Marshall computed tomography classification

- Imaging findings for severe traumatic brain injury
- Retinal manifestations of traumatic brain injury
- Metabolomics Analysis Reveals Potential Biomarkers for Diffuse Axonal Injury Article Category: Original Work
- COMPUTED TOMOGRAPHY SCORING SCALES AS EARLY OUTCOME PREDICTORS IN PATIENTS WITH TRAUMATIC BRAIN INJURY: WHICH ONE TO USE?
- Brain Imaging Features in Patients with Gunshot Wounds to the Head
- The Incidence and Aetiology of Maxillofacial Trauma and Concomitant Traumatic Brain Injury in a Johannesburg Tertiary Hospital
- Comparative Analysis of Traumatic Brain Injury Severity in Motorcycle and Car Accident Victims Treated at Korle-Bu Teaching Hospital
- Resting-State EEG Signature of Early Consciousness Recovery in Comatose Patients with Traumatic Brain Injury

---

The Marshall CT Classification remains the most widely used system globally because of its simplicity and integration into many TBI protocols.

The Rotterdam CT Score is increasingly popular, particularly in research and prognostic modeling, due to its comprehensive nature.

---

see Traumatic brain injury CT Classification.

see also Helsinki CT score.

The introduction of structural imaging of the brain by computed tomography (CT) scans and magnetic resonance imaging (MRI) has further refined classification of head injury for prognostic, diagnosis, and treatment purposes.

The classification was published in 1992 [1)] describes 6 categories of severity of TBI based on a non-contrast head CT with binary assessments for presence or absence of:

1. intracranial abnormalities

2. CT evidence of increased ICP as demonstrated by a) midline shift (MLS) >5mm and/or

b) compression of basal cisterns

3. presence or absence of mass lesions (contusions/hemorrhages)

4. planned evacuation of mass lesions

Since its introduction in 1991, the Marshall CT classification has become largely accepted for its descriptive and predictive value. For example, the IMPACT (International Mission for Prognosis and

Analysis of Clinical Trial in TBI) prognostic model applies the Marshall CT score for 6-month outcome prediction in patients with moderate to severe TBI [2].

The Marshall CT classification was, however, not designed for outcome prediction, and in 2005, Maas et al redesigned it for 6-month mortality prediction, resulting in the Rotterdam CT score [3].

Classification

Diffuse injury I (no visible pathology) No visible intracranial pathology seen on CT scan

Diffuse injury II Cisterns are present with midline shift of 0-5 mm and/or lesions densities present; no high or mixed density lesion >25 cm3 may include bone fragments and foreign bodies

Diffuse injury III (swelling) Cisterns compressed or absent with midline shift of 0-5 mm; no high or mixed density lesion >25 cm3

Diffuse injury IV (shift) Midline shift >5 mm; no high or mixed density lesion >25 cm3 Evacuated mass lesion Any lesion surgically evacuated Non-evacuated mass lesion High or mixed density lesion >25 cm3; not surgically evacuated [4].

Since its introduction in 1991, the Marshall CT classification has become largely accepted for its descriptive and predictive value. For example, the IMPACT (International Mission for Prognosis and Analysis of Clinical Trials in TBI) prognostic model applies the Marshall CT score for 6-month outcome prediction in patients with moderate to severe TBI [5].

Case series

634 consecutive neurosurgical trauma patients, who presented with mild-to-severe traumatic brain injury (TBI) from January 2013 to April 2014 at a tertiary care center in rural Nepal. All pertinent medical records (including all available imaging studies) were reviewed by the neurosurgical consultant and the radiologist on call. Patients' worst CT image scores and their outcome at 30 days were assessed and recorded. They then assessed their independent performance in predicting the mortality and also tried to seek the individual variables that had significant interplay for determining the same.

Both imaging score Marshall CT classification and clinical score (Rotterdam) can be used to reliably predict mortality in patients with acute TBI with high prognostic accuracy. Other specific CT characteristics that can be used to predict early mortality are traumatic subarachnoid hemorrhage, midline shift, and status of the peri-mesencephalic cisterns.

They demonstrated in this cohort that though the Marshall CT classification has the high predictive power to determine the mortality, better discrimination could be sought through the application of the Rotterdam score that encompasses various individual CT parameters. They thereby recommend the use of such comprehensive prognostic model so as to augment the predictive power for properly dichotomizing the prognosis of the patients with TBI. In the future, it will therefore be important to develop prognostic models that are applicable for the majority of patients in the world they live in, and not just a privileged few who can use resources not necessarily representative of their societal environment [6].

1)
Marshall LF, Marshall SB, Klauber MR, et al. The diagnosis of head injury requires a classification based on computed axial tomography. J Neurotrauma. 1992; 9:S287–S292
2)
Steyerberg EW, Mushkudiani N, Perel P, et al. Predicting outcome after traumatic brain injury: development and international validation of prognostic scores based on admission characteristics. PLoS Med. 2008;5 (8):e165.
3)
Maas AI, Hukkelhoven CW, Marshall LF, Steyerberg EW. Prediction of outcome in traumatic brain injury with computed tomographic character- istics: a comparison between the computed tomographic classification and combinations of computed tomographic predictors. Neurosurgery. 2005;57 (6):1173-1182; discussion 1173-1182.
4)
Maas AIR, Hukkelhoven CWPM, Marshall LF, Steyerberg EW. Prediction of outcome in traumatic brain injury with computed tomographic characteristics: a comparison between the computed tomographic classification and combinations of computed tomographic predictors. Neurosurgery. 2005 Dec.;57(6):1173-82
5)
Steyerberg EW, Mushkudiani N, Perel P, et al. Predicting outcome after traumatic brain injury: development and international validation of prognostic scores based on admission characteristics. PLoS Med. 2008;5 (8):e165.
6)
Munakomi S, Bhattarai B, Srinivas B, Cherian I. Role of computed tomography scores and findings to predict early death in patients with traumatic brain injury: A reappraisal in a major tertiary care hospital in Nepal. Surg Neurol Int. 2016 Feb 19;7:23. doi: 10.4103/2152-7806.177125. eCollection 2016. PubMed PMID: 26981324; PubMed Central PMCID: PMC4774167.