Neurocognitive Disorders in Mild Head Trauma: Casablanca Experience

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ABSTRACT

Background: Mild head trauma (MHT) is defined as loss of consciousness of less than 30 minutes, GCS> 13, post-traumatic amnesia duration of less than 24 hours. The aim of our study is to analyze all the neurological and psychological consequences of MHT

Methods: We carried out a prospective study on 40 cases of mild head trauma in the neurosurgical diagnostic center of Ibn Rochd Hospital Casablanca over a period of 4 months.

Results: The average age was 30 years, with 70% male predominance. At the time of the accident, more than 50% were in professional activity. Road accidents represent 78% of the causes. Hemorrhagic contusion was found in 35% of cases, epidural hematoma in 27%, and only 20% without any radiological abnormalities. The neuropsychiatric sequelae most frequently found are irritability in 92%, followed by headache and restlessness in 90% of cases, rapid mood changes in 87.5%, rapid fatigue, intolerance to noise and light, dizziness as well as memory disorders and sleep disorders are frequent. Patients with hemorrhagic contusions have heavier sequelae, a close relationship was observed between the sequelae of MHT and the disappearance of friendly relations in more than 50% of our patients, as well as the job loss. In 45% of patients, with a marked decline in leisure activities and sports practice.

Conclusion: MHT is a frequent pathology, with a good evolution but sometimes heavy and underestimated neuropsychiatric sequelae. The legal implications are important and lack specificity and the cost is enormous.

Keywords: Medico-legal management, mild head trauma, neurocognitive disorders.

I. INTRODUCTION

Mild head trauma (MHT) is usually defined by a loss of consciousness less than 30 minutes, a Glasgow coma scale between 13 and 15, a duration of post-traumatic amnesia of less than 24 hours according to the authors [1].

Due to their frequency and their potential consequences, they represent a major public health problem. The prognosis of MHT is often benign, but a not insignificant number of patients will present long-lasting complaints, with a socio-professional impact which can be major.

These complaints are relatively stereotypical and include somatic complaints (headache, dizziness, fatigue, visual disturbances, sensitivity to noise, to light, sleep disturbances), cognitive (memory disturbances, difficulty concentrating), and emotional or behavioral complaints. (irritability, anxiety, depression). The chronicization of these disorders causes, at a distance from the accident, a decrease in general performance, especially at work, as well as relationship and emotional difficulties leading to withdrawal and, sometimes, in some cases, to a breakdown of social and family ties. With as consequences the loss of employment, or the divorce.

However, since these complaints rarely coexist with abnormalities on CT or standard MRI, the lack of knowledge of the etiopathogenesis of post-traumatic syndrome has long led healthcare professionals to group these complaints under the ambiguous term of "subjective syndrome. », leaving no room for a hypothesis of organic origin. Today, researchers agree in considering that the causes of the occurrence and persistence of plains are multifactorial, associating organic and psychological...
dimensions.

Abundant literature has been devoted to these complaints. Indeed, these complaints raise many questions relating to their organic or psychological origin, the role of intrinsic and environmental factors in their genesis and maintenance, their prevention, or even the legitimacy of any compensation.

Confronted with the absence of information on this subject in our context, we conducted this work to better understand the reality of neuropsychic sequelae in Moroccan patients. Indeed, a better knowledge of post-traumatic syndrome would allow a preventive approach by early identification of symptoms. Thus, early, and appropriate management would reduce the incidence of the post-traumatic syndrome and improve the quality of life of patients.

II. MATERIAL AND METHODS

The aim of the study is to analyze all the neurological and psychological consequences of people who have suffered a slight head trauma.

We carried out a prospective study of all adult patients ≥18 years old, having consulted for mild head trauma at the neurosurgical diagnostic center of Casablanca University hospital over a period of 4 months between December 2018 and March 2019.

We collected 40 patients who were diagnosed according to the diagnostic criteria of MHT developed by the "World Health Organization collaborating center task force on Mild Head Traumatic Injury" in 2004 [1].

All patients were assessed more than three months after the date of the trauma. With an average follow-up of 19 months.

The variables used for the analysis are:
- Sociodemographic characteristics (sex, date of birth, age, department of domicile, level of education, family situation, profession),
- The characteristics of the head trauma (date of the accident, circumstances of the accident, Glasgow score at the time of the accident, duration of the coma, duration of post-traumatic amnesia),
- The existence of neuropsychic sequelae:
  - neurological dimension
  - cognitive dimension
  - behavioral dimension
- the socio-professional dimension

III. RESULTS

A. Epidemiology

The age varied between 18 and 66 years, with an average age of 30 years, a male predominance at 70% of men was objectified with a sex ratio from 2.3.

For the history: 30% of our patients are alcohol-smoking and 5% of our patients have a psychiatric history.

The mechanism of head trauma is dominated by road accidents at 77% followed by aggressions at 17%. All our patients were admitted to the emergency departments, 70% of which are hospitalized, 50% of our patients having a recoil <1 year which varies between 3 months to 8 months, while the other patients present a recoil ≥ 1 year. All of our patients underwent a CT scan which was normal in 20% of cases and abnormal in 80% of cases thus demonstrated an extradural hematoma in 27% of patients (n = 11) (Fig. 1), focused hemorrhagic contusions in 35% of patients, acute subdural hematomas (HSDA) in 22.5%, skull bone fractures in 15% and subarachnoid hemorrhages in 22.5% of patients.

Among the 28 patients who were hospitalized, 7 patients (40%) were operated on urgently, and the others were admitted to the department for neurological monitoring, with follow-up in consultation after discharge in all of our patients.

B. Neuropsychological Sequelae

The symptoms are grouped together in the following table (Table I).

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incidence of light cranial injuries should be estimated probably at more than 600/100 000 inhabitants.

The incidence of MHT, in general, is twice as high in men as in women between 15 and 35 years old, this difference decreases with age [3]. The maximum incidence peak is between 15 and 25 years in both sexes. There are two other smaller peaks before 5 years and after 65 years. In our series, the sex ratio M / F was 2.3.

The main causes of head trauma are road accidents, falls, assaults, sports accidents [4]-[6]. Recent work highlights the resurgence of mild head injuries in the practice of many sports, so each year 20 to 40% of athletes suffer concussions [7], [8].

In our series, road accidents come at the top of the list of causes (77%) followed by assaults (17%) and 3% concerning home and work accidents.

VI. ADDITIONAL TESTS

A. Imaging

The CT scan does not reveal, in the majority of cases, any organic lesion during MHT. The conventional T1 or T2 sequence MRI is not sensitive enough to detect physiopathological elements secondary to a TCL, certain sequences such as diffusion are more sensitive in the detection of cerebral lesions of the diffuse axonal trauma type.

Matsumita has shown that a reduction in the anisotropy fraction in the frontal white matter and the splenium of the corpus callosum in the acute phase of mild to moderate head trauma could be a prognostic factor for long-term cognitive dysfunction [9].

Mass compared the diffusion MRIs of patients with a favorable or unfavorable evolution following a MHT, the patients with an unfavorable evolution presented a change in diffusion of the nerve fibers of the white matter, which was not found in the patients with a favorable evolution [10].

These results suggest that a diffusion MRI in the acute phase could provide predictive elements of unfavorable evolution following a MHT.

B. Biology

After a MHT, damage to neurons and supporting cells leads to intracellular proteins leak into the surrounding extracellular medium and the CSF if the blood-brain barrier is damaged, these proteins reach the peripheral circulation where they can be collected and measured. Peripheral blood markers of cerebral distress such as neuron-specific enolase (NSE) a cytoplasmic enzyme which is involved in the glycolysis of neurons, the cleaved-Tau protein (CTP) a phosphoprotein bound to microtubules which is found in the axons of normal neurons and the S-100B protein were studied [11]. The most important contribution of these markers in TC should be the aid in the diagnosis of minor or moderate brain trauma, for which the clinical examination or the brain scan may be insufficiently sensitive [12].
VII. NEUROPSYCHOLOGICAL SEQUELAE

A. Neurological Dimension

1) Headache

It is the most common symptom, with variable type: migraine-type headaches, localized neuralgic headaches, tension headaches.

A recent study by [12] reports a headache rate of 77% out of 107 MHT included in Montreal and 100 in Sydney 3 months after the accident.

In addition, it was found that the more the trauma is mild, the more symptoms of pain are likely to develop [13]. Pain can disrupt cognitive performance, alter character and mood, affect the sleep cycle, and can lead to visual disturbances, dizziness, fatigue, depressed mood, and cognitive impairment.

In our series, the headache was among the most frequent persistent manifestations 90%.

2) Fatigue and Sleep Disturbances

Sleep disorders can also be manifested by hypersomnias, insomnia, and a need for sleep greater than usual, difficulty falling asleep, or waking up too early. Complaints of sleep disturbance, or greater fatigue are among the most common.

Reference [14] reports that MHT experience twice as much fatigue after than before the trauma. According to [15], they would have their origin in an organic disorder by damage to the cerebral structures involved in sleep.

Reference [16] has shown that fatigue has an impact on cognitive performance.

3) Noise Intolerance

One finds among the complaints of the MHT, an intolerance to the noise [17]. This phenomenon is little studied, it is characterized by difficulty in supporting more noise, it would have for origin a neuronal auditory disorder caused by a lesion of the inner ear, the sound resistance is lower, which causes an increased hearing sensitivity. This can cause tinnitus, pain, nausea, dizziness, headache, increased fatigue, irritability, even depression, and a tendency to avoid social contact.

This symptomatology is still poorly understood by the medical profession and difficult to treat and often poorly understood.

4) Dizziness and Balance Disorders

Dizziness and balance disorders are often reported in the early phase of MHT.

Reference [18] reports 66.7% of MHT who complain of vertigo at 6 months of trauma. They are also more anxious and depressed than those without dizziness.

5) Visual Disturbances

Complaints relating to visual disturbances are less frequent, the literature on this subject is relatively little developed, visual disturbances can be expressed by blurred, double, or undifferentiated vision, and this type of complaint must take into account the difference between pre and post-traumatic visual acuity.

Visual disturbances can be caused by the shock of the trauma, this can have an impact on the visual accommodation functions in which the lens is involved.

Studies on these deficits report a range of 10 to 40% of MHT who have visual accommodation disorders [19].

6) Post-Traumatic Epilepsy

MHT is a risk factor for post-traumatic epilepsy during the first four years after shock. From a dimensional perspective with neuropsychic disorders, this indicates the definite impact that mild head trauma inflicts on the brain [20].

B. Cognitive Dimension

1) Attentional Functions

Attention disorders can manifest as difficulty concentrating, greater distractibility, reduced working time without a break, more frequent forgetfulness due to lack of concentration, according to [21], the alert would not be altered following MHT, while the selective attention would be quite pronounced.

Sustained attention seems to be more specifically achieved in MHT which is observed during the execution of complex tasks, more costly in attentional resources [22].

2) Memory Functions

Following MHT there may be memory deficits concerning the antegrade memory but this type of deficit is found mainly in more severe brain injury. However, a few studies have been able to show alterations in antegrade verbal and visual memory in head injuries [23]. These alterations are manifested by anomalies in the temporal areas (75%) and some anomalies in the frontal areas (30%).

3) Executive Functions

Executive functions represent a whole set of complex processes that involve high-level treatments and that involve several brains, frontal and prefrontal regions, which are connected to other regions (parietal region, basal ganglia, brainstem linked by cortical loops – subcortical [24]. When we talk about executive functions, we are actually talking about a whole set of functions that are closely or remotely attached to the executive system.

In MHT, we will see that very often at least one of the functions involved in this system is affected by the trauma, in a rather subtle way.

C. Behavioral Dimension

1) Depressive Disorders

Depressive disorders occupy a large area during post-traumatic syndrome. They could be induced by the traumatic brain injury itself causing dysfunction of the emotional regulation system [25]. Reference [26] linked the presence of depressive symptoms with physiological changes in the brain due to MHT. They show a difference in neuronal activations for athletes having had a MHT compared to the control group and the development of a depressive syndrome. These differences are manifested by lower brain activity in the cingulate gyrus, median orbitofrontal cortex, rostral anterior cingulate gyrus, and posterior cingulate gyrus. This decrease is correlated with the severity of depressive symptoms. In addition, these same patients present with a decrease in gray matter density in the medial frontal cortex and temporal regions.

PTS is often accompanied by a more or less depressed mood. The more severe the post-traumatic syndrome, the more depressed the mood will be [27].
2) Anxiety Disorders

Several hypotheses have been proposed to explain the appearance of symptoms or anxiety disorders after a MHT. First, it is possible that the impact with the skull may influence the structures of the brain involved in the development of anxiety symptoms, notably the prefrontal cortex. It is also possible that the accident creates a temporary psychological vulnerability to the development of psychological disorders since many experience significant stresses such as ambulance transport, hospitalization or the appearance of temporary deficits. Thus, these difficult situations would make the person more vulnerable to developing psychological disorders. Second, people who have suffered a MHT are often very aware of their deficits soon after the accident, compared to those with moderate or severe brain trauma injury who are often less aware of their deficits. Increased awareness of deficits after MHT has been associated with increased symptoms of anxiety and depression [2].

Indeed, studies have identified that depressive symptoms and anxiety symptoms experienced in the days following MHT are among the best predictors of symptoms that persist at least three months after the accident [28]. Anxiety symptoms may have an important role in other symptoms related to MHT, which may exacerbate or prolong some symptoms [29].

All of these symptoms form an articulated picture giving the overall impression of a rich and fuzzy symptomatology with a background of physical, mental and sexual senility as well as multiple complaints related to the head.

In our series, irritability, headaches, fatigue, intolerance to noise, dizziness, memory disorders, and memory problems come at the top of the various manifestations reported by patients both in terms of frequency and of severity.

3) Manic States

In two studies of post-traumatic manic states, manic disorders were significantly correlated with temporal injury for the first study and manic-looking symptoms were, in both studies, difficult to dissociate from typical frontal symptoms.

In addition, head trauma can also appear as a vulnerability factor favoring the onset of the manic state by its sole dimension of psychogenic trauma [30].

D. The Socio-Professional Dimension

The fate of MHT patients is a subjective subject on which there are not many articles in the literature. Reference [31] reports that 70% of symptomatic MHT have had a work or school absence or a suspension of their leisure time. In our study 45% of the cases lost their jobs, more than 50% lost their friends and only 20% of the patients were able to maintain a sport activity.

E. The Medico-Legal Course of Action for Light Cranial Injuries

The measurement of the damage suffered by so-called “light” head injuries is very difficult to apprehend in the appraisal and compensation. Indeed, the current medico-legal framework is not adapted to this “miserable minority” which retains its consequences and finds itself trapped in the alternative risks of denial or dramatization. Neither the imagery nor the form of the disorders allows an obvious connection to a traumatic history. And from the point of view of proof, jurists demand a direct and certain traumatic link that medicine struggles to establish. In spite of a good knowledge of the process of installation of the disorders, the law does not have a specific methodology of evaluation which would make it possible to better overcome the problems of causality and quantification of the damage of these singular victims [32].

The forensic consultation at the forensic medicine department of CHU Ibn Rochd in Casablanca, allows in the event of slight head trauma, depending on the circumstances of the trauma (AVP, AT, aggression, recklessness) to establish:

Initial medico-legal certificate, which specifies the duration of temporary incapacity or work staff (ITT), according to the clinical examination of the patient and the exploration of paraclinical examinations. Knowing that the limit of this duration of ITT, it differs between accident of the public road of 30 days and 20 days in the physical attacks according to article 400 and 401 of the Moroccan penal code. Medico-legal certificate of prolongation in AT, justified by the clinical condition of the patient and the results of paraclinical examinations. Certificate of cure, which specifies the permanent partial incapacity (PPI), issued after the patient has consolidated and which allows an assessment of the sequela which keeps the patient after his consolidation. The sequelae of mild head trauma are dominated by the post-concussion subjective syndrome, where the PPI is from 2 to 10%, according to Decree No. 2-84-744, relating to the functional scale of disabilities.

To improve the quality of forensic analysis concerning TCL and consequently improve their compensatory management, it will be necessary to develop a common methodology adapted to this category of patients. The latter would provide information on:

- The right time to consolidate (neither premature nor late).
- The need to collect as much information as possible on the injured person's existential trajectory (before, during and since the accident).
- The need for a neuropsychological assessment and a neurophysiological and other functional exploration.

In this way, we would promote the obtaining of sufficient clues to allow the judge to settle the problem of imputability and provide a compensatory response more suited to the disorder of life suffered [32].

The great promise that diffusion MRI represents for detecting objective signs of neuronal damage is an attractive modality for the legal field. He promises to help the medical examiner in his conduct to resolve some forensic issues surrounding mild head injury litigation [33].

VIII. Conclusion

TCL is a frequent pathology which accounts for about 80% of all head trauma. It can be complicated by a post-concussion syndrome comprising rich and stereotypical
complaints, which combine somatic, cognitive and psychic complaints. The wealth of so-called subjective complaints is associated with the normality of the neurological examination and the classical complementary examinations. Recovery is usually good, but progression to chronicity is possible. This persistence of symptoms is at the origin of a social, professional and family repercussion inversely proportional to the apparent lightness of the organic attack. The legal implications are significant and lack specific, and the cost is enormous both on an individual and collective scale.

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