain injury, and, in the opinion of the examining physician, the findings are essentially negative. Thus there is a striking discrepancy between the presumably “subjective” complaints of the patient and the presumably “objective” findings of the physician; this almost inevi-