

How necessary is the computerized brain tomography in minor head trauma?

● Serhat Yıldızhan, M.D.,¹ ● Mehmet Gazi Boyacı, M.D.,¹ ● Şerife Özdiñç, M.D.²

¹Department of Neurosurgery, Afyonkarahisar Health Sciences University Faculty of Medicine, Afyonkarahisar-Turkey

²Department of Emergency Medicine, Afyonkarahisar Health Sciences University Faculty of Medicine, Afyonkarahisar-Turkey

ABSTRACT

BACKGROUND: Head trauma is a health problem that may be observed in all age groups, and it may cause significant losses in terms of health and economy. The purpose of our study is to evaluate the abnormal computerized brain tomography (CBT) prevalence and the rate of admission to brain surgery clinics in patients who applied to the Emergency Service Department for CBT due to minor head trauma.

METHODS: In the present study, the patients who were admitted to Afyonkarahisar Health Sciences University, Faculty of Medicine Hospital, Emergency Service Department between January 1st, 2017, and December 31st, 2017, due to head trauma and in who CBT was performed were examined retrospectively. The electronic files, CBTs, and consultation notes of these patients were accessed in the information system of the hospital.

RESULTS: A total of 43,389 patients who applied to the Emergency Service Department in 1 years' time (2017) were examined retrospectively. As a result of the examination, it was determined that a total of 2,515 (5.7%) patients received CBT. The reason for a total of 1,152 (45%) of these patients was traumatic injury. It was determined that 618 (53.6%) of the patients in who CBT was performed due to trauma were aged <18 years; 280 (24.3%) patients were aged <2 years; 179 (15.5%) patients had to consult with the Brain Surgery Clinic; and 94 (8.1%) were hospitalized. It was also determined that there were abnormal computed tomography (CT) findings in only 68 (5.9%) of the patients in who CBT was performed.

CONCLUSION: The use of CBT indication criteria, which have been previously established and which reliability has been proven, in emergency trauma cases applying to the Emergency Service Department with minor head traumas may reduce the complication risk that may appear as a result of an unnecessary CBT and avoid complications that may occur in the long run due to CBT.

Keywords: Computerized computed tomography; minor head trauma; rules for computed tomography.

INTRODUCTION

The number of applications to the Emergency Service Department is increasing every day. Approximately half of these applications consist of trauma patients. Traumatic brain injuries (TBI) are observed frequently and progress with a bad prognosis when they are severe. TBIs are the primary cause of death in people aged <45 years and are most commonly mildly severe in the population. In addition, approximately 8%–10% of these are moderate or severe.^[1] Computerized brain tomography (CBT) as a result of the developments in technology is used increasingly in patients who present with

head trauma to the Emergency Service Department. The radiation received during CBT poses a greater risk, especially in the pediatric patient groups. The aim of our study is to evaluate the prevalence of abnormal CBT and the rate of admission to brain surgery clinics of patients in who CBT was performed and who applied to the Emergency Service Department due to head trauma.

MATERIALS AND METHODS

In the present study, the patients who applied to Afyonkarahisar Health Sciences University, Faculty of Medicine

Cite this article as: Yıldızhan S, Boyacı MG, Özdiñç Ş. How necessary is the computerized brain tomography in minor head trauma?. *Ulus Travma Acil Cerrahi Derg* 2019;25:378-382.

Address for correspondence: Serhat Yıldızhan, M.D.

Afyonkarahisar Sağlık Bilimleri Üniversitesi Tıp Fakültesi, Beyin ve Sinir Cerrahisi Anabilim Dalı, Afyonkarahisar, Turkey

Tel: +90 272 - 246 33 01 E-mail: serhatyildizhan07@gmail.com

Ulus Travma Acil Cerrahi Derg 2019;25(4):378-382 DOI: 10.5505/tjtes.2018.94849 Submitted: 13.07.2018 Accepted: 23.11.2018 Online: 08.07.2019

Copyright 2019 Turkish Association of Trauma and Emergency Surgery



Hospital, the Emergency Service Department between January 1st, 2017, and December 31st, 2017, due to head trauma and in who CBT was applied, were examined retrospectively. From the hospital information system and the electronic files of these patients, age, gender, trauma causes, examination findings, consciousness levels, and the Glasgow Coma Scale values, reasons for CBT, consultation notes, and result information were accessed. Patients were classified according to their consciousness levels, CBT indications, and clinical diagnosis after CBT. The patients who requested counseling and who were hospitalized were also evaluated. Data obtained in this way were analyzed using the Descriptive Statistical Analyses SPSS 22.0 Software (IBM, New York, USA). The present study was approved by Afyonkarahisar Health Sciences University, Clinical Research Ethics Board.

RESULTS

It was determined that a total of 43,389 patients applied to the Emergency Service Department within 1 year (2017). As a result of the examination, it was determined that 2,515 (5.7%) patients received CBT. The reason for application in a total of 1,152 (45%) of these patients was traumatic injury. Among the trauma causes, traffic accidents (40.6%) were listed first as the most frequent, and simple falls (36.4%) were listed second. It was also determined that a total of 618 (53.6%) patients who received CBT were under aged <18 years, and 648 (56.2%) patients were male. It was found that 179 (15.5%) patients who received CBT consulted with the Brain Surgery Clinic; 94 (8.1%) were admitted to the Brain

Surgery Clinic; and 128 (11.1%) patients were admitted to other clinics. Patients were divided into groups according to consciousness levels (Table 1). It was also determined that a great many of the patients (85.7%) had a mild mental state of consciousness. When patients with trauma-related CBT and their files were evaluated in an accurate manner, it was determined that having only a head trauma (n=246; 38.6%) was the most common complaint, and nausea and vomiting (n=146; 22.9%) were the second most common complaints (Table 2). It was observed that only 68 of the patients (5.9%) had abnormal CBT findings. The most common clinical condition was linear fractures (Table 3).

DISCUSSION

Today, applications to the Emergency Service Department are increasing every day. In 2017, the number of emergency service applications in our country exceeded 100 million. Important increases are observed in imaging methods due to reasons such as a high number of Emergency Service Department applications, an increase in the quality of imaging methods due to technological developments, defensive practices of consultation with doctors, an inadequate number of health care staff, social reasons, physical insufficiency of the emer-

Table 1. The post-traumatic consciousness levels in the patients who underwent CBT

Consciousness level	Glasgow Coma Scale	Patient count
Light	14–15	988 (85.7%)
Mild	8–13	116 (10.0%)
Severe	3–8	48 (4.3%)

CBT: Computerized brain tomography.

Table 2. Complaints of the patients undergoing CBT in the emergency service department at admission

Complaint at admission	Patient number
Head trauma (no symptoms)	246
Nausea-vomiting	146
Multi-trauma	105
Loss of consciousness	63
Amnesia	50
Epileptic seizures	26

CBT: Computerized brain tomography.

Table 3. Clinical features of patients hospitalized in the brain surgery department

Diagnosis	Patient number
Subarachnoid bleeding	18
Linear fractures	26
Collapsing fractures	12
Epidural, subdural hematoma	20
Intraparenchymal hematoma	8
No CBT pathologies were detected	14

CBT: Computerized brain tomography.

Table 4. The criteria showing that the intracranial damage risk is low

The absence of the following symptoms must be determined clinically

Changes in the consciousness
Behavioral disorders
Increase in the headache
Speech disorders
Weakness or loss of sense in arms or legs
Continuous vomiting
Expansion in one or both of the pupils and no reaction to light
Epileptic seizures
Significant increase in the swelling in the damage area

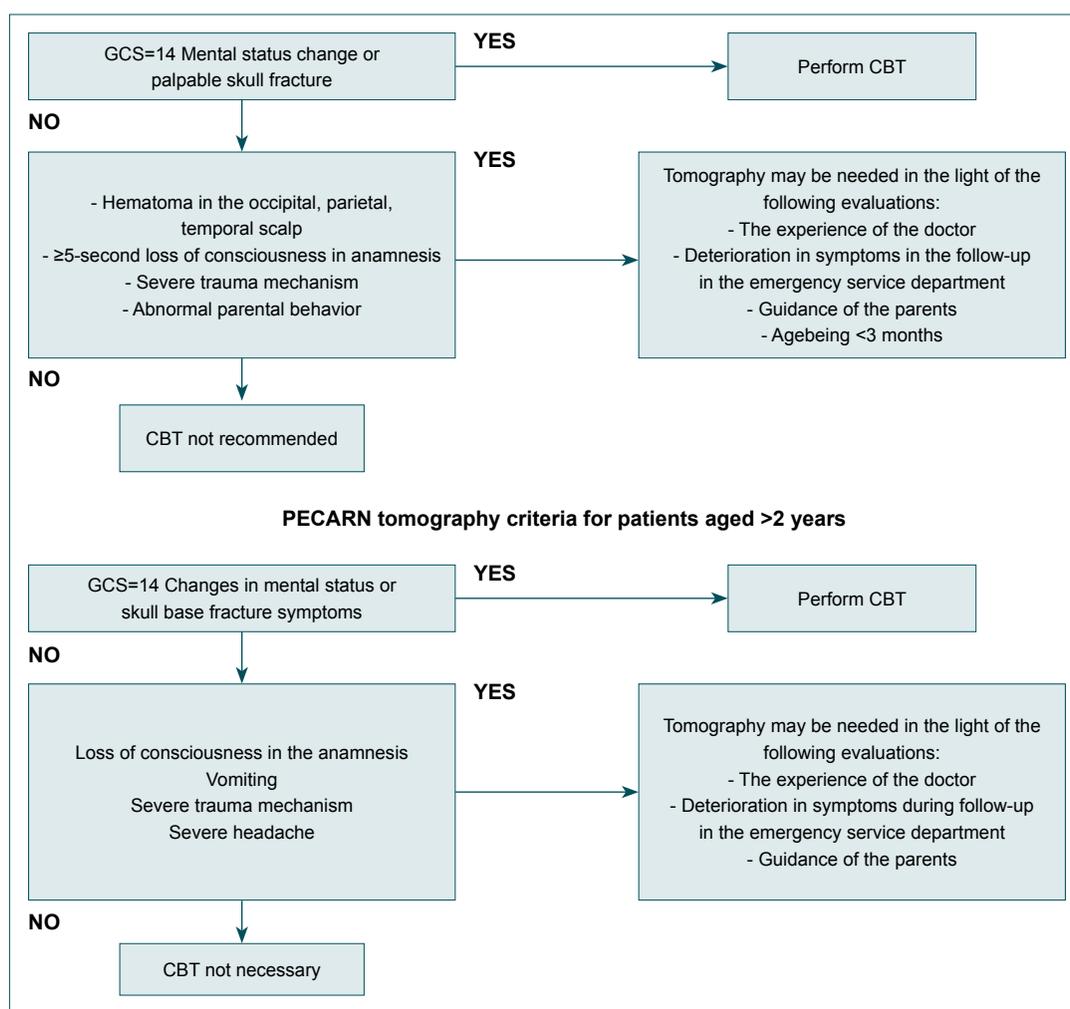


Figure 1. PECARN tomography criteria for patients aged <2 years.

gency departments, and an increase in abuse cases.

The method that applies the highest radiation levels to the body is CBT when compared to other imaging methods. An effective dose is 2-4 mSv when performing CBT. This dose contains approximately 200 times more radiation than a lung graphics. Cell proliferation is faster in children, and radiation poses a greater risk when compared to adults because it affects the cells that reproduce at a great speed. Although these facts are known, the rate of using computed tomography (CT) is still increasing.^[2]

One of the most common causes of applications to the Emergency Service Department is head trauma, and it is the most important cause of mortality and morbidity, especially in childhood. Falls, traffic accidents, and sports injuries are the most common causes of head traumas. Melo et al.^[3] conducted a study and reported that the most frequent cause of head trauma was falling from high places with 72%. Güzel et al.^[4] conducted a study and reported that falls were the most frequent reason with a rate of 49.5%. Işık et al.^[5] conducted another study and reported that the causes of head traumas were simple falls with 70% and traffic accidents

with 18%. Gürses et al.,^[6] on the other hand, reported that the reasons of head traumas were traffic accidents (46%), falls (39%), and bicycle accidents (15%). In our study, traffic accidents were the first (40.6%), and simple falls were the second (36.4%).

The rate of performing CBT is higher in pediatric patients than in adult patients. Among the reasons, it is possible to name the fast deterioration of the clinical symptoms in children with TBI, difficult observation, social indications, abuse cases, and doctors' desire to avoid taking risks. Recently, many studies have been conducted to determine the effective use of CBT in patients with mild head traumas to reduce the number of CBT as much as possible.^[7,8] Osmond et al.^[9] conducted a study with 3,866 children that had a mild head trauma and reported that 52.8% of these children had CBT, only 4.1% had brain damage, and 0.6% underwent surgery. In a study conducted by Atabaki et al.,^[10] it was reported that after the CBT was performed in 1,000 children with mild head trauma, intracranial injury was detected only in 6.5% of the patients, and only 0.6% of these patients underwent surgery. In addition, clinical rules must be defined for CBT,

and these rules must be employed in performing CBT. In a study conducted by Er et al.,^[11] a total of 314 pediatric patients were examined, and it was determined from CBT results that no surgical interventions were necessary for 19 patients (6%), although pathological CBT results were determined. In our study, 1,152 (42.9%) of the 2,682 patients who applied to the Emergency Service Department due to head trauma were found to have undergone CBT, and 618 (53.6%) of these were aged <18 years. A total of 280 of these patients (24.3%) were 0–2 years. A total of 94 patients (8.1%) were hospitalized, and 68 (5.9%) had abnormal CT findings. The most frequent clinical finding were linear skull fractures. It was also determined that 24 patients (2.0%) underwent surgery. In a study conducted by Lyttle et al., the three current algorithms were compared: PECARN, CATCH, and CHALICE (Children's Head Injury Algorithm for Prediction of Important Clinical Events), which were used in clinical decision-making processes for children with mild head trauma to avoid unnecessary radiation. As a result of the study, the PECARN algorithm (Fig. 1) was found to be more sensitive than the CATCH and CHALICE algorithms, and PECARN rules recommended that CBT should be performed.^[12] In this study, when the patients were re-evaluated by taking the PECARN criteria as the basis according to physical examination findings and clinical complaints, it was determined that 98 patients (35%) out of 280 patients under aged <2 years were found to be followed up without CBT. When the results of the 338 patients aged 2–18 years were re-evaluated in respect to the PECARN criteria, it was found that 68 (20%) patients would be treated without CBT. According to these results, it is understood that as the age decreases, the CBT performing reflex also increases.

In a multidisciplinary study that involved 7,035 patients with head traumas,^[13] the patients were grouped as low, moderate, and high-risk based on the intracranial injury levels (Table 4). According to this classification, CBT was not recommended for the patients with low risk for intracranial injury; however, patients with moderate to high risk were recommended to undergo CBT. In our study, when the 340 patients whose files could be examined in detail out of the 504 patients who underwent CBT were evaluated, it was determined that 66 (19.4%) patients had undergone CBT although they were in the low-risk group for intracranial injury.

When 636 patients who had undergone CBT and whose files could be examined accurately were examined, it was determined that in 246 (38.6%) of patients, the most frequent reason for presenting to the Emergency Service Department was the head trauma without any symptoms in the patients. There were no clinical complaints in these patients. The second most common reason for application to the Emergency Service Department was nausea and vomiting with 146 (22.9%) patients. Only 68 patients (5.9%) patients who underwent CBT had abnormal CBT findings. The most frequently observed clinical condition were linear fractures.

Conclusion

CBT is an important imaging method used in children, and it has been employed more frequently in pediatric patients in recent years parallel to the developments in the IT technology. Today, complete adherence to the algorithms related to the use of CBT leads us away from unnecessary CBT and its long-term unwanted effects. With this study, it was determined that the number of CBTs may be reduced by applying the CBT indications whose reliability was proven in the presence of minor head traumas in patients admitted to the Emergency Service Department of our hospital due to head trauma.

Conflict of interest: None declared.

REFERENCES

1. Thornhill S, Teasdale GM, Murray GD, McEwen J, Roy CW, Penny KI. Disability in young people and adults one year after head injury: prospective cohort study. *Br Med J* 2000;320:1631–5. [\[CrossRef\]](#)
2. Macias CG, Sahouria JJ. The appropriate use of CT: quality improvement and clinical decision-making in pediatric emergency medicine. *Pediatr Radiol* 2011;41 Suppl 2:498–504. [\[CrossRef\]](#)
3. Melo JR, Di Rocco F, Lemos-Júnior LP, Roujeau T, Thélor B, Sainte-Rose C, et al. Defenestration in children younger than 6 years old: mortality predictors in severe head trauma. *Childs Nerv Syst* 2009;25:1077–83.
4. Güzel A, Ceylan A, Tatli M, Başoğlu M, Ozer N, Kahraman R, et al. Falls from height in childhood in Diyarbakir province: A questionnaire study combined with clinical data. *Ulus Travma Acil Cerrahi Derg* 2009;15:277–84.
5. Işık HS, Gökçar A, Yıldız Ö, Bostancı U, Özdemir C. Çocukluk çağı kafa travmaları, 851 olgunun retrospektif değerlendirilmesi: Epidemiyolojik bir çalışma. *Ulus Travma Acil Cerrahi Derg* 2011;17:166–72. [\[CrossRef\]](#)
6. Gürses D, Sarıoğlu Büke A, Başkan M, Herek Ö, Kılıç İ. Travma nedeniyle çocuk acil servise başvuran hastaların epidemiyolojik değerlendirilmesi. *Ulusal Travma Derg* 2002;8:156–9.
7. Maguire JL, Boutis K, Uleryk EM, Laupacis A, Parkin PC. Should a head-injured child receive a head CT scan? A systematic review of clinical prediction rules. *Pediatrics* 2009;124:145–54. [\[CrossRef\]](#)
8. Dunning J, Daly JP, Lomas JP, Lecky F, Batchelor J, Mackway-Jones K; Children's head injury algorithm for the prediction of important clinical events study group. Derivation of the children's head injury algorithm for the prediction of important clinical events decision rule for head injury in children. *Arch Dis Child* 2006;91:885–91. [\[CrossRef\]](#)
9. Osmond MH, Klassen TP, Wells GA, Correll R, Jarvis A, Joubert G, et al. CATCH: a clinical decision rule for the use of computed tomography in children with minor head injury. *CMAJ* 2010;182:341–8. [\[CrossRef\]](#)
10. Atabaki SM, Stiell IG, Bazarian JJ, Sadow KE, Vu TT, Camarca MA, et al. A clinical decision rule for cranial computed tomography in minor pediatric head trauma. *Arch Pediatr Adolesc Med* 2008;162:439–45.
11. Er A, Akman C, Alatas İ, Ünlü HB, Ceylan I, Gün C, ve ark. Minör Kafa Travması Olan Çocuklarda Rutin Olarak BT Yapmalı mıyız? *JOPP Derg* 2013;5:131–5. [\[CrossRef\]](#)
12. Lyttle MD, Crowe L, Oakley E, Dunning J, Babl FE. Comparing CATCH, CHALICE and PECARN clinical decision rules for paediatric head injuries. *Emerg Med J* 2012;29:785–94. [\[CrossRef\]](#)
13. Masters SJ, McClean PM, Arcarese JS, Brown RE, Campbell JA, Freed HA, et al. Skull x-ray examinations after head trauma. Recommendations by a multidisciplinary panel and validation study. *N Engl J Med* 1987;316:84–91. [\[CrossRef\]](#)

ORİJİNAL ÇALIŞMA - ÖZET

Minör kafa travmasında bilgisayarlı beyin tomografisi ne kadar gerekli?

Dr. Serhat Yıldızhan,¹ Dr. Mehmet Gazi Boyacı,¹ Dr. Şerife Özdiç²

¹Afyonkarahisar Sağlık Bilimleri Üniversitesi Tıp Fakültesi, Beyin ve Sinir Cerrahisi Anabilim Dalı, Afyonkarahisar

²Afyonkarahisar Sağlık Bilimleri Üniversitesi Tıp Fakültesi, Acil Tıp Anabilim Dalı, Afyonkarahisar

AMAÇ: Kafa travmaları tüm yaş gruplarında görülebilen, sağlık ve ekonomi açısından önemli kayıplara neden olabilen bir sağlık sorunudur. Çalışmamızın amacı, acil servise minör kafa travması nedeniyle başvuran ve bilgisayarlı beyin tomografisi (BBT) çekilen hastalarda, anormal BBT prevalansını ve beyin cerrahi kliniğine yatış oranlarını değerlendirmektir.

GEREÇ VE YÖNTEM: Çalışmada Afyonkarahisar Sağlık Bilimleri Üniversitesi Tıp Fakültesi Hastanesi Acil Servisi'ne 01.01.2017–31.12.2017 tarihleri arasında kafa travması nedeniyle gelen ve BBT çekilen hastalar geriye dönük olarak incelendi. Hastane bilgi sisteminden bu hastaların elektronik dosyalarına, BBT'lerine ve konsültasyon notlarına ulaşıldı.

BULGULAR: Bir yıllık (2017) süre içerisinde acil servise başvuru yapan 43.389 hastaya ulaşıldı. İnceleme sonucunda 2515 (%5.7) hastaya BBT çekildiği saptandı. Bu hastaların 1152'sinin (%45) başvuru nedeni travma idi. Travmaya bağlı olarak BBT çekilen 618 (%53.6) hastanın 18 yaş altı olduğu, 280 (%24.3) hastanın iki yaş altı olduğu, 179 (%15.5) hastanın beyin cerrahisi kliniği ile konsülte edildiği ve 94 (%8.1) hastaya yatış verildiği saptandı. BBT çekilen sadece 68 (%5.9) hastada anormal BT bulguları saptandı.

TARTIŞMA: Acil servise minör kafa travması ile gelenlerde, daha önce tespit edilen ve güvenilirliği kanıtlanan BBT çekim endikasyon kriterlerinin kullanılması, düşük riskli hastaların takip edilmesi, gereksiz BBT çekimlerini ve çekime bağlı uzun dönemde gelişebilecek komplikasyonları azaltabilir.

Anahtar sözcükler: Beyin tomografisi çekim kuralları; bilgisayarlı beyin tomografisi; minör kafa travması.

Ulus Travma Acil Cerrahi Derg 2019;25(4):378-382 doi: 10.5505/tjtes.2018.94849