Med Clin (Barc). 2017;xxx(xx):xxx–xxx

MEDICINA CLINICA

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Review

Update in mild traumatic brain injury☆

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ARTICLE INFO

Article history:
Received 21 April 2017
Accepted 1 May 2017
Available online xxx

Keywords:
Mild traumatic brain injury
Intracranial lesion
Head computed tomography
Brain injury biomarkers

ABSTRACT

There has been concern for many years regarding the identification of patients with mild traumatic brain injury (TBI) at high risk of developing an intracranial lesion (IL) that would require neurosurgical intervention. The small percentage of patients with these characteristics and the exceptional mortality associated with mild TBI with IL have led to the high use of resources such as computerized tomography (CT) being reconsidered. The various protocols developed for the management of mild TBI are based on the identification of risk factors for IL, which ultimately allows more selective indication or discarding both the CT application and the hospital stay for neurological monitoring. Finally, progress in the study of brain injury biomarkers with prognostic utility in different clinical categories of TBI has recently been incorporated by several clinical practice guidelines, which has allowed, together with clinical assessment, a more accurate prognostic approach for these patients to be established.

Actualización en el traumatismo craneoencefálico leve

Palabras clave:
Traumatismo craneoencefálico leve
Lesión cerebral
Tomografía axial computarizada craneal
Biomarcadores de lesión cerebral

RESUMEN

Durante años ha existido preocupación por la identificación de pacientes con traumatismo craneoencefálico (TCE) leve en alto riesgo de presentar lesión intracraneal (LI) subsidiaria de intervención neuroquirúrgica. El pequeño porcentaje de pacientes de estas características, y la mortalidad excepcional ligada al TCE leve con LI, han llevado a reconsiderar la elevada utilización de recursos como la tomografía craneal (TC). Los diversos protocolos desarrollados para el manejo del TCE leve se basan en la identificación de factores de riesgo de presentar LI, lo que finalmente permite indicar o descartar selectivamente tanto la solicitud de TC como la estancia hospitalaria para la vigilancia neurológica. Finalmente, el avance realizado en el estudio de biomarcadores de lesión cerebral con utilidad de carácter pronóstico, en diferentes categorías clínicas del TCE, ha sido recientemente incorporado por diversas guías de práctica clínica, lo que ha permitido, junto con la valoración clínica, una estimación pronóstica más exacta para estos pacientes.

Introduction

Traumatic brain injury (TBI) represents a major public health problem worldwide. Epidemiological studies show high variability in their results, with a crude incidence rate ranging from 47.3 to 849 cases per 100,000 inhabitants/year for all ages and severity types.[1] Specifically, mild TBI constitutes 70–90% of all cases.[2]

Currently, this process is a health priority due to several key facts. First, it has a high incidence, estimated at 224 cases per 100,000 inhabitants. Second, it causes many emergency department visits. Third, there is a lack of specific symptomatology that allows the identification of those patients at risk of developing an intracranial lesion (IL), which causes a high consumption of resources and complementary tests.[3]

Several protocols and clinical practice guidelines have been developed in recent years aimed at the early identification of patients who may present IL after mild TBI. These protocols attempt to weight the risk factors and thus the indication of neuroimaging tests or hospital observation. Compliance with these guidelines would make it possible to balance health costs and reduce ionizing radiation in patients with very low IL probability.[4] In fact, only

☆ Please cite this article as: Freire-Aragón MD, Rodríguez-Rodríguez A, Egea-Guerrero JJ. Actualización en el traumatismo craneoencefálico leve. Med Clin (Barc). 2017. http://dx.doi.org/10.1016/j.medcli.2017.05.002

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2387-0206/

7–10% of patients with mild TBI have tomographic findings after trauma and less than 1% require neurosurgical intervention, with death being a very rare outcome (0.1%).[5]

The objective of the present review is to address the management of adult patients with mild TBI considering conventional risk factors, such as advanced age, anticoagulant (AC)/antiplatelet intake, as well as indication of neuroimaging studies, need of neurosurgical assessment and the recent introduction of brain injury biomarkers to discriminate patients with a true risk of having IL.

Initial management of mild traumatic brain injury

In general, TBI does not have a universal definition; additionally, there are several denominations published to define mild TBI, which sometimes makes the standardized management of this pathology more complicated.[6]

The score reached on the Glasgow Coma Scale (GCS) has been used without changes for the last 4 decades to assess the conscious level impairment following a TBI, and is one of the most relevant prognostic indicators in this pathology.[7] Classically, the mild TBI category includes patients with a score of 13–15. However, a tendency adopted by many authors is to exclude patients with 13 points from the "mild" category, given the high anomaly percentage in cranial computed tomography (CT), as well as their clinical and prognostic progression, which is closer to moderate TBI. This difference of criteria adopted to define mild TBI has been, perhaps, one of the most important biases in the comparison of the different published series.[8,9]

The information derived from an adequate case history and physical examination allows the identification of certain risk factors for IL and is the basis of renowned clinical decision protocols that prompt the CT indication. However, the lack of specificity of the accompanying symptoms, coupled with the absence of conclusive evidence for individual risk factors, somehow explains the discrepancies found in the different guidelines designed for the management of this pathology.[10–12]

The presence of primary or acquired coagulopathy, post-traumatic neurological deterioration or the presence of clinical cranial fracture signs are widely recognized as high risk factors for IL association.[10,13] However, we find variable considerations for other factors. In this sense, the recently revised Scandinavian guidelines recognize an insufficient predictive capacity for age (>65 years) or antiplatelet as individual risk factors for IL. Within the lesion mechanisms considered by some guidelines, having an accident has proven to be a higher risk factor for IL association.[14] In relation to symptomatology referred by the patient, the loss of consciousness, or suspicion of the same, is a risk factor in itself.[10] However, other symptoms such as headache, nausea or amnesia have shown, in some series, a low capacity to predict the presence of IL. It is worth mentioning the recent inclusion of patients with a *shunt* for the treatment of hydrocephalus as a specific group of patients at risk.[10] Finally, the presence of cranial fracture has shown a 5-times-higher association with the existence of IL requiring a neurosurgical intervention versus the subgroup of mild TBI without fracture.[13]

Indication of initial cranial CT and scheduled cranial CT to monitor progression

The availability of cranial CT in most centres, coupled with the practice of a somewhat defensive medicine for a normally benign process, has been responsible for the exponential increase in the use of CT scans in mild TBI. The corresponding increase in costs, associated with the risk of cancer due to radiological exposure, as well as the low frequency with which an IL requiring intervention is detected, have led to question its indication.[15]

The usefulness of CT in the early management of moderate and severe TBI is well established.[10–12] However, the variability in its application shown for mild TBI has led to the development of protocols that identify cases which could actually involve an IL.[10–12] Specifically, patients with a GCS score of 15 points, without other risk factors, should be discharged from hospital without CT or observation, with family support, and ensuring specific recommendations. In a recent systematic review, which compares the diagnostic accuracy of different clinical decision protocols, it was observed that both *Canadian CT Head Rule* (CCHR) as well as the *New Orleans Criteria* (NOC) have a good negative odds ratio (OR) (0.04 and 0.08, respectively) and diagnostic accuracy to detect patients at low risk of requiring neurosurgical intervention (CCHR: OR of 0.05; NOC: OR of 0.7).[14] Previously, the analysis of the subgroup of patients with a 15-point GCS score after a TBI had shown a high sensitivity (100%) for both protocols, although CCHR had a greater specificity versus the NOC, both for detection (50.6% versus 12.7%) as well as to predict the need for neurosurgical intervention (76.3% versus 12.1%, respectively).[16]

A second problem to be considered, which is an issue still without consensus, is the indication of a cranial CT to monitor progression in patients in whom the existence of an IL after mild TBI has been confirmed.[17] Although the presence of some lesions has not necessarily demonstrated an increase in morbidity and mortality, a large number of examinations are finally carried out in order to rule out progression of intracranial bleeding and obtain radiological evidence which could help to plan the patient's transfer to centres with neurosurgical services, hospital admission or strengthen the discharge decision.[18] In a recent meta-analysis, it was observed that scheduled CT scans leads to management changes in only a minority of patients (9.6–11.4%), including cases with tomographic evidence of IL progression. For example, in the mild TBI subgroup (GCS of 13–15 points), treatment strategy only changed in 2.3–3.9% of the cases.[17]

The type of IL should be an element that determines the indication of a progression control CT. There are lesions such as convexity subarachnoid haemorrhage, laminar subdural hematomas (SDH) or small volume hematomas (<4–7 mm), as well as small single convexity contusions, where other factors should reinforce the decision to repeat imaging tests. Among them, we could highlight the patient's own progression and clinical condition, the presence of coagulopathies or other blood dyscrasias that favour the progression of IL or the timing of trauma.[19]

The possible occurrence of late bleeding in anticoagulated patients or, less frequently, in patients with shunts for the treatment of hydrocephalus deserves a special consideration after a normal initial CT.[20] Although the management protocol varies between centres, performing follow-up CT scans after a first normal imaging study or admission for observation during 24 h would not allow the detection of the small number of cases that present bleeding beyond the first 24 h after trauma, its indication being widely questioned.[21] In the group of anticoagulated patients, the reported incidence of bleeding within the 24 h after trauma following a normal initial CT scan is very low (0.6%), with cases of sub-therapeutic AC levels having been reported.[22,23] Considering current evidence, the risk of late bleeding is low enough to allow discharge with specific recommendations. However, particular aspects such as the high-energy injury mechanism, associated antiplatelet therapy or an excessive level of AC (INR > 3) should be considered in an individualized way when deciding the management strategy. Special mention should be made of patients treated with new oral ACs (dabigatran, apixaban, among others). For this subgroup, considered in risk, there are no updated recommendations in the guidelines.[24]