

KQ 1. 경미한 뇌 외상 환자에서 진단을 위한 적절한 영상검사는 무엇인가?

권고 1. 경미한 뇌 외상 환자에게 적절한 영상검사로 CT 또는 MRI를 권고한다.
(권고등급 B, 근거수준 II)

근거요약

성인의 급성 뇌 손상환자는, 글라스고 척도(Glasgow scale)이 13~15점인 경미한 손상(mild), 8~12점의 중등도 손상(moderate), 8점 이하의 심한(severe) 뇌 손상으로 구분할 수 있으며(1,2), 이중 경미한 손상 환자(mild traumatic brain: MBT) 환자에게서 부적절한 검사를 피하거나, 경미한 손상 환자(MBT)의 일부에게서 나타나는 합병증, 동반손상 및 진행되는 병변을 진단하는 것은 임상적으로 무척 중요하다(3). MBT 환자 군의 영상진단에 대해 가이드라인은 검색 후 6개의 관련 가이드라인이 선택되었다. 6개의 class II 문헌 리뷰결과, 주로 CT를 일반적으로 권고하며(4-7), 보완적으로 MRI를 권고하였고(8,9), 일부 제한적 경우에 조영제 사용을 권고하며(10), 단순두개골촬영(11, 12), 관류영상(13), 기능적 자기공명영상(13)과 확산텐서영상(13) 등은 권고하지 않았다. 소아 환자의 경우에는 일반적으로 권고하지 않으며, 두개 내 손상 위험요인이 높은 경우에만 CT 시행을 권고하였다(14,15,16).

표 1. Glasgow Coma Scale (GCS)

Category	Adult	Scale	Infant
Eye Opening	Spontaneous	4	Spontaneous
	To speech	3	To speech
	To pain	2	To pain
	No response	1	No response
Best moter response	obeys verbal command	6	obeys verbal command
	Localizes pain	5	Localizes pain
	Withdraws form pain	4	Withdraws form pain
	Flexion - abnormal*	3	Flexion - abnormal
	Extension**	2	Extension
No response	1	No response	
Best verbal response	Oriented and converses	5	Coos, babbles
	Disoriented and converses	4	Cries but consonable
	Inappropriate words	3	Persistently irritable
	Incomprehensible sounds	2	Grunts to pain/restless
	No response	1	No response

표 2. Classification of traumatic brain injury and indication for immediate head CT

분류	분류항목	Immediate head CT 지표
Mild	Hospital admission GCS=13~15 Loss of consciousness if present 30 min or less	
분류	1 GCS=15 No risk factors or only 1 minor risk factor present(CHIP rule) Head injury, no traumatic brain injury	No
	2 GCS=15 With risk factor: ≥ 1 major risk factor(s) or ≥ 2 minor risk factor(CHIP rule)	Yes
	3 GCS = 13-14	Yes
Moderate	GCS=9-12	Yes
Severe	GCS \leq 8	Yes
Critical	GCS=3-4, with loss of pupillary reactions and absent or decelerate motor reactions	Yes

표 3. 위험요인

분류	요인
History	Age Loss of consciousness Headache Vomiting Post-traumatic seizure Dizziness Pre-traumatic seizure Anticoagulation therapy
Examination	GCS score < 15 Suspicion of open or depressed skull fracture Clinical signs of basal skull fracture Clinical signs of skull fracture Intoxication Persistent anterograde amnesia Focal neurologic deficit Retrograde amnesia Contusion of the skull Signs of facial fracture Contusion of the face GCS score deterioration Prolonged PTA Multiple injuries
Mechanism	Dangerous mechanism (Dangerous mechanism in CHIP defined as ejected from vehicle, pedestrian or cyclist versus vehicle) High-energy trauma Unclear trauma mechanism

권고 고려사항



1. 이득과 위해


일반적으로 CT를 권고하나, 미만성 축삭손상(diffuse axonal injury)(17,18), 아급성 및 만성 시기의 뇌손상 평가, 지주막하 출혈 등을 목적으로 하는 경우에는 MRI를 권고하였고, 소아나 2세 미만의 경우 CT는 방사선 피폭이나 의료비(cost)를 고려해야 한다.

2. 국내 수용성과 적용성(Acceptability and Applicability)

진료지침의 국내 수용성과 적용성은 평가결과 큰 무리가 없는 것으로 판단되었다. 수용성과 적용성 평가표는 부록에 제시한다.

3. 검사별 방사선량

뇌 CT, CT 뇌혈관 조영검사(Brain CT angiography)  

단순두개골 촬영 

참고문헌

1. National Institute for Health and Care Excellence. Head Injury: assessment and early management. Clinical guideline. Available from: URL: <http://nice.org.uk/guidance/cg176> . Accessed Jan 22, 2014.
2. Vos PE, Alekseenko Y, Battistin L, Ehler E, Gerstenbrand F, Muresanu DF, Potapov A, Stepan C A, Traubner P, Vecsei L, von Wild K, European Federation of Neurological Societies. Mild traumatic brain injury. *Eur J Neurol.* 2012;19(2):191–8.
3. Cassidy JD, Carroll LJ, Peloso PM, Borg J, von Holst H, Holm L, Kraus J, Coronado VG, Incidence, Risk Factors and Prevention of Mild Traumatic Brain Injury: Results of the WHO Collaborating Centre Task Force on Mild Traumatic Brain Injury. *J Rehabil Med.* 2004;43(Suppl):28–60.
4. Livingston DH, Loder PA, Hunt CD, Minimal Head Injury: Is Admission Necessary? *Am Surg.* 1991;57(1):14–7.
5. Nagy KK, Joseph KT, Krosner SM, et al. The Utility of Head Computed Tomography After Minimal Head Injury. *J Trauma* 1999;46(2):268–70.
6. Stein SC, O'Malley KF, Ross SE, Is Routine Computed Tomography Scanning Too Expensive for Mild Head Injury. *Ann Emerg Med.* 1991;20(12):1286–9.
7. Undén Ingebrigtsen T, Romner B; Scandinavian Neurotrauma Committee (SNC). Scandinavian Guidelines for Initial Management of Minimal, Mild and Moderate Head Injuries in Adults: an Evidence and Consensus-Based Update. *BMC Med.* 2013;25(11):50.
8. Kampfl A, Schmutzhard E, Franz G, et al. Prediction of Recovery from Post-Traumatic Vegetative State with Cerebral Magnetic-Resonance Imaging. *Lancet* 1998;351(9118):1763–7.
9. Ashikaga R, Araki Y, Ishida O, MRI of Head Injury Using FLAIR. *Neuroradiology* 1997;39(4):239–42.
10. Lang DA, Hadley DM, Teasdale GM, Macpherson P, Teasdale E, Gadolinium DTPA Enhanced Magnetic Resonance Imaging in Acute Head Injury. *Acta Neurochir. (Wien)* 1991;109(1–2):5–11.
11. Jagoda AS, Bazarian JJ, Bruns JJ Jr, Cantrill SV, Gean AD, Howard PK, Ghajar J, Riggio S, Wright DW, Wears RL, Bakshy A, Burgess P, Wald MM, Whitson RR, Clinical Policy: Neuroimaging and Decisionmaking in Adult Mild Traumatic Brain Injury in the Acute Setting. *J Emerg Nurs.* 2009;35(2):5–40.
12. Stiell IG, Wells GA, Vandemheen K, et al. The Canadian CT Head Rule for Patients with Minor Head Injury. *Lancet.*
13. Ashikaga R, Araki Y, Ishida O, MRI of Head Injury Using FLAIR. *Neuroradiology* 2001;357(9266):1391–6.
14. Dunning J, Patrick Daly J, Lomas JP, Lecky F, Batchelor J, Mackway-Jones K, Derivation of the Children's Head Injury Algorithm for the Prediction of Important Clinical Events Decision Rule for Head Injury in Children. 2006;91(11):885–91.
15. Kuppermann N, Holmes JF, Dayan PS, Hoyle JD Jr, Atabaki SM, Holubkov R, Nadel FM, Monroe D, Stanley RM, Borgialli DA, Badawy MK, Schunk JE, Quayle KS, Mahajan P, Lichenstein R, Lillis KA, Tunik MG, Jacobs ES, Callahan JM, Gorelick MH, Glass TF, Lee LK, Bachman MC, Cooper A, Powell EC, Gerardi MJ, Melville KA, Muizelaar JP, Wisner DH, Zuspan SJ, Dean JM, Wootton-Gorges SL; Pediatric Emergency Care Applied Research Network (PECARN). Identification of Children at Very Low Risk of Clinically-Important Brain Injuries after Head Trauma: a Prospective Cohort Study. *Lancet* 2009;374(9696):1160–70.
16. Atabaki SM, Stiell IG, Bazarian JJ, Sadow KE, Vu TT, Camarca MA, Berns S, Chamberlain JM, A Clinical Decision Rule for Cranial Computed Tomography in Minor Pediatric Head Trauma. [Arch Pediatr Adolesc Med.](#) 2008;162(5):439–45.

17. Gentry LR, Imaging of Closed Head Injury. *Radiology*. 1994;191(1):1-17.
18. Gentry LR, Godersky JC, Thompson B, MR Imaging of Head Trauma: Review of the Distribution and Radiopathologic Features of Traumatic Lesions. *AJR Am J Roentgenol*. 1988;150(3):663-72.