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The Traumatic Brain Injury: Diagnosis and Management at Emergency Department by General Surgeon. A Retrospective Critical Analysis on the Use of the CT Head Scan

Travmatik Beyin Hasarı: Travmatik Beyin Hasarının Genel Cerrah Tarafından Teşhis ve Yönetimi. Bilgisayarlı Beyin Tomografisinin Kullanımının Retrospektif Bir İncelemesi

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ABSTRACT

AIM: In recent decades, considerable progress has been made in diagnosis and management of cranial trauma patients. Computed Tomography has resulted in a revolution in head injury diagnosis, making it possible to detect cases suitable for surgical treatment in a rapid, non-invasive manner. We present our experience in treating patients with head injuries at Emergency Department by describing the process and the criteria under which any diagnostic test is performed focusing in CT head scan.

MATERIAL and METHODS: Between 2007-2009 we studied 1356 adult patients (725 male and 631 female) who came at the emergency department claiming head injury. The factors registered were the mechanism of injury, the neurological evaluation, the Glasgow Coma Scale (GCS), the specialty of the doctor who made the first evaluation, and finally in which cases and with which criteria the CT scan was performed.

RESULTS: Only a disproportionate small number of the patients who arrive at the emergency room claiming head injury require neurosurgical intervention (4.8% in our study). The majority of the CT scans who are performed as emergency procedure have no pathological findings (53.4%).

CONCLUSION: The general surgeon with the appropriate education is able to evaluate the patients with head injury.

KEYWORDS: Traumatic brain injury, Glasgow coma scale, Emergency department, Intensive care unit, CT scan

ÖZ

AMAÇ: Kafa travmalı hastaların teşhis ve yönetiminde son yıllarda hatırı sayılır ilerlemeler olmuştur.Bilgisayarlı beyin tomografisi ile noninvaziv olarak kafa travması geçiren hastaların tanıları konulabilmekte ve cerrahi tedavi gereken hastalar hızla teşhis edilmektedir. Kafa travması geçiren ve bilgisayarlı beyin tomografisi çekilen hastaların teşhis ve yönetimleri ile ilgili olan birikimlerimiz bu yazıda sunulmaktadır.

YÖNTEM ve GEREÇLER: Kafa travması geçirdiğini ifade eden 1356 (725 erkek, 631 kadın) hasta 2007-2009 yılları arasında acil servisde görülüp değerlendirilmiştir. Çalışma sırasında; kafa travması geçiren hastaların nörolojik muayeneleri, travma mekanizması, Glaskow koma sıkalası, hastayı muayene eden doktorun uzmanlık dalı ve hangi ölçütlere göre beyin tomografisi istendiği araştırılmıştır.

BULGULAR: Acil servise kafa travması nedeni ile başvuran hastaların % 4,8'ine beyin cerrahisi girişimi gerekmiştir.Beyin tomografisi çekilen olguların %53,4'ünde patolojik bir bulguya rastlanmadı.

SONUÇ: Uygun eğitim almış bir genel cerrah kafa travması ile gelen hastaların değerlendirmesini yapabilir.

ANAHTAR SÖZCÜKLER: Travmatik beyin hasarı, Glakow koma sıkalası, Acil servis, Yoğun bakım ünitesi, Bilgisayarlı tomografi

INTRODUCTION

Head injuries are a common reason for patients approach to the Emergency Department (ED) of every hospital. Despite of the high incidence of traumatic head injury, there is still controversy and disparity of criteria regarding its management. The lack of consensual protocols and clinical guidelines can lead to deficiencies in the attention to these patients and to inadequate use of resources. To determine the circumstances in which a CT-scan should be done, researchers

have developed the New Orleans Criteria and the Canadian CT head rule (Table I, II).

CT scan is a necessary diagnostic tool in patients with TBI. Our aim was to study those factors that lead us to the decision of performing a CT scan and to clarify if that decision is the most appropriate not only for the patient but for the hospital as well.

Between January of 2007 and January of 2009, all the patients presenting at our emergency department claiming a head injury were studied. The mechanism of injury, the neurological status and GCS at the arrival as well as the specialty of the doctor who first evaluate the patient were recorded. Finally the decision-making criteria for a CT scan were evaluated in combination with the results of this examination.

MATERIAL and METHODS

In the ED of our hospital 1356 adult patients with head injury arrived between January 2007 to January 2009: 725 male and 631 female age between 15 to 94 years old (mean age 54, 6 years).

The most frequent mechanisms of injury were: 1) motor vehicle accidents (41,2%), 2) falls (37,8%) and 3) physical violence (19%).

Table I: The New Orleans Criteria

New Orleans Criteria (GCS:15/15)
1. Headache
2. Vomiting
3. Older than 60 years old
4. Drug or alcohol intoxication
5. Persistent anterograde amnesia (deficits in short-term memory)
6. Visible trauma above the clavicle
7. Seizure

Patients were divided in 3 categories according to their GCS score, clinical condition and neurological status:

- 1st Group: without neurological findings - GCS 15/15.
- 2nd Group: subjective symptoms of TBI - GCS 15/15.
- 3rd Group: Patients with pathological findings in neurological examination και GCS <13-14.

The co-existing injuries were evaluated and treated separately.

ED in our hospital is not yet separated from other departments. When a patient arrives at the ED is evaluated by a member of the nursing stuff and is immediately referred at the appropriate department (mainly surgical, pathological and pediatric). Also, the Neurosurgery Department consists only by three specialist neurosurgeons who cover the needs of our territory constantly without neurosurgery residents. Due to this lack of personnel neurological assessment of patients suffering from traumatic brain injury at the ED is performed by neurologists instead of neurosurgeons when is needed.

So the first medical evaluation of every case with head injury was made from the general surgeon who reported the GCS of the patient and made a brief neurological examination. Radiological examination of skull with X-Ray was done in every patient as routine to exclude the possibility of skull fracture. In patients with GCS: 15/15 and subjective symptoms of TBI a neurologist was made a separate neurological examination and in co-ordination with general surgeon made the decision of performing a CT-scan if that was necessary. In all cases that patients have had neurological findings at brief neurological examination or GCS fewer than 15 the general surgeon gave the order for a head CT-scan. The neurosurgeon treated patients in which a CT-scan has been made and had pathological findings that needed surgery. The rest of the patients were admitted in surgery department for observation (Figure 1). Neurosurgery Department and 1st Surgery Department are located in the same floor in our hospital, so the nursing personnel as well as the doctors are trained in dealing with neurosurgical patients.

Table II: Canadian CT Head Rule

CANADIAN CT HEAD RULE
CT is required for patients with minor head injury when any 1 one of the following findings is described: • GCS:13/15 (except patients who are taking warfarin or have bleeding disorders and patients with open skull fracture) • Witnessed loss of consciousness • Amnesia • Confusion
High risk for neurosurgical intervention exists when: • GCS<15 two hours after head injury • Suspected open or depressed skull fracture • Signs of basal skull fracture (hemotympanum, racoon eyes, cerebrospinal fluid, otorrhea or rhinorrhea, Battle's sign) • Two or more episodes of vomiting • Patients ≥ 65 years old
Medium risk for brain imaging detection by CT imaging: • Amnesia before impact for 30 minutes or more • Dangerous mechanism of head impact

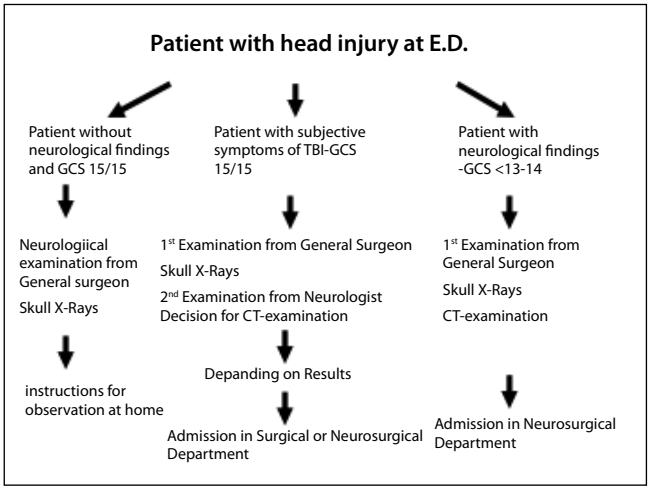

Figure 1: Management of patients with head injury at Emergency Department.

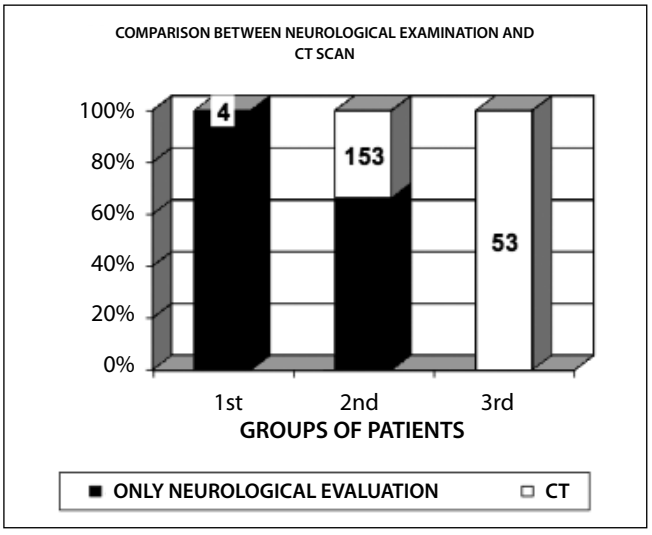

Figure 2: Comparison between neurological examination and CT scan.

RESULTS

The first group of patients was 849 (62, 6% of the total number of patients) and treated from the general surgeon with instructions for observation at home from their relatives. From these patients 18 came back at the ED for re-evaluation and at 4 of them decided to do a head CT-scan. 2 of them admitted to the neurosurgical clinic with subdural hematoma 1 month after injury.

From the second group of patients combined from 454 patients (33, 5% of the total number of patients), head CT-scan was done in 153 with pathological findings at 43. At the surgical clinic admitted 88 patients for observation.

All the patients from the third group (3, 9% of the total number of patients) were admitted at the neurosurgical clinic and had a surgery after their admission.

Head CT-scan was performed in 210 patients (15, 5% of the total number of patients): 4 patients of first group, 153 patients of second group and 53 patients of the third group. Pathological findings have been reported at 98 patients from the total 210 of patients (46, 6%) (Figure 2, 3).

Neurosurgical intervention had to be performed at 65 patients (4, 8% of the total number of patients): 2 patients of first group, 10 patients of second group and all patients of third group. From these patients 14 had depressed skull fracture, 4 patients had fracture of skull basis, 18 patients had epidural hematoma, 22 patients had subdural hematoma, 5 patients had subarachnoid hemorrhage and 2 patients had chronic subdural hematoma (Figure 4).

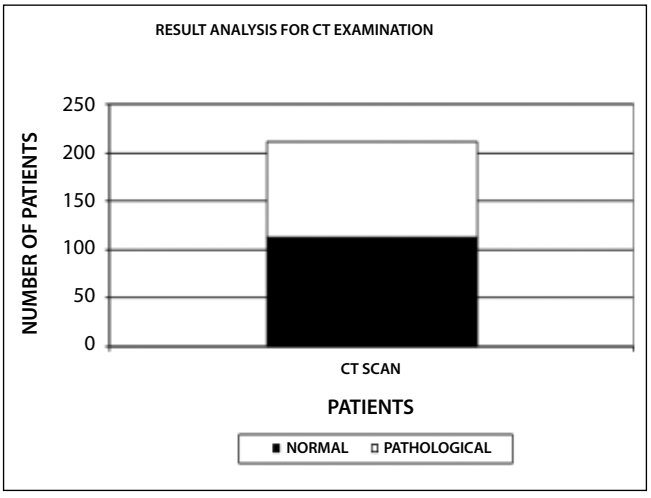

Figure 3: Result analysis for CT examination.

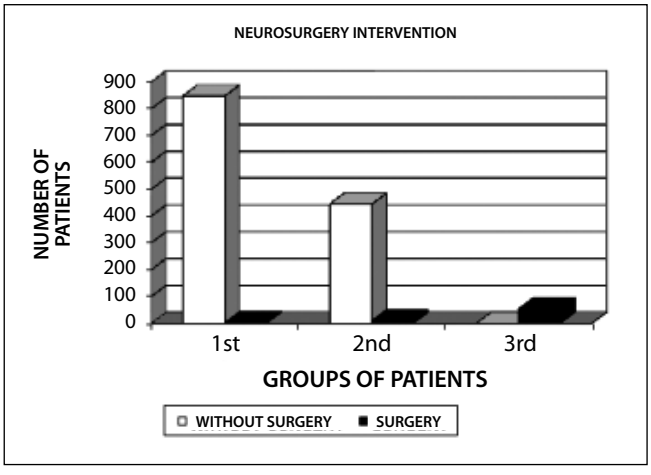

Figure 4: Neurosurgery intervention.

DISCUSSION

Head injuries remain one of the most common reasons for medical attention at the ED. It is known that more than 1, 5 million people are treated for head injuries annually in the United States (10). More than 80% of these injuries are considered minor.

In Sweden, 17000 patients are admitted with traumatic head injury every year and 20% of them receive a computed tomography (1, 2).

The base of decision making in our ED was clinical examination of the patients by the general surgeon and evaluation of their neurological profile at the moment of arrival at emergency department. The Glasgow Coma Scale has been used for all our patients to determine and report their neurological condition at the ED. The most appropriate for our decision making model, in order to ask a CT examination, was the New Orleans Criteria. These are consisted of seven clinical and/or historical findings any of which calls for a CT after a head injury.

In our study we used plain radiographs of skull to all patients with TBI although it is known that skull fractures are present in approximately 5% of mild head injuries (3). The risk of intracranial hematoma that requires neurosurgical intervention in patients without skull fracture is very small; on the other hand skull fracture doesn't mean surgery for 96,875% of patients with traumatic brain injury (5) (Table III). Many researchers recommended abandoning plain radiographs of the head in diagnosing traumatic injuries. This is also supported by the Royal College of Radiologists, who concluded that plain radiographs of the head have a very low diagnostic value and do not give any additional information that would lead to treatment changes, recommending wisely use of CT scans (11).

CT is the method of choice for detecting intracranial lesions that require surgery. The fact that less than 10% of patients with minor head injury have positive findings on CT scan and less than 1% requires neurosurgical intervention, leading to some questioning whether CT is cost effective (7,12). Reinus et al estimated that a 10% reduction in the number of CT-scans performed on patients with minor head injury could save more than $20 million per year (9). On the other hand, several cases have been documented in which patients where present awake and alert, with no loss of consciousness or amnesia, and yet required neurosurgical intervention, after CT scans revealed traumatic injuries. In our series, we had two such cases of asymptomatic patients who required further neurosurgical intervention.

CT examination costs less than hospital admission for observation and as it was found by economical studies that were performed in several countries and our research agrees with these findings (4). Furthermore some scientists declare that prolonged observation in the ED can save money, although many hospitals don't have the means and the human sources to achieve this. Livingston et al, in a study for Minimal Head Injury concluded that only 50% of patients admitted to non-ICU beds had documented neurological observation (6). On the other hand the solution to this problem is observation at home from relatives although it is not always reliable (7).

The availability of a CT scanner in every hospital is of a great importance in diagnosing brain injuries although sometimes doctors may overuse this diagnostic method. The performance of a CT scan, even in patients with no indications for this exam, is unfortunately a common tactic by some physicians in order to avoid possible legal problems when they are not certain following their medical evaluation. For this reason, the general surgeon cooperates with neurologists at the E.D. in our hospital in an effort to reduce the number of unnecessary CT-scans.

The existence of neurosurgical units is very important especially in distinct areas, as it was found that in some parts of Europe (i.e. United Kingdom) up to 33% of severe traumatic brain injured patients do not reach a hospital with a Neurosurgery unit and this implies a 26% increase in mortality (8). The neurosurgical unit of our hospital is a small unit but serves in the best manner the needs of our area (Thrace) that is located far away from the major trauma centers of our country.

Table III: Risk of Surgical Intervention in Patients with or without Skull Fracture after Traumatic Head Injury (Lindsay/Bone/Callander-Neurology and Neurosurgery Illustrated Second Edition Churchill Livingstone 1991 pp222)

Risk of intracranial haematoma (requiring removal) in adult attending A&E department after head injury.	
Without skull fracture	Orientated 1 in 6000 patients
Without skull fracture	Not orientated 1 in120 patients
Skull fracture	Orientated 1 in 32 patients
Skull fracture	Not orientated 1 in 4 patients

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