Terminology of Mild Traumatic Brain Injury

An Austrian survey on mild traumatic brain injury with reference to the difficulties caused by the lack of consensus in nomenclature, definition and management at a national and international level

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Abstract:

As there are varying opinions regarding the nomenclature, diagnosis and management of mild traumatic brain injuries (MTBI) in international literature, a survey was carried out to ascertain the current standard in Austria. A European-wide questionnaire, which was presented by *de Kruijk et al.* as part of the 3rdi EFNS Congress in Seville, served as a basis for this survey.

Just as in international literature, there is no consensus in Austria in the field of MTBI. Various names such as *Commotio cerebri* (90%), *Gehirnerschütterung* (31 %) and Mild Traumatic Brain Injury (5%) are used for the same constellation of symptoms. There is relative agreement on the symptoms referred to in diagnosis (retrograde amnesia 88%, loss of consciousness 86%, vegetative complaints 54%). It became apparent that the flow of information between medical centers in all federal provinces of Austria concerning available treatment guidelines is less than adequate. Various departments have their own guidelines without there being any nationwide agreement on information. Similarly in the field of technical investigations (skull and cervical spine x-ray, cCT, MRI, EEG) the survey revealed that there is no common procedure in use. This seems to be due on one hand to local conditions and on the other hand to the various published recommendations.

The results were compared with other investigations, as well as recommendations made in international literature.

Key words: Survey, mild traumatic brain injury, commotio cerebri; leichte Hirnverletzung.

Introduction

At the third **EFNS** Congress **in** September 1998, *de Kruijk* presented the data from a European-wide survey on the subject of **MTBI.** Particularly as this survey did not include Austria, an attempt was consequently made to evaluate the current situation in this country. The supposition was that a similar picture would emerge as in the rest of Europe.

The purpose of this paper was to view MTBI in the light of international literature, and to feed back in the data collected in Austria. The attempt was to gain an overview of synonyms for MTBI, the diagnostic criteria used and contemporary treatment currently used.

MTBI — Synonyms:

In the field of neurotraumatology there are some differences in the terminology between European and American schools. In Europe, the most commonly used term is *Commotio cerebri.* Other terms are used as synonyms, such as *leichte Himverletzung,* or, particularly in the German speaking literature, *Gehirnerschütterung* ("brain concussion"). In comparison "mild traumatic brain injury" is used in Anglo-American terminology. Again there are other terms such as "minor head injury" and "traumatic head syndrome" among others.

When analyzing international literature on this topic, many differences occur in nomenclature of the injury and in the suggested diagnostic measures between different authors. *Rosenthal, 1993,* described MTBI as a syndrome, which creates difficulties when assessing it. The problematic nature of arriving at a diagnosis is caused by a lack of information about the pathophysiology and unclear definitions and classifycations (1). Other authors think that these difficulties arise due to the different nature of the patient group (2).

Definition:

Traumatic Brain Injury is defined as a constellation of symptoms which is either temporarily or permanently caused by an external trauma on the skull (1, 3, 4, 5, 6). A more precise definition of Mild Traumatic Brain Injury, which most authors follow in their interpretations, is the one suggested by the Committee of Head Injury Interdisciplinary Special Interest Group of the American Congress of Rehabilitation Medicine. The following symptoms required to diagnose a patient with MTBI were considered essential: Loss of consciousness, loss of memory for events shortly before or after the event, any change in consciousness and focal neurological deficits, which may or may not be transient. Loss of consciousness may not exceed a time period of 30 minutes.

After 30 minutes the patient must score between 13 and 15 on the Glasgow Coma Scale (GCS). Post-traumatic amnesia should last no longer than 24 hours (7). *Alexander, 1995,* additionally alludes in his paper to negative findings on cCT as a criterion for a definition. The existence of a neurological deficit is not necessary in order to establish a diagnosis in his view (8).

The clinic of MTBI is connected to a multitude of features such as peripheral vestibular symptoms, pain symptoms and neuropsychological changes. Skull and cervical spine x-ray are carried out as additional examinatons. Further possibilities are cCT, MRI and EEG. An additional option can be the SPECT examination offering a technical aid. Especially in the Anglo-American literature, the possibility of neuropsychological findings in the context of the initial investigation is denoted in order to minimize the risk of a post contusional syndrome (1, 3, 8, 11,17,18). If symptoms of MTBI are found, hospitalized observation of the patient should follow. This would also be suitable if no monitoring is available at home (3, 6).

In Europe the term *Commotio cerebri* (Cc) is used for the constellation of symptoms which occur after an external violent blow to the head. This is defined as follows: immediately after the event loss of consciousness for seconds or minutes, presence of retrograde and anterograde amnesia are established. Neither should last longer than 6 hours as an inconspicuous neurological state. Additionally vestibular symptoms such as dizziness or vomiting can occur for a while. The same clinical criteria apply to the definition of the term "leichte Hirnverletzung". (19, 20, 21,22, 23). The term *Gerhirner-schütterung* is used as a synonym for the same syndrome.

Methodology

The basis of the survey was a questionnaire which was used by de *Krujik et a/* for a European-wide survey on **MTBI** (24, 25). This questionnaire was adapted to relate to Austria and consisted of eight questions (Tabl. 1).

The first question presented a description of a patient with typical symptoms valid both for Cc and MTBI, in order to record which terms in use are applied as synonyms. The fictitious patient had a closed brain trauma, recorded short post-traumatic amnesia (< one hour) and / or loss of consciousness of less than 15 minutes. For this question, it was possible to submit more than one diagnostic term from a choice of: *Gehirner-schütterung, Commotio cerebri,* **Mild** Brain Injury and *leichte* (mild) Contusio cerebri. It was also possible to choose an additional diagnosis. More than one answer was regarded as desirable.

The second question asked about the present symptoms, which are absolutely necessary for investigators in order to arrive at the diagnosis of **MTBI.** Options available were GCS, post-traumatic amnesia, retrograde amnesia, loss of consciousness, vegetative complaints and headaches. These questions were answered yes or no.

The third and eight questions dealt with the availability of guidelines on treatment of patients with brain trauma in individual hospitals and within federal provinces, without referring to their specification. In addition, the survey asked for special schemes for children.

Questioning focused further on the technical add-on investigations used by individual departments as an aid to diagnosis. The choices, in line with international literature, consisted of skull and cervical spine x-ray, cCT, MRI and EEG.

The seventh question asked for guidelines for out-patients. The selection consisted of availability of an observation program, without requiring specific details of bed rest, sick leave and the prescription of analgesic treatment.

In total the questionnaire was sent to 105 emergency surgery, neurological and neurosurgery departments in Austria.

Results

Replies were received from all of the federal provinces. The return rate for the questionnaire was 62%. As replies were received from all 9 federal states, a statement to cover the whole of Austria is possible.

The diagnostic term *Commotio cerebri* was used by 90% of the responding provinces. 31% used the term *Gehirnerschütterung.* 5% of responders allowed "Mild Brain Injury" as a synonym. The term *leichte Contusio cerebri* and others were used by 2% each. 3% of respondents did not answer this question (Figure 1).

Retrograde amnesia was given as the main criterion by 88% of respondents, followed by loss of consciousness (86%) and posttraumatic amnesia (81%). 54% found the presence of vegetative complaints to be of diagnostic significance, and 53% felt the same for headaches. Only 32% named GCS as a source of diagnosis (Figure 2).

73% of hospitals indicated that they use a set of guidelines for the treatment of adults. In contrast 17% do not, while 10% did not respond to this question. For children, 31% use special guidelines, 61% do not and 8% did not respond. The question about joint

guidelines put forward by hospitals in individual provinces, was answered positively by 10%, negatively by 36% and 54% gave no answer. This is interesting as both negative and positive answers came from each of the federal provinces (Tab. 2).

86% of hospitals arrange a skull X-ray for patients with MTBI. In 83% of departments a cervical spine X-ray is additionally carried out. 73% use a CT scan of the skull as a further measure. Only 29% carry out an EEG. An MRI is carried out by 10% of the departments.

95% of respondents deem it necessary to hospitalize patients with MTBI. On the contrary, only 2% of departments regard such monitoring to be unnecessary and 3% gave no response. At the end of hospitalized observation, 71 % of departments arrange for outpatient monitoring, whereas 24% do not deem this necessary and 5% did not respond.

Of those patients under no hospitalized supervision, 46% are booked for out-patient observation. 19% do not carry out out-patient monitoring, and 36% gave no response.

The survey reveals that 39% of departments are able to provide a program of home monitoring, whereas 10% of respondents are not and 51% gave no response. 32% of respondents recommend sick leave, 25% prescribed analgesic medication and 10% would recommend bed rest. The highest percentages of non-responses occurred with this overall question: 69% did not respond to the question about bed rest, 61% and 59% failed to respond to the questions on pain medication and time off work respectively (Tab. 3).

Discussion

On evaluation of the survey it was found that the use of synonyms relating to MTBI is not standardized in Austria, like in the other European study.

Thus the term *Commotio cerebri* was used by most of those who completed the questionnaire (90%), although at the same time *Gehirnerschütterung* was submitted as a second option (31%). Although less common, "Mild Brain Injury" (5%) and *Contusio cerebri* (2%) are still used. The above terms are obviously used synony-mously, although they do differ slightly in their core definition.

Already in 1993 the Committee of Head Injury Interdisciplinary Special Interest Group alluded to a similar situation in the Anglo-American literature. Thus a multitude of terms are used such as "minor head injury", "postconcussive syndrome", "traumatic

head syndrome" and "traumatic cephalea" amongst others (7). This can be linked back both to a lack of homogeneity in the patient group (2) as well as to the large number of symptoms which are included (3). A further possibility which should not be overlooked is that many different medical disciplines (such as emergency doctors, neurosurgeons, neurologists) are concerned with the diagnosis and treatment of such patients (8).

Definition Commotio cerebri — Mild Traumatic Brain Injury:

In the choice of symptoms used deemed important in diagnosis there is general agreement on the definition Cc, as it is used in Europe.

Similarly, with the exception of the GCS, the results can be brought into line with the diagnostic criteria of the Committee of Head Injury Interdisciplinary Special Interest Group as necessary symptoms for the diagnosis of MTBI.

There was a high level of agreement in the survey in regard to the points on amnesia and loss of consciousness. A relatively small significance is attributed to vegetative complaints and headache.

The survey shows that GCS is only used by 32% as a means of diagnosis. In comparison 37% deem its use as unnecessary, and 31% gave no response.

The use of GCS for patients with MTBI is also discussed in the Anglo-American literature. Posttraumatic amnesia, which is an important diagnostic indicator, is not taken into account in this scale. Thus the GCS was extended with a self-developed amnesia scale by *Nell et al* within the framework of a study of 561 patients in the United Kingdom and South Africa. The extended scale is named GCS-Extended (GCS-E). This was how amnesia was proven in 27% of patients in the United Kingdom and 31% in South Africa with a GCS score of 15 (25).

In particular, the question of availability of treatment guidelines demonstrated the problems of inconsistent procedure. Without going into the specification of the guidelines, questions were asked on the available clinical management processes for adults and children with MTBI. The answers differed widely.

An irregular picture also emerges when technical aid is investigated. This is confirmed by the interpretations of the value of the individual investigations in relevant literature.

There is relative consensus on the necessity to carry out skull and cervical spine scans on patients with MTBI (26) (Figure 5). The role of CT scans for patients with MTBI

receives controversial treatment (12). On one hand it is recommended within the framework of acute phase treatment in order to exclude cerebral hemorrhage, on the other hand lack of evidence of axonal lesions are alluded to (1,10,27). In a retrospective study *Tellier et al* changes in the CT scan in 31 % of the 80 patients with a GCS of 13-25 points showed up. It should be mentioned that none of the patients was anticoagulated at the time of the traumatic incident (2). In Austria 73% of departments arrange a CT scan to diagnose MTBI, and 10% additionally use MRI. A possible cause for the infrequent use of MRI could be their unavailability nationwide. This applies in particular to rural areas. In principle MRI should also be considered for patients with MTBI. In doing so, smaller lesions can be detected than by CT scan (1,10,11). In their comparative study *Voller et al* found evidence in one third of all patients (13). In a larger study by *Levin et al* the effectiveness of MRI to better determine the presence of cerebral lesions in mild and moderate closed brain trauma had been demonstrated in 50 patients. Hypointense areas could be found more often in the MRT than in the CT. These areas were predominantly localized in the fronto-temporal region. No correlation was found between the size of the lesions and the severity of the change in consciousness. Nevertheless a relationship was found between the neuropsychological disorder and the location of the lesion, with individual bias (14).

In relation to the use of EEG in diagnosis in acute phase and its progression,there is a lack of consensus nationally and internationally as to the merits of this investigation. Thus it seems that temporary changes in the EEG are possible in the acute phase (10,19, 28, 29). *Rosenthal, 1993* reported changes to EEG in 90% of patients in his work Mild Traumatic Brain Injury Syndrome (1). *Holler et al* found no evidence of EEG changes in a work in which MRT, EEG and neuropsychological investigations in 12 patients were compared (13). The variety of views is reflected also in the results of the survey. 29% of departments say they carry out an EEG in the acute phase.

There is no consensus as to whether neuropsychological test methods should be introduced (11). There are also controversial opinions about the use of tests (1, 11). In some individual works possible neuropsychological deficits are alluded to, which could have existed for several years (13,17).

In regard to hospitalized supervision of patients with MTBI there is a high percentage of agreement on guidelines, as recommended both in Anglo-American and European literature.

In contrary very different picture appears in relation to follow up out-patient observations in individual departments. This corresponds with contemporary literature (8).

Conclusion

In conclusion there appears to be no consensus in the field of MTBI in Austria just as in international literature. Thus various terms such as Cc, *"Gehirnerschütterung"*, "mild brain injury" and "MTBI" are used for the same medical condition. Relative agreement exists on the symptoms used for diagnosis. In relation to treatment guidelines available, there is a lack of agreement between individual medical centers. In the field of technical aid investigations the survey also reveals a similar lack of uniformity. This could be due on one hand because of local conditions and on the other to various recommendations in relevant literature.

The results described above correspond with those described by *de Krujik* as well as with the results of a German survey published in 2001. This survey was carried out *by Wild et al* in 1997 and questioned 130 neurosurgeons on problems encountered in the field of MTBI (30). The fact, that there is so much divergence of opinion in one individual field, emphasizes the significance of this topic.

The problems we face in the field of MTBI may well have many causes, as already described by *Alexander* in 1995. Firstly acute therapy is carried out by physicians of various disciplines and therefore of varying competence. Secondly there is often an improvement in most patients without medical treatment. The author also mentions optional medical therapies as a reason for the differences in academic opinion. In addition, Alexander comments on the problems surrounding MTBI with the ironic point: "There is no academic reward from these patients" (8).

The assumption given at the beginning that there is no consensus regarding MTBI is confirmed. On the basis of the survey data and spurred on by Alexander's work, an attempt should be considered to draw a single line of clarity through the muddled picture of mild brain injuries.

A first step to a common nomenclature, diagnosis and treatment in traumatic brain injury, was the presentation of the EFNS guidelines on MTBI *by Vos et al.* in 2002. Those guidelines are acceptable for all European countries. Vos defined MTBI in category 0 to 3 for an easier diagnosis and management. (6)

Outlook

We have seen that terms are used in neurotraumology where there are no safeguards to ensure they are understood internationally. It is therefore necessary to determine

what one means. Clarity results from a minimum number of known or at least easily explainable terms and criteria.

The first and most important step is to agree on a single term where less the "word" and more the definition is the fore.

For example, also old terms such as *Commotio cerebri,* which command a high level of acceptance, can be used and fit the definition through the passage of time. Traditional terms could also be proposed with revised content. Thought should be given to the fact that at the time of the definition many diagnostic options were not available being a matter of routine for us. Thus the definition of Cc assumes the lack of structural damage. In contrast, new findings show that even in the case of MTBI damage to the neuronal structure is possible. Time will tell whether this injury is worth evaluating dependening on sensitivity and specification of future investigative techniques.

To improve the current situation, Europe should take a leading role and introduce a golden standard in the field of neurotraumatology. A common term should be found and based on a definition acceptable to all. The solution for a common nomenclature should be less the empirical view but much more the exactly defined term. In doing so the problems of terms used synonymously with various definitions can be avoided.

In a period of time still to be stipulated it would be important to bring the definition up to date by the newest scientific findings. This procedure would improve interdisciplinary cooperation and optimize patient care. The EFNS guidelines could be a further common basis in the future of the traumatic brain injury.

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Tab. 1.:

- **Questionnaire used for the survey, based on de Kruijk et. al. 2001 (translated from German)**

1. Which diagnostic term do you use in patients with closed head injury followed by post traumatic amnesia (< 1 h) and/or short loss of consciousness (< 15min)?

   θ Gehirnerschütterung
   θ Commotio cerebri
   θ Mild brain injury
   θ Mild contusio cerebri
   θ Other: _____

2. Which of the following clinical criterias do you use to judge the sequals of a MTBI?

Glascow Coma Scala	θ Yes	(GCS.....)	θ No
Loss of consciousness	θ Yes	(.....min)	θ No
Posttraumatic amnesia	θ Yes	(.....min)	θ No
Alteration of the mental state	θ Yes		θ No
Retrograde amnesia	θ Yes	(.....min)	θ No
Haedache	θ Yes		θ No

3. Are there any guidlines concerning the management of mild brain injury?

In your hospital	θ Yes	θ No
In your federal state	θ Yes	θ No

   If yes: _____

4. Which technical investigations do you perform?

X-ray of the skull	θ Yes	θ No
MRI of the brain	θ Yes	θ No
X-ray of the cervical spine	θ Yes	θ No
EEG	θ Yes	θ No
cCT	θ Yes	θ No

5. Do you admit these patients to a hospital?

   θ Yes θ No

6. If the patient is not admitted, which advice do you give these patients:

Home observation programme	θ Yes		θ No
Take full bedrest	θ Yes	(.....day)	θ No
Take sick leave	θ Yes	(.....day)	θ No
Pain medication	θ Yes	(.....day)	θ No

7. Is there any controlling system of patients with MTBI in the outpatient departement?

After clinical observation	θ Yes	θ No
Without clinical observation	θ Yes	θ No

8. Are there any guidelines for children?

   θ Yes θ No

Tab. 2.:

■ **Available guidelines on treatment of patients with MTBI**

	Yes %	No %	No answer %
In hospital	73	17	10
In province	10	36	54
For children	31	61	8

Tab. 3.:

■ **Advice given by responders to patients with MTBI**

	Yes %	No %	No answer %
Home observation programme	**39**	**10**	**51**
To take full bedrest	**10**	**20**	**69**
To take sick leave	**32**	**8**	**59**
Pain medication	**25**	**14**	**61**

Figure 1.

- **Diagnostic terms used for patients with closed head injury followed by posttraumatic amnesia and/or short loss of consciousness**

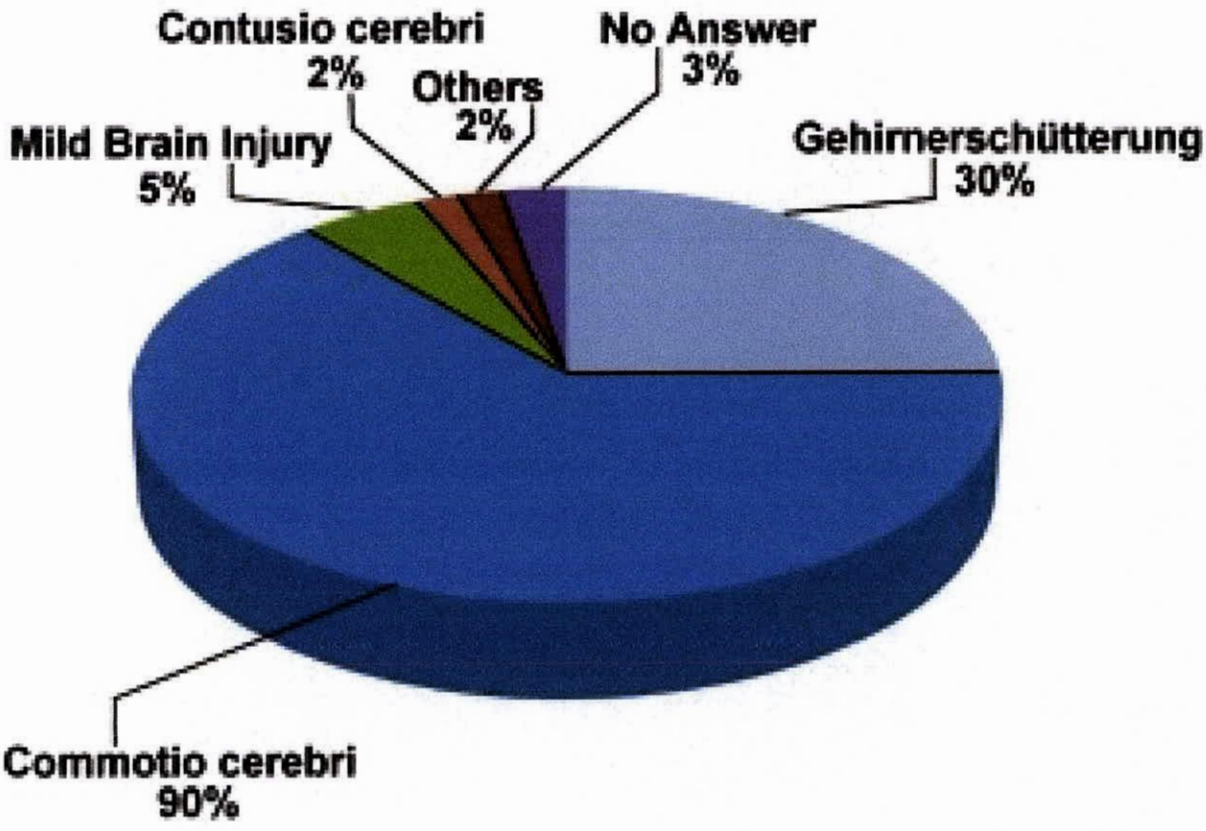
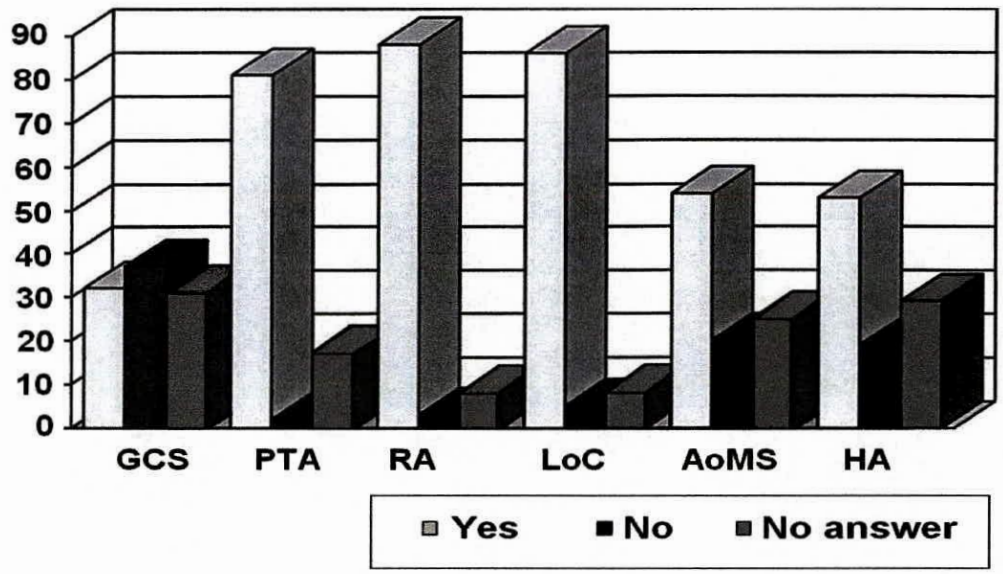
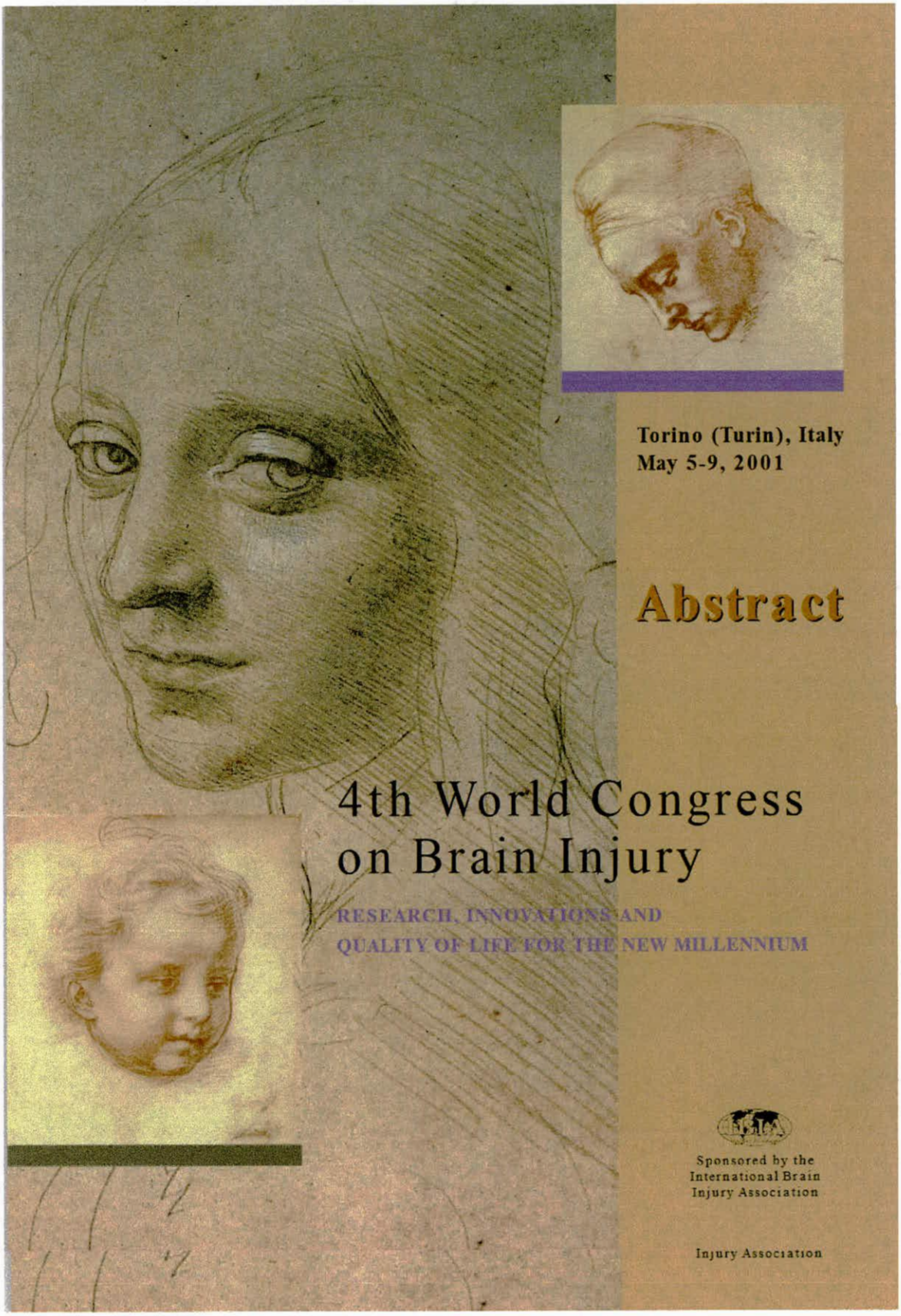


Figure 2:

■ **Clinical symptoms which are used by the responders to form the diagnosis of MTBI**



■ **GCS = Glasgow Coma Scale, PTA = post-traumatic amnesia, RA = retrograde amnesia, Loc = loss of consciousness, AoMS = alteration of the mental state, HA = headache**



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Abstract

4th World Congress on Brain Injury

RESEARCH, INNOVATIONS AND
QUALITY OF LIFE FOR THE NEW MILLENNIUM

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