

## Neuroimaging Following Mild Traumatic Brain Injury

No imaging is recommended if criteria not met and symptoms are improving

Modality	Clinical indications in mTBI	Acute (injury-7 days post injury) <b>GOAL of IMAGING:</b> Identify surgical mass or lesions via Clinical red Flags	Sub-Acute (8-89 Days post injury) <b>GOAL of IMAGING:</b> Evaluate, enhance counseling, identify need for referral	Chronic (90 days or greater post injury) <b>GOAL of IMAGING:</b> Evaluate, enhance counseling, identify need for referral
CT	Utility varies based upon length of time between injury and presentation	Modality of choice if clinical evaluation indicates	Use only if MRI is contraindicated	Use only if MRI is contraindicated
MRI	<b>Minimum</b> requirements of a mTBI exam includes: 1.5 tesla or above with 3D T1/T2, FLAIR, DWI/DTI, SWI/GRE SWI/ GRE SWI may identify areas of prior DAI or prior microhemorrhage. GRE may be substituted if SWI not available or run as a complimentary exam DWI trace maps calculated from DTI data may be substituted for conventional DWI	If symptoms are worsening after 72 hours	Modality of choice	Modality of choice  DWI has low yield for individuals with chronic mTBI and persistent symptoms
PET	18 FDG-PET	No clinical indication	If there are no structural abnormalities identified on MRI or CT and/or abnormalities do not explain persistent symptoms, PET may offer additional information in the understanding of sequelae following mTBI	If there are no structural abnormalities identified on MRI or CT and/or abnormalities do not explain persistent symptoms, PET may offer additional information in the understanding of sequelae following mTBI
SPECT	If PET not available, consider HMPAO or ECD SPECT	No clinical indication	If there are no structural abnormalities identified on MRI or CT and/or abnormalities do not explain persistent symptoms, SPECT may offer additional information in the understanding of sequelae following mTBI	If there are no structural abnormalities identified on MRI or CT and/or abnormalities do not explain persistent symptoms, SPECT may offer additional information in the understanding of sequelae following mTBI

## Red Flags and Acute Imaging Indications<sup>1,2</sup>

Deteriorating level of consciousness	Double vision	Increased restlessness, combative or agitated behavior	Repeat vomiting
Results from a structural brain injury detection device (if available)	Seizures	Weakness or tingling in arms or legs	Severe or worsening headache

1. Haydel, M., Preston, C., Mills, T., Luber, S., Blaudeau, E., & DeBlieux, P., (2000). Indications for computed tomography in patients with minor head injury. *New England Journal of Medicine* 343(2), 100-105.  
2. TBICoE Military Acute Concussion Evaluation 2 Card (2020).

## Relationship Between Neuroimaging Techniques and Common mTBI Pathophysiology

mTBI Pathophysiology	MRI imaging Technique
Axonal Injury/White matter injury	Fluid Attenuated Inversion Recovery (FLAIR) Diffusion Weighted Imaging (DWI) 2D/3D T2
Traumatic Sub-Arachnoid Hemorrhage (tSAH)	FLAIR 3D T1 Susceptibility Weighted Imaging (SWI)/Gradient Echo (GRE)
Cortical contusions	FLAIR 3D T1 SWI/GRE
Vascular injury	SWI/GRE
Volume loss	3D T1

## Comprehensive History

Key Consideration	Example
Trajectory of symptoms	Is the individual seeing improvement or worsening of symptoms?
Functional impact on patient. Consideration of the societal, occupational and familial function impacts on patient	Does the service member have the ability to rest or is there a requirement to return to normal activities immediately?
Service member's history of concussions	Has the service member experienced more than one concussion? If so, how many and over what period of time?
Service member's history of examinations and assessments	How many visits to medical care has the service member had since time of injury?
Symptom tracking and documentation	How are symptoms being documented and what is being used to track symptoms? (Example, Neurobehavioral Symptom Inventory).
Service member's history of imaging after injury	If indicated, has c-spine imaging been completed?