Pediatrik Kafa Travmaları

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İnönü Üniversitesi
T.Ö.T.M. Acil Tıp A.D.

SUNUM HEDEFLERİ

- Epidemiyoloji
- Travma mekanizması
- Patofizyoloji
- Klinik sınıflama
- Görüntüleme
- Yatış endikasyonları
- Taburculuk kriterleri

EPİDEMİYOLOJİ

- Travmaya bağlı ölümlerin **%80** nedenidir
- Travmatik beyin hasarından etkilenim **200/100.000**

Yıllık ABD verileri:
- **~ 500 000** acil başvuru
- **~ 2000** ölüm
- **~ 37 000** hastane yatışı
- **~ 2 milyar $** maliyet

Tüm yaş grupları göz önünde bulundurulduğunda;

ÇOCUK TRAVMASI

neden önemlidir?

ÇÜNKÜ ÇOCUKLARDA KAFANIN HASARLANMASI FAZLADIR…

Kafanın vücuda oranı erişkinlerden daha fazladır

Kafa kemikleri incedir

Oksiput daha çıkıntılıdır

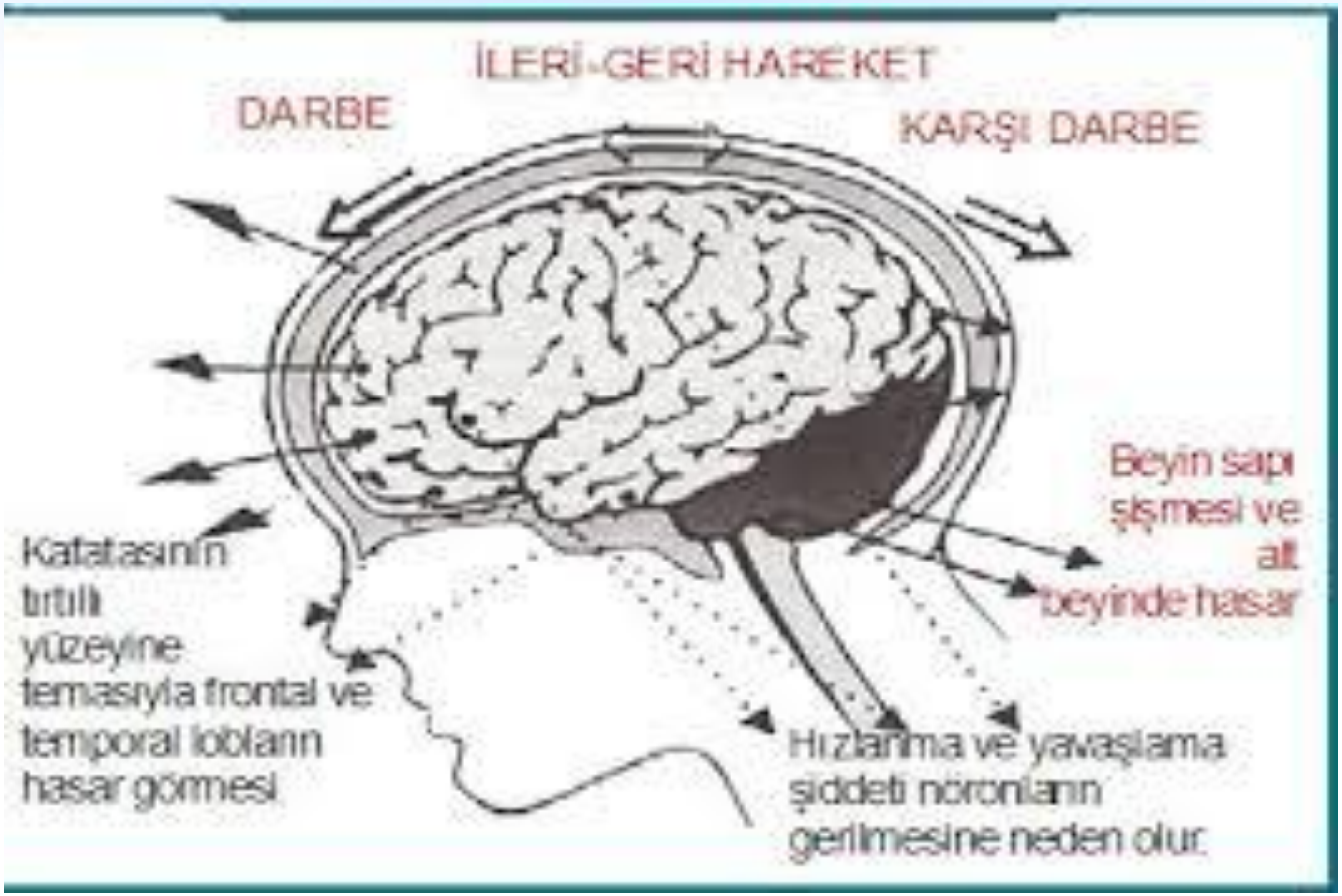
Boyun kasları gelişmemiştir

Özellikle 0-1 yaş grubunda beyin miyelinizasyonu tamamlanamadığı için kolaylıkla hasara uğrar.

TRAVMA MEKANİZMASI

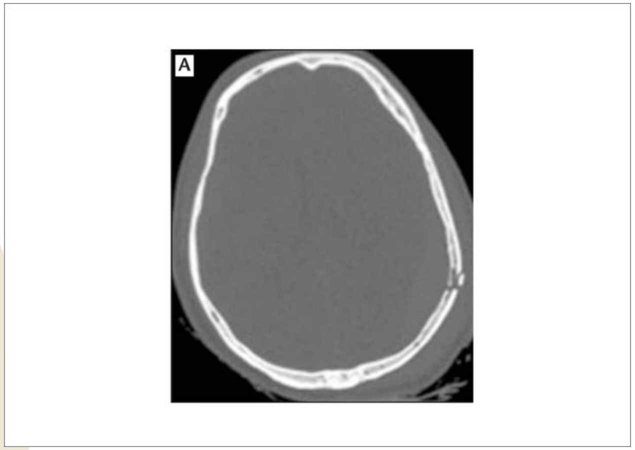
- Düşmeler (en sık)
- Motorlu araç yaralanmaları
- Bisiklet kazaları
- Sporla ilişkili yaralanmalar
- Çocuk istismarları
- Ateşli silah yaralanmaları

PATOFİZYOLOJİ



BİRİNCİL YARALANMA

- Direkt travma etkisinin kinetik enerjisine bağlı olarak meydana gelen yaralanmadır.
  - Kontüzyonlar
  - Hematomlar
  - Aksonal ve vasküler hasarlar

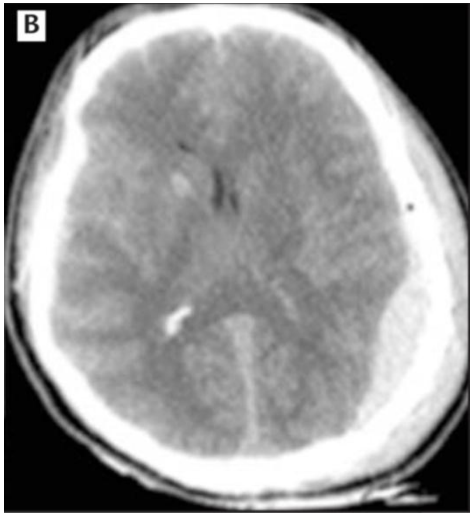


İKİNCİL BEYİN HASARI'NIN;

SİSTEMİK NEDENLERİ	İNTRAKRANİAL NEDENLERİ
Anemi	KİBAS
Hipoksi	Beyin ödemi
Hiperkarbi	Geç intraserebral hematom
Hipotansiyon	Epileptik nöbet
Hiperkalsemi,	Enfeksiyon
Hipermagnesemi	Hidrosefali
Hipoglisemi	Vazospazm

KLİNİK SINIFLAMA

- Ciddi kafa travması (**GKS 8 ve altında)**
- Orta kafa travması (**GKS 9-13)**
- Hafif kafa travması (**GKS 14-15)**



HAFİF KAFA SINIFLAMASI

- Minör Kafa Travması (%85-90) düşünülüyor,

GKS'de 14-15 olarak hesaplanıyor ise;

nereden başlayalım?

ÖYKÜ

- Travmanın zamanı ve şekli nasıl?
- Kaza öncesinde nörolojik problem var mı?
- Nörolojik semptom var mı?
- Çevresel faktörler (hipotermi gibi)
- Kullandığı ilaçlar nelerdir?
- Bilinç kaybı oldu mu?
- Bulantı? Kusma?

KAFA TRAVMALARININ FİZİK MUAYENESİ

- Skalp muayenesi
- Hematom, krepitasyon vs.
- Göz
- Kulaklar
- Burun, boğaz, yüz bölgesinin değerlendirilmesi
- İnfantlarda; frontal fontanel açıklığı

MİNİ NÖROLOJİK MUAYENE

- Bilinç düzeyi
- Ekstremite motor gücü
- Glasgow Koma Skalası (GKS)
- Pupil reaktivitesi

KİBA BULGULARI

İNFANT	ÇOCUK
Fontanel bombeliği	Baş ağrısı
Süturların ayrılması	Ense sertliği
Biliçte değişiklik	Biliçte değişiklik
Huzursuzluk	Fotofobi
Tekrarlayan kusma	Tekrarlayan kusma
Kusma	Papil ödem
“Gün batımı” bulgusu	Dekortike ve deserebre postür

	GLASKOW KOMA SKALASI	PEDİATRİK GLASKOW KOMA SKALASI	Skor
Göz açma (E)	Spontan	Spontan	4
	Sözel	Sözel	3
	Ağrı	Ağrı	2
	Kapalı	Kapalı	1
Konuşma (V)	Oryante	Manasız sözler	5
	Konfü	Huzursuz ağlama	4
	Uygunsuz	Ağrıyla ağlama	3
	Anlaşılmaz	Ağrıyla inleme	2
	Yok	Yok	1
Motor (M)	Emirlere uyuyor	Normal spontan yanıt	6
	Uyarıya yöneliyor	Dokunmayla çeker	5
	Ağrıdan kaçıyor	Ağrıyla çeker	4
	Ağrıya fleksiyon	Ağrıya fleksör yanıt	3
	Ağrıya ekstansiyon	Ağrıya ekstansör yanıt	2
	Hareketsiz	Hareketsiz	1
			15

Tanı - Görüntüleme

- Minör kafa travmalı çocukların çoğu kranial BT'ye ihtiyaç duymazlar.
- Bu grupta BT'ye karar vermek için klinik öngörüler kullanılmalı.

Original Investigation

The Use of Computed Tomography in Pediatrics and the Associated Radiation Exposure and Estimated Cancer Risk

Diana L. Miglioretti, PhD; Eric Johnson, MS; Andrew Williams, PhD; Robert T. Greenlee, PhD, MPH; Sheila Weinmann, PhD, MPH; Leif I. Solberg, MD; Heather Spencer Feigelson, PhD, MPH; Douglas Roblin, PhD; Michael J. Flynn, PhD; Nicholas Vanneman, MA; Rebecca Smith-Bindman, MD

IMPORTANCE Increased use of computed tomography (CT) in pediatrics raises concerns about cancer risk from exposure to ionizing radiation.

OBJECTIVES To quantify trends in the use of CT in pediatrics and the associated radiation exposure and cancer risk.

DESIGN Retrospective observational study.

SETTING Seven US health care systems.

PARTICIPANTS The use of CT was evaluated for children younger than 15 years of age from 1996 to 2010, including 4 857 736 child-years of observation. Radiation doses were calculated for 744 CT scans performed between 2001 and 2011.

MAIN OUTCOMES AND MEASURES Rates of CT use, organ and effective doses, and projected lifetime attributable risks of cancer.

RESULTS The use of CT doubled for children younger than 5 years of age and tripled for children 5 to 14 years of age between 1996 and 2005, remained stable between 2006 and 2007, and then began to decline. Effective doses varied from 0.03 to 69.2 mSv per scan. An effective dose of 20 mSv or higher was delivered by 14% to 25% of abdomen/pelvis scans, 6% to 14% of spine scans, and 3% to 8% of chest scans. Projected lifetime attributable risks of solid cancer were higher for younger patients and girls than for older patients and boys, and they were also higher for patients who underwent CT scans of the abdomen/pelvis or spine than for patients who underwent other types of CT scans. For girls, a radiation-induced solid cancer is projected to result from every 300 to 390 abdomen/pelvis scans, 330 to 480 chest scans, and 270 to 800 spine scans, depending on age. The risk of leukemia was highest from head scans for children younger than 5 years of age at a rate of 1.9 cases per 10 000 CT scans. Nationally, 4 million pediatric CT scans of the head, abdomen/pelvis, chest, or spine performed each year are projected to cause 4870 future cancers. Reducing the highest 25% of doses to the median might prevent 43% of these cancers.

CONCLUSIONS AND RELEVANCE The increased use of CT in pediatrics, combined with the wide variability in radiation doses, has resulted in many children receiving a high-dose examination. Dose-reduction strategies targeted to the highest quartile of doses could dramatically reduce the number of radiation-induced cancers.

JAMA Pediatr. 2013;167(8):700-707. doi:10.1001/jamapediatrics.2013.311
Published online June 10, 2013.

Editorial page 693

Author Audio Interview at jamapediatrics.com

Supplemental contentat jamapediatrics.com

DOZU DÜŞÜK OLAN KRANİYOGRAFİ Mİ ÇEKSEK?

- Kafa travmalı olguların değerlendirilmesinde yerleri çok sınırlı;
  - Penetran yaralanması varsa,
  - Daha önceden geçirilmiş kraniotomi varsa,
  - Deprese kırık varsa grafi istenebilir.

- Aslında kraniyal kırıkların yarıdan fazlası düz kraniyografilerde tespit de edilemiyor

ATUDER 1999 Tıp Uzmanl

Pecarn, Chatch ve Chalice !

Lancet. 2017 Apr 11. pii: S0140-6736(17)30555-X. doi: 10.1016/S0140-6736(17)30555-X. [Epub ahead of print]

Accuracy of PECARN, CATCH, and CHALICE head injury decision rules in children: a prospective cohort study.

Babl FE[1], Borland ML[2], Phillips N[3], Kochar A[4], Dalton S[5], McCaskill M[5], Cheek JA[6], Gilhotra Y[3], Furyk J[7], Neutze J[8], Lyttle MD[9], Bressan S[10], Donath S[11], Molesworth C[12], Jachno K[12], Ward B[12], Williams A[12], Baylis A[13], Crowe L[12], Oakley E[14], Dalziel SR[15]; Paediatric Research in Emergency Departments International Collaborative (PREDICT).

⊕ Author information

Abstract

BACKGROUND: Clinical decision rules can help to determine the need for CT imaging in children with head injuries. We aimed to validate three clinical decision rules (PECARN, CATCH, and CHALICE) in a large sample of children.

METHODS: In this prospective observational study, we included children and adolescents (aged <18 years) with head injuries of any severity who presented to the emergency departments of ten Australian and New Zealand hospitals. We assessed the diagnostic accuracy of PECARN (stratified into children aged <2 years and ≥2 years), CATCH, and CHALICE in predicting each rule-specific outcome measure (clinically important traumatic brain injury [TBI], need for neurological intervention, and clinically significant intracranial injury, respectively). For each calculation we used rule-specific predictor variables in populations that satisfied inclusion and exclusion criteria for each rule (validation cohort). In a secondary analysis, we compiled a comparison cohort of patients with mild head injuries (Glasgow Coma Scale score 13-15) and calculated accuracy using rule-specific predictor variables for the standardised outcome of clinically important TBI. This study is registered with the Australian New Zealand Clinical Trials Registry, number ACTRN12614000463673.

FINDINGS: Between April 11, 2011, and Nov 30, 2014, we analysed 20 137 children and adolescents attending with head injuries. CTs were obtained for 2106 (10%) patients, 4544 (23%) were admitted, 83 (<1%) underwent neurosurgery, and 15 (<1%) died. PECARN was applicable for 4011 (75%) of 5374 patients younger than 2 years and 11 152 (76%) of 14 763 patients aged 2 years and older. CATCH was applicable for 4957 (25%) patients and CHALICE for 20 029 (99%). The highest point validation sensitivities were shown for PECARN in children younger than 2 years (100·0%, 95% CI 90·7-100·0; 38 patients identified of 38 with outcome [38/38]) and PECARN in children 2 years and older (99·0%, 94·4-100·0; 97/98), followed by CATCH (high-risk predictors only; 95·2%; 76·2-99·9; 20/21; medium-risk and high-risk predictors 88·7%; 82·2-93·4; 125/141) and CHALICE (92·3%, 89·2-94·7; 370/401). In the comparison cohort of 18 913 patients with mild injuries, sensitivities for clinically important TBI were similar. Negative predictive values in both analyses were higher than 99% for all rules.

INTERPRETATION: The sensitivities of three clinical decision rules for head injuries in children were high when used as designed. The findings are an important starting point for clinicians considering the introduction of one of the rules.

FUNDING: National Health and Medical Research Council, Emergency Medicine Foundation, Perpetual Philanthropic Services, WA Health Targeted Research Funds, Townsville Hospital Private Practice Fund, Auckland Medical Research Foundation, A + Trust.

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Comparison of PECARN, CATCH, and CHALICE rules for children with mi [Ann Emerg Med. 2014]

Clinical Decision Rules for Paediatric Minor Head Injury: Are CT : [Ann Acad Med Singapore. 2015]

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Review Comparing CATCH, CHALICE and PECARN clinical decision r [Emerg Med J. 2012]

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pecarn head injury (61) PubMed

Pediatric Emergency Care Applied Research Network

Düşük risk kriterleri

YAŞ	KLİNİK KRİTERLERİ
<2	Normal zihinsel durum
	Normal davranışlar
	Bilinç kaybının hiç olmaması
	Kafatası fraktür bulgusunun olmayışı
	Skalp hematomunun olmaması
	Ciddi bir yaralanma mekanizmasının olmayışı
>2- 18	Normal zihinsel durum
	Normal davranışlar
	Bilinç kaybının hiç olmaması
	Kusma olmaması
	Ciddi baş ağrısının olmaması
	Kafa tabanı kırığı bulgularının olmaması

Curr Pediatr Rev. 2017 Apr 4. doi: 10.2174/1573396313666170404113214. [Epub ahead of print]

Minor Head Trauma in the Pediatric Emergency Department: Decision Making Nodes.

Mastrangelo M[1], Midulla F[2].

⊕ Author information

Abstract

BACKGROUND: Minor head trauma is one of the leading cause of access to pediatric emergency departments with only a limited quote of patients resulting in clinically relevant brain injuries.

OBJECTIVES: The aim of this review is to guide physicians involved in the management of pediatric head trauma towards a correct clinical approach.

METHODS: A Pubmed/Medline search was realized through different entries including "minor head trauma" or "mild head trauma", "minor head injury" or "mild head injury", "acute head trauma". All the studies including pediatric samples between 2000 and 2015 were considered for a critical revision while a minority of papers written before 2000 was analyzed because of their relevance.

RESULTS: The Pediatric Emergency Care Applied Research Network (PECARN) algorithm stratified the main risk factors for clinically relevant brain injuries (very low risk for children with normal mental status no loss of consciousness no vomiting, non-severe injury mechanism, no signs of basilar skull fracture, no severe headache, no evident clinical worsening over time and no multiple symptoms) and offered the only validated clinical prediction rule to select candidates for CT scans. Skull X-ray, cerebral magnetic resonance and cranial ultrasonography could provide useful information in selected cases.

CONCLUSIONS: The critical use of PECARN rule represents the best validated clinical tool for the early identification of children with a clinically relevant bran injury.

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KEYWORDS: children; clinical prediction rule ; clinically relevant brain injury; minor head trauma

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External Validation of the PECARN Head Trauma Prediction Rules in Jap [Acad Emerg Med. 2017]

Review Will Neuroimaging Reveal a Severe Intracranial Injury in This Adult Wit [JAMA. 2015]

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J Neurosurg Pediatr. 2017 Apr 7:1-7. doi: 10.3171/2017.2.PEDS16419. [Epub ahead of print]

Medical necessity of routine admission of children with mild traumatic brain injury to the intensive care unit.

Ament JD[1], Greenan KN[1], Tertulien P[1], Galante JM[2], Nishijima DK[3], Zwienenberg M[1].

⊕ Author information

Abstract

OBJECTIVE Approximately 475,000 children are treated for traumatic brain injury (TBI) in the US each year; most are classified as mild TBI (Glasgow Coma Scale [GCS] Score 13-15). Patients with positive findings on head CT, defined as either intracranial hemorrhage or skull fracture, regardless of severity, are often transferred to tertiary care centers for intensive care unit (ICU) monitoring. This practice creates a significant burden on the health care system. The purpose of this investigation was to derive a clinical decision rule (CDR) to determine which children can safely avoid ICU care. METHODS The authors retrospectively reviewed patients with mild TBI who were ≤ 16 years old and who presented to a Level 1 trauma center between 2008 and 2013. Data were abstracted from institutional TBI and trauma registries. Independent covariates included age, GCS score, pupillary response, CT characteristics, and Injury Severity Score. A composite outcome measure, ICU-level care, was defined as cardiopulmonary instability, transfusion, intubation, placement of intracranial pressure monitor or other invasive monitoring, and/or need for surgical intervention. Stepwise logistic regression defined significant predictors for model inclusion with $p < 0.10$. The authors derived the CDR with binary recursive partitioning (using a misclassification cost of 20:1). RESULTS A total of 284 patients with mild TBI were included in the analysis; 40 (14.1%) had ICU-level care. The CDR consisted of 5 final predictor variables: midline shift > 5 mm, intraventricular hemorrhage, nonisolated head injury, postresuscitation GCS score of < 15, and cisterns absent. The CDR correctly identified 37 of 40 patients requiring ICU-level care (sensitivity 92.5%; 95% CI 78.5-98.0) and 154 of 244 patients who did not require an ICU-level intervention (specificity 63.1%; 95% CI 56.7-69.1). This results in a negative predictive value of 98.1% (95% CI 94.1-99.5). CONCLUSIONS The authors derived a clinical tool that defines a subset of pediatric patients with mild TBI at low risk for ICU-level care. Although prospective evaluation is needed, the potential for improved resource allocation is significant.

KEYWORDS: CDR = clinical decision rule; GCS = Glasgow Coma Scale; ICH = intracranial hemorrhage; ICP = intracranial pressure; ICU = intensive care unit; ICU monitoring; IQR = interquartile range; ISS = Injury Severity Score; IVH = intraventricular hemorrhage; LOS = length of hospital stay; MLS = midline shift; MVC = motor vehicle crash; NPV = negative predictive value; PECARN = Pediatric Emergency Care Applied Research Network; TBI = traumatic brain injury; clinical decision rule; resource allocation; trauma; traumatic brain injury; triage

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Prognostication of traumatic brain injury outcomes in older tra [Int J Crit Illn Inj Sci. 2017]

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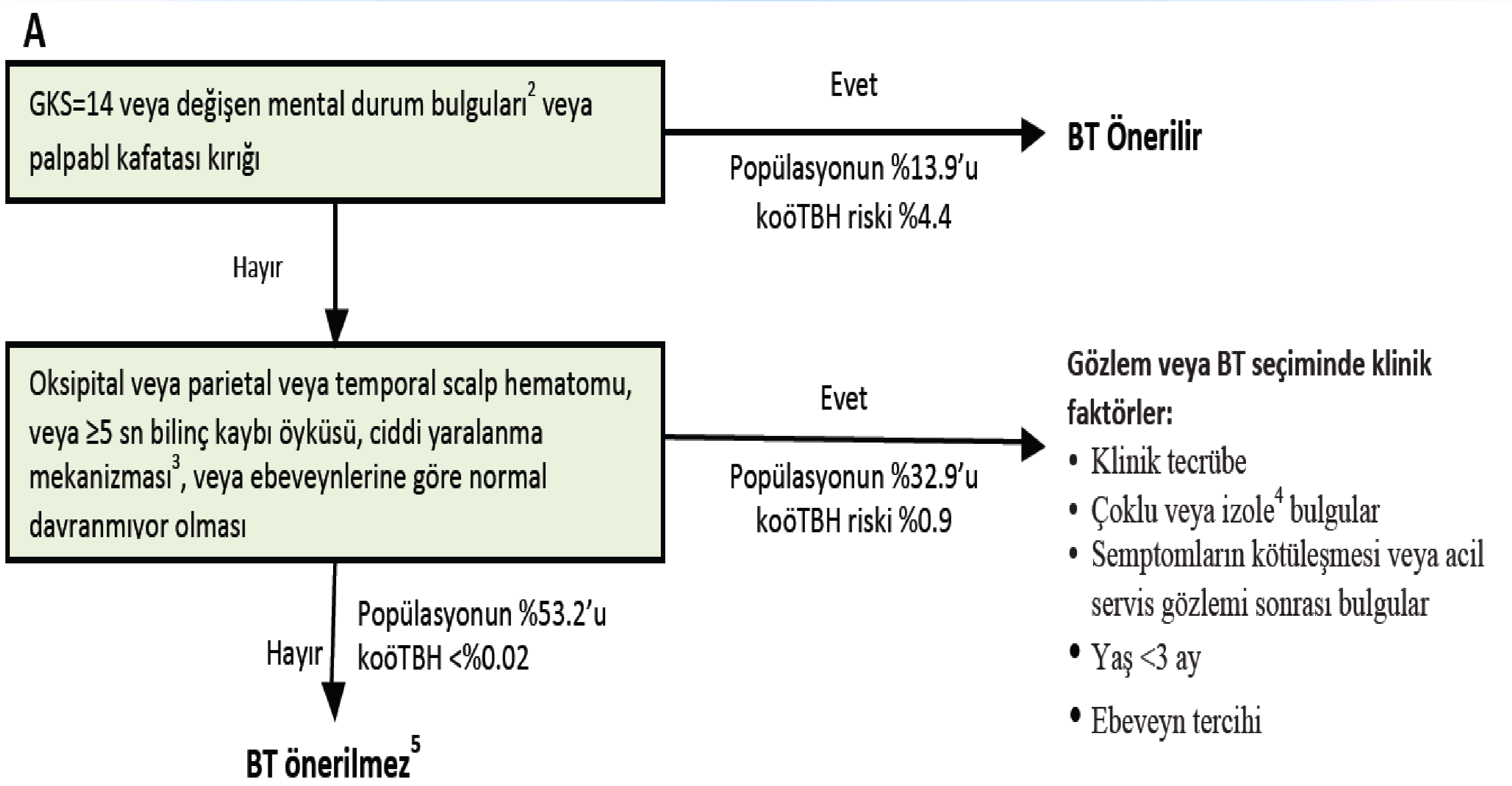
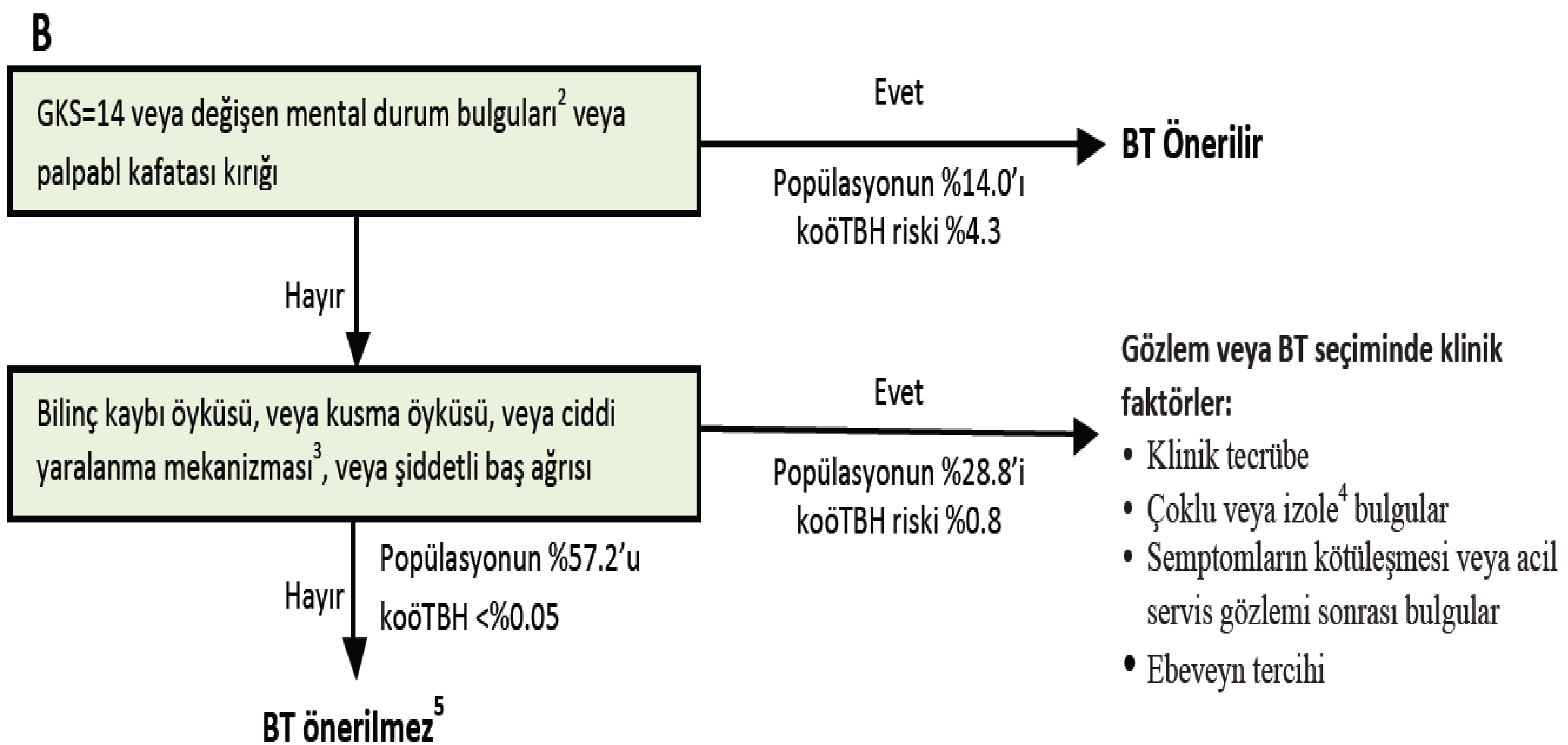


PECARN ALGORİTM
> 2 Yaş



Pediatrics. 2017 Mar 24. pii: e20162709. doi: 10.1542/peds.2016-2709. [Epub ahead of print]

Use of Traumatic Brain Injury Prediction Rules With Clinical Decision Support.

Dayan PS[1], Ballard DW[2,3], Tham E[4], Hoffman JM[5], Swietlik M[6], Deakyne SJ[6], Alessandrini EA[7], Tzimenatos L[8,9], Bajaj L[4], Vinson DR[3,10], Mark DG[11], Offerman SR[12], Chettipally UK[13], Paterno MD[14], Schaeffer MH[15], Wang J[16], Casper TC[16], Goldberg HS[14,15], Grundmeier RW[17], Kuppermann N[8,9]; Pediatric Emergency Care Applied Research Network (PECARN); Clinical Research on Emergency Services and Treatment (CREST) Network; and Partners Healthcare; Traumatic Brain Injury-Knowledge Translation Study Group.

⊕ Author information

Abstract

OBJECTIVES: We determined whether implementing the Pediatric Emergency Care Applied Research Network (PECARN) traumatic brain injury (TBI) prediction rules and providing risks of clinically important TBIs (ciTBIs) with computerized clinical decision support (CDS) reduces computed tomography (CT) use for children with minor head trauma.

METHODS: Nonrandomized trial with concurrent controls at 5 pediatric emergency departments (PEDs) and 8 general EDs (GEDs) between November 2011 and June 2014. Patients were <18 years old with minor blunt head trauma. Intervention sites received CDS with CT recommendations and risks of ciTBI, both for patients at very low risk of ciTBI (no Pediatric Emergency Care Applied Research Network rule factors) and those not at very low risk. The primary outcome was the rate of CT, analyzed by site, controlling for time trend.

RESULTS: We analyzed 16 635 intervention and 2394 control patients. Adjusted for time trends, CT rates decreased significantly ($P < .05$) but modestly (2.3%-3.7%) at 2 of 4 intervention PEDs for children at very low risk. The other 2 PEDs had small (0.8%-1.5%) nonsignificant decreases. CT rates did not decrease consistently at the intervention GEDs, with low baseline CT rates (2.1%-4.0%) in those at very low risk. The control PED had little change in CT use in similar children (from 1.6% to 2.9%); the control GED showed a decrease in the CT rate (from 7.1% to 2.6%). For all children with minor head trauma, intervention sites had small decreases in CT rates (1.7%-6.2%).

CONCLUSIONS: The implementation of TBI prediction rules and provision of risks of ciTBIs by using CDS was associated with modest, safe, but variable decreases in CT use. However, some secular trends were also noted.

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Canadian Assessment of Tomography for Childhood Head Injury (CATCH)

CT of the head is required only for children with minor head injury* and any one of the following findings:
High risk (need for neurologic intervention)
1. Glasgow Coma Scale score <15 at two hours after injury
2. Suspected open or depressed skull fracture
3. History of worsening headache
4. Irritability on examination
Medium risk (brain injury on CT scan)
5. Any sign of basal skull fracture (eg, hemotympanum, "raccoon" eyes, otorrhea or rhinorrhea of the cerebrospinal fluid, Battle's sign)
6. Large, boggy hematoma of the scalp
7. Dangerous mechanism of injury (eg, motor vehicle crash, fall from elevation ≥3 ft [≥91 cm] or 5 stairs, fall from bicycle with no helmet)

CT: computed tomography.
* Minor head injury is defined as injury within the past 24 hours associated with witnessed loss of consciousness, definite amnesia, witnessed disorientation, persistent vomiting (more than one episode) or persistent irritability (in a child under two years of age) in a patient with a Glasgow Coma Scale score of 1315.

Childs Nerv Syst. 2016 May;32(5):827-31. doi: 10.1007/s00381-016-3030-5. Epub 2016 Feb 3.

Presenting characteristics of children who required neurosurgical intervention for head injury.

Tavor O[1], Boddu S[2], Kulkarni AV[3].

⊕ Author information

Abstract

PURPOSE: The purpose of this study is to describe the presenting characteristics of a large group of children who required neurosurgical intervention (NSI) following a head injury and to retrospectively assess which of the criteria for imaging from Children's Head Injury Algorithm for the Prediction of Important Clinical Events (CHALICE), Pediatric Emergency Care Applied Research Network (PECARN), and Canadian Assessment of Tomography for Childhood Head Injury (CATCH) clinical decision rules (CDRs) were met by these patients.

STUDY DESIGN: We retrospectively reviewed all patients undergoing NSI following a head injury, between 2000 and 2008, at a large tertiary pediatric trauma center. We excluded patients having non-accidental injury, other neurosurgical interventions, penetrating injuries, and patients with incomplete data. To those who presented initially with mild head injury (GCS 14-15), we retrospectively applied the criteria for imaging of the CHALICE, PECARN, and CATCH CDRs.

RESULTS: Out of 289 patients undergoing NSI, 182 met inclusion criteria and comprised our cohort. Of the 72 (39.6 %) with mild head injury (GCS 14-15), 71 (98.6 %) met at least one criteria for imaging from each of the three CDRs, including severe mechanism of injury (68, 94.4 %), clinically evident skull fracture (35, 48.6 %), neurological deficit (19, 26.3 %), or severe headache (6, 8.3 %). Of the 182 patients in the entire cohort, only 1 (0.5 %) did not present with an obvious indication for CT on all three CDRs.

CONCLUSIONS: In a large sample of children requiring NSI after head trauma, the vast majority met CT criteria listed in each of the three CDRs. The most common indication for CT was a severe mechanism of injury. This, combined with clinically evident skull fracture, neurological deficit, and severe headache, identifies almost all patients requiring NSI.

KEYWORDS: CT scan; Head injury; Neurosurgical intervention

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Minör kafa travması olan çocuklarda BT istenmesinde karar verme yöntemleri

- GKS 13-15
- Geçici bilinç kaybı
- Amnezi
- Oryantasyon bozukluğu
- İki yada daha fazla epizodda (en az 15 dk ara) kusma
- İritabilite (2 yaş ve altında)

Acad Emerg Med. 2016 May;23(5):576-83. doi: 10.1111/acem.12957. Epub 2016 Apr 15.

Scalp Hematoma Characteristics Associated With Intracranial Injury in Pediatric Minor Head Injury.

Burns EC[1], Grool AM[2], Klassen TP[3], Correll R[4], Jarvis A[5], Joubert G[6], Bailey B[7], Chauvin-Kimoff L[8], Pusic M[9], McConnell D[10], Nijssen-Jordan C[11], Silver N[11], Taylor B[12], Osmond MH[2,13]; Pediatric Emergency Research Canada (PERC) Head Injury Study Group.

⊕ Collaborators (6)

⊕ Author information

Abstract

OBJECTIVES: Minor head trauma accounts for a significant proportion of pediatric emergency department (ED) visits. In children younger than 24 months, scalp hematomas are thought to be associated with the presence of intracranial injury (ICI). We investigated which scalp hematoma characteristics were associated with increased odds of ICI in children less than 17 years who presented to the ED following minor head injury and whether an underlying linear skull fracture may explain this relationship.

METHODS: This was a secondary analysis of 3,866 patients enrolled in the Canadian Assessment of Tomography of Childhood Head Injury (CATCH) study. Information about scalp hematoma presence (yes/no), location (frontal, temporal/parietal, occipital), and size (small and localized, large and boggy) was collected by emergency physicians using a structured data collection form. ICI was defined as the presence of an acute brain lesion on computed tomography. Logistic regression analyses were adjusted for age, sex, dangerous injury mechanism, irritability on examination, suspected open or depressed skull fracture, and clinical signs of basal skull fracture.

RESULTS: ICI was present in 159 (4.1%) patients. The presence of a scalp hematoma (n = 1,189) in any location was associated with significantly greater odds of ICI (odds ratio [OR] = 4.4, 95% confidence interval [CI] = 3.06 to 6.02), particularly for those located in temporal/parietal (OR = 6.0, 95% CI = 3.9 to 9.3) and occipital regions (OR = 5.6, 95% CI = 3.5 to 8.9). Both small and localized and large and boggy hematomas were significantly associated with ICI, although larger hematomas conferred larger odds (OR = 9.9, 95% CI = 6.3 to 15.5). Although the presence of a scalp hematoma was associated with greater odds of ICI in all age groups, odds were greatest in children aged 0 to 6 months (OR = 13.5, 95% CI = 1.5 to 119.3). Linear skull fractures were present in 156 (4.0%) patients. Of the 111 patients with scalp hematoma and ICI, 57 (51%) patients had a linear skull fracture and 54 (49%) did not. The association between scalp hematoma and ICI attenuated but remained significant after excluding patients with linear skull fracture (OR = 3.3, 95% CI = 2.1 to 5.1).

CONCLUSIONS: Large and boggy and nonfrontal scalp hematomas had the strongest association with the presence of ICI in this large pediatric cohort. Although children 0 to 6 months of age were at highest odds, the presence of a scalp hematoma also independently increased the odds of ICI in older children and adolescents. The presence of a linear skull fracture only partially explained this relation, indicating that ruling out a skull fracture beneath a hematoma does not obviate the risk of intracranial pathology.

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Clinical Decision Rules for Paediatric Minor Head Injury: Are CT Scans a Necessary Evil?

Thiam DW[1], Yap SH, Chong SL.

⊕ Author information

Abstract

INTRODUCTION: High performing clinical decision rules (CDRs) have been derived to predict which head-injured child requires a computed tomography (CT) of the brain. We set out to evaluate the performance of these rules in the Singapore population.

MATERIALS AND METHODS: This is a prospective observational cohort study of children aged less than 16 who presented to the emergency department (ED) from April 2014 to June 2014 with a history of head injury. Predictor variables used in the Canadian Assessment of Tomography for Childhood Head Injury (CATCH), Children's Head Injury Algorithm for the Prediction of Important Clinical Events (CHALICE) and Pediatric Emergency Care Applied Research Network (PECARN) CDRs were collected. Decisions on CT imaging and disposition were made at the physician's discretion. The performance of the CDRs were assessed and compared to current practices.

RESULTS: A total of 1179 children were included in this study. Twelve (1%) CT scans were ordered; 6 (0.5%) of them had positive findings. The application of the CDRs would have resulted in a significant increase in the number of children being subjected to CT (as follows): CATCH 237 (20.1%), CHALICE 282 (23.9%), PECARN high- and intermediate-risk 456 (38.7%), PECARN high-risk only 45 (3.8%). The CDRs demonstrated sensitivities of: CATCH 100% (54.1 to 100), CHALICE 83.3% (35.9 to 99.6), PECARN 100% (54.1 to 100), and specificities of: CATCH 80.3% (77.9 to 82.5), CHALICE 76.4% (73.8 to 78.8), PECARN high- and intermediate-risk 61.6% (58.8 to 64.4) and PECARN high-risk only 96.7% (95.5 to 97.6).

CONCLUSION: The CDRs demonstrated high accuracy in detecting children with positive CT findings but direct application in areas with low rates of significant traumatic brain injury (TBI) is likely to increase unnecessary CT scans ordered. Clinical observation in most cases may be a better alternative.

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Computed tomography of the head is required if any of the following criteria are present.

History

- Witnessed loss of consciousness of >5 min duration
- History of amnesia (either antegrade or retrograde) of >5 min duration
- Abnormal drowsiness (defined as drowsiness in excess of that expected by the examining doctor)
- ⩾3 vomits after head injury (a vomit is defined as a single discrete episode of vomiting)
- Suspicion of nonaccidental injury (NAI, defined as any suspicion of NAI by the examining doctor)
- Seizure after head injury in a patient who has no history of epilepsy

Examination

- Glasgow Coma Score (GCS) <14, or GCS <15 if <1 year old
- Suspicion of penetrating or depressed skull injury or tense fontanelle
- Signs of a basal skull fracture (defined as evidence of blood or cerebrospinal fluid from ear or nose, panda eyes, Battles sign, haemotympanum, facial crepitus or serious facial injury)
- Positive focal neurology (defined as any focal neurology, including motor, sensory, coordination or reflex abnormality)
- Presence of bruise, swelling or laceration >5 cm if <1 year old

Mechanism

- Highspeed road traffic accident either as pedestrian, cyclist or occupant (defined as accident with speed >40 m/h)
- Fall of >3 m in height
- Highspeed injury from a projectile or an object

If none of the above variables are present, the patient is at low risk of intracranial pathology.

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Comparison of PECARN, CATCH, and CHALICE rules for children with minor head injury: a prospective cohort study.

Easter JS[1], Bakes K[2], Dhaliwal J[3], Miller M[3], Caruso E[2], Haukoos JS[4].

⊕ Author information

Abstract

STUDY OBJECTIVE: We evaluate the diagnostic accuracy of clinical decision rules and physician judgment for identifying clinically important traumatic brain injuries in children with minor head injuries presenting to the emergency department.

METHODS: We prospectively enrolled children younger than 18 years and with minor head injury (Glasgow Coma Scale score 13 to 15), presenting within 24 hours of their injuries. We assessed the ability of 3 clinical decision rules (Canadian Assessment of Tomography for Childhood Head Injury [CATCH], Children's Head Injury Algorithm for the Prediction of Important Clinical Events [CHALICE], and Pediatric Emergency Care Applied Research Network [PECARN]) and 2 measures of physician judgment (estimated of <1% risk of traumatic brain injury and actual computed tomography ordering practice) to predict clinically important traumatic brain injury, as defined by death from traumatic brain injury, need for neurosurgery, intubation greater than 24 hours for traumatic brain injury, or hospital admission greater than 2 nights for traumatic brain injury.

RESULTS: Among the 1,009 children, 21 (2%; 95% confidence interval [CI] 1% to 3%) had clinically important traumatic brain injuries. Only physician practice and PECARN identified all clinically important traumatic brain injuries, with ranked sensitivities as follows: physician practice and PECARN each 100% (95% CI 84% to 100%), physician estimates 95% (95% CI 76% to 100%), CATCH 91% (95% CI 70% to 99%), and CHALICE 84% (95% CI 60% to 97%). Ranked specificities were as follows: CHALICE 85% (95% CI 82% to 87%), physician estimates 68% (95% CI 65% to 71%), PECARN 62% (95% CI 59% to 66%), physician practice 50% (95% CI 47% to 53%), and CATCH 44% (95% CI 41% to 47%).

CONCLUSION: Of the 5 modalities studied, only physician practice and PECARN identified all clinically important traumatic brain injuries, with PECARN being slightly more specific. CHALICE was incompletely sensitive but the most specific of all rules. CATCH was incompletely sensitive and had the poorest specificity of all modalities.

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Physician practice and PECARN rule outperform CATCH and CHALICE rules based on the detection of traumatic brain injury as defined by PECARN. [Evid Based Med. 2015]

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