

Did You Know? Brain Injuries

Take home message

- In Europe 2.5 million people suffer from TBI each year
- In Europe the incidence of out-of-hospital CA is approximately 80 patients per 100,000 people annually
- The estimated lifetime cost for each survivor of a severe brain injury exceeds \$4 million in the U.S. (3)



- There are two types of brain injury: traumatic and following cardiac arrest.

Traumatic brain injury (TBI) occurs when a sudden trauma causes damage to the brain by direct brain shock.

TBI is a major cause of mortality and morbidity in young people, and their incidence is increasing in people aged 65 years and older (1).

A TBI is caused by a bump, blow or jolt to the head.

Cardiac arrest (CA) is a major cause of mortality and neurologic disability. In Europe the incidence of out-of-hospital CA is approximately 80 patients per 100,000 people annually (2).

Cardiac arrest induces the cessation of cerebral blood flow, which can result in brain damage. When oxygen levels are significantly low for four minutes or longer, brain cells begin to die.

After five minutes permanent anoxic brain injury can occur. This cardiac arrest is a trauma to the body and brain.

Complications

- Recurring seizures, called post-traumatic epilepsy
- Small or large blood vessels damage
- Cranial nerves damage
- Communication problems
- Altered cognitive skills
- Coma
- Vegetative state
- Minimally conscious state
- Locked-in state (a person is awake but can't speak or move)

Possible treatment

- Medical treatment
(for minimizing restlessness and secondary injury)
- Surgery for injuries
(bleeding vessels or tissues may need to be repaired)
- Rehabilitation therapy

In Olea Sphere®?

The case above shows a patient in vegetative state, 28 days after cardiac arrest.

Morphological images could be analyzed using multiplanar view (MPVR) in Olea Vision™.

Using diffusion tensor imaging (DTI) technique, we can quantify the value of the fraction of anisotropy (FA) in the ROI (region of interest) (ROI 2 and 3 in visibly pathological zones, FA equal to 0.18) (Picture 1).

This measurement is proportional to the density of fibers.

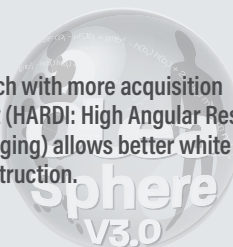
The major decrease of FA value suggests severe damage of the white matter. In this case FA value is measured in several ROIs of the white matter. The analysis by ROIs shows a significant decline in FA in all studied regions.

The tractography makes it possible to reconstruct and thus to display the beam path of the white matter.

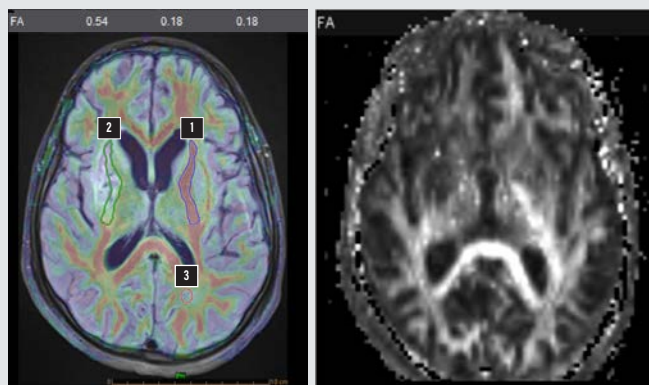
In this case the tractography shows the deep involvement of the right corticospinal tract (Picture 2).



A DTI approach with more acquisition management (HARDI: High Angular Resolution Diffusion Imaging) allows better white matter fibers reconstruction.

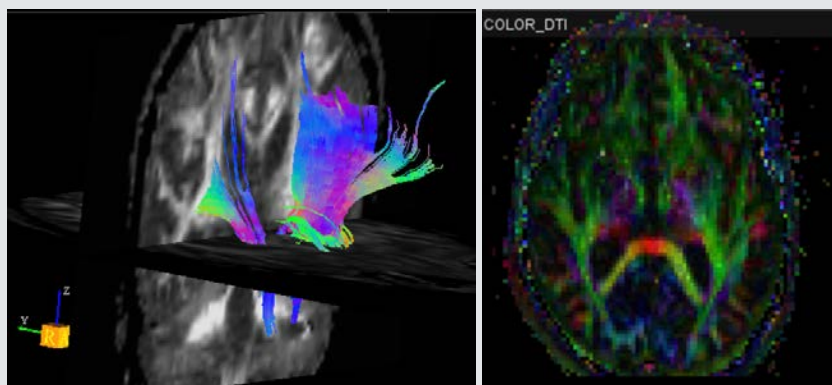


◀ Picture 1 ▶



Acknowledgements: Dr. Velly, APHM

◀ Picture 2 ▶



Sources: ■ [Ref 1] [http://www.thelancet.com/pdfs/journals/lanpub/PIIS2468-2667\(16\)30017-2.pdf](http://www.thelancet.com/pdfs/journals/lanpub/PIIS2468-2667(16)30017-2.pdf) ■ [Ref 2] <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5390465/> ■ [Ref 3] <https://biu.org/facts-about-brain-injury/> ■ <http://www.asnr.org/patientinfo/conditions/tbi.shtml#shaahsA9p5f8.dpbs> ■ <http://www.em-consulte.com/en/article/722761> ■ https://www.researchgate.net/publication/280997598_Epidemiology_of_traumatic_brain_injury_in_Europe ■ https://ec.europa.eu/health/sites/health/files/data_collection/docs/dlt_report_2013_en.pdf ■ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC469652/> ■ <https://www.cdc.gov/traumaticbraininjury/data/index.html> ■ https://www.cdc.gov/traumaticbraininjury/pdf/bluebook_factsheet-a.pdf ■ <https://www.headway.org.uk/about-brain-injury/further-information/statistics/> ■ <https://www.ncbi.nlm.nih.gov/pubmed/2012788> ■ <http://www.aajnr.org/content/36/2/E13full> ■ <http://www.asnr.org/patientinfo/conditions/tbi.shtml#shaahsA9p5f8.dpbs> ■ <https://www.headway.org.uk/about-brain-injury/further-information/statistics/> ■ <http://www.visionteam.com/why-stats.asp> ■ <http://www.mayoclinic.org/diseases-conditions/traumatic-brain-injury/basics/complications/con-20029302> ■ <http://www.traumaticbraininjury.com/treatments-for-tbi/acute-treatment/> ■ <https://jintensivecare.biomedcentral.com/articles/10.1186/s40560-016-0140-9> ■ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4056000/> ■ <https://www.upToDate.com/contents/hypoxic-ischemic-brain-injury-evaluation-and-prognosis> ■ <https://www.headway.org.uk/about-brain-injury/individuals/types-of-brain-injury/hypoxic-and-anoxic-brain-injury-treatment-and-recovery/> ■ <https://www.headway.org.uk/about-brain-injury/individuals/types-of-brain-injury/hypoxic-and-anoxic-brain-injury-effects/> ■ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3074242/> ■ <https://jhu.pure.elsevier.com/en/publications/management-of-brain-injury-after-cardiac-arrest-3> ■ http://www.hear.org/HEARTORG/Conditions/More/CardiacArrest/Prognosis-for-Cardiac-Arrest-Survivors_UCM_307918_Article.jsp#WglgGjWxPY ■ https://scl.drl.it/usherbrooke.ca/wp-content/papers/Descoteaux_eeels.pdf ■ VA // BT // SF // LV.