

# **Neurotrauma**

**First Edition  
January 2023**

**History  
Diagnosis  
Therapy**

**By**

**Armin A. Norousi M.D.  
Jalal J. Shokouhi M.D.**

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**Armin A. Norusi M.D.**  
Neurosurgeon

Head of Spine Care /MVZ, Berlin, Germany  
Guest Professor in the University Lemberg /  
UKs

Chairman of international Europe-Middle-  
East Neurocongress  
CEO & Founder of International Education  
Center e. V. (IEC e. V.), Munich, Germany  
[www.sinapublisher.com](http://www.sinapublisher.com)  
[info@sinapublisher.com](mailto:info@sinapublisher.com)  
[Book.neurosurgery@gmail.com](mailto:Book.neurosurgery@gmail.com)



**Jalal J. Shokouhi M.D.**  
Neuroradiologist

President of Iranian Society of Radiology  
Founder of TBP Co. No.467, Hafez St.  
Tehran, Iran

Co-Founder of International Education  
Center e.V (IEC e. V.), Munich, Germany  
Medical Manager of Koroush and Jaame-  
Jam imaging centers  
[www.Medimage.ir](http://www.Medimage.ir)  
[www.Radioogle.ir](http://www.Radioogle.ir)  
[Jalaljalalshokouhi@hotmail.com](mailto:Jalaljalalshokouhi@hotmail.com)



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[info@sinapublisher.com](mailto:info@sinapublisher.com)  
[Book.neurosurgery@gmail.com](mailto:Book.neurosurgery@gmail.com)

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**TO THOSE,  
WHO ARE SUFFERING**

## **Preface**

Rapid advances in the field of CNS disorders have opened a new route of diagnostic and therapy in this field.

Knowledge of current concepts associated with Neurotrauma of CNS and PNS is a crucial issue for providing appropriate evaluation, referral and treatment of patients with traumatic injuries of central- and Prepheral traumatic injuries.

The main goal of this book is to provide broad based current knowledge of diverse fields of neurotrama of CNS & PNS on a high level.

The book contains a compact text from several neurosurgical sources consisting of many journals and books, which have been published currently in the neurosurgical field.

The topics have been arranged in Top Down starting from cerebral to the spine to provide the readers with sound knowledge base in the fundamentals of anatomy, history, diagnostics, clinical assessment and also operative and non-operative therapy of neurotrauma of CNS & PNS.

The text has been made spare and concise therefore it could be read quickly in the clinic during the patient rounds daily work and also in the operating room.

We have created about 56 tables by ourselves in the hope to keep the readers attention to the essential points and to avoid unnecessary details.

In addition we have integrated about 57 suitable original photographs into the book. The most important clinical and radiological features were usually labeled and highlighted in color.

The intended audience will be wide ranging including from medical student, residents and of course neurosurgeons and neuroradiologists.

The book may also be of interest to physicians and nurses working at the ICU as well as patients with post traumatic Injuries of CNS & PNS.

We are especially grateful to Dr. A. Khadem and Dr. A. Ghasemi for bringing this book to editorial and technical completion.

Armin A. Norusi M.D.  
Neurosurgeon

Jalal J. Shokouhi M.D.  
Neuroradiologist

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## Neurotrauma

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## General Anatomy of CNS

### History

The pioneers are Prof. Mahmud G. Yasargil, Prof. Wolfgang Seeger and J. Lang. There is a major difference between the normal neuro-anatomy and microsurgical anatomy. This is a three dimensional (D3) operative anatomy, which a neurosurgeon will find under the microscope during the operation.

The important thing for a neurosurgeon is a better understanding the anatomical relationship between the skull landmarks and brain structures – ventricles, cisterns and also neurovascular structures. This makes it possible to achieve a successful intracranial procedure without damaging the neurovascular structures.

### General Anatomical Consideration of CNS

The nervous system is typically divided into two parts: The central nervous system (CNS) that consists of the brain and the spinal cord, and the peripheral nervous system that connects the central nervous system to the whole body. This chapter focuses only on CNS.

The CNS is protected by skull bone and vertebral column. They also compose from several craniometric points and anatomical markings which are useful for performing a successful surgical procedure on Brain and Spinal cord. The brain has been divided into 3 different regions: The forebrain, the midbrain, and the hindbrain. This is covered by 3 meninges: The Dura mater, the arachnoid mater, and the pia mater. These are continuous with the corresponding meninges of the spinal cord. The cerebrospinal fluid surrounds the brain and spinal cord in the subarachnoid space.

\* The forebrain is a part of the cerebral cortex which is supported by the brain stem and consists of thalamus and hypothalamus. It is responsible for voluntary movement, attention, behavior and may also be for emotional temperament. The thalamus relays and translates incoming sensory messages, except those for smell. The hypothalamus governs motivation, emotion and also controls the CNS in time of stress.

\* The midbrain lies between the hindbrain and forebrain and is crucial for hearing and sight

\* The hindbrain is made up of the pons, cerebellum, and the medulla oblongata. The pons, located just above the medulla, connects the top of the brain to the cerebellum. It has a large number of transverse fibers on its anterior aspect connecting the 2 cerebellar hemispheres. It also contains many nuclei and ascending and descending nerve fibers.

\* The cerebellum is divided into two hemispheres. It controls the reflexes and is responsible for balance and body's actions.

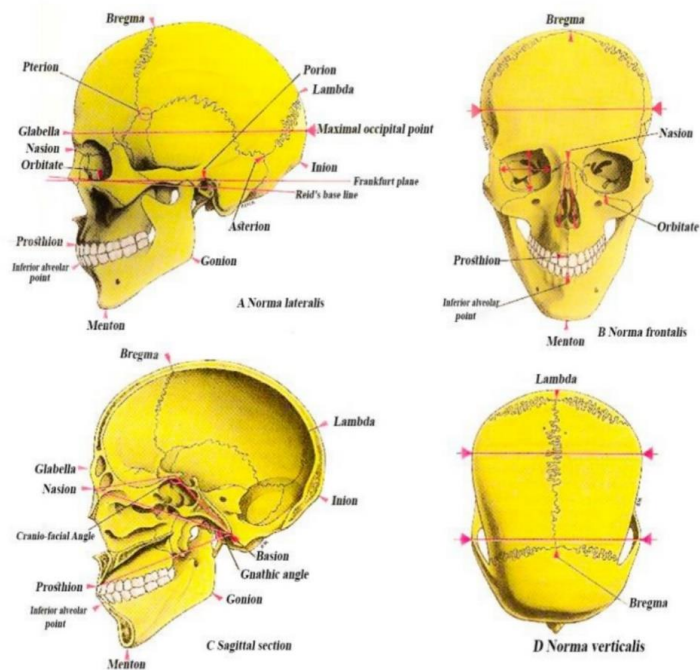
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\* The medulla oblongata controls functions as breathing, heart rate, and blood pressure. The fourth ventricle is surrounded by Medulla, the pons, and the cerebellum and is filled with CSF. It is connected superiorly to the third ventricle by the cerebral aqueduct and inferiorly to the central canal of the spinal cord.

## Cranium (Skull)

*Tab. 1 shows useful craniometric points for performing an intracranial approach.*

- Nasion: Junction of glabella and rhinion.
- Glabella: Projected point in the middle of supraorbital ridge.
- GWS: Greater wing of sphenoid bone
- Pterion: Cross of temporal, frontal, GWS and parietal bones.
- This is positioned in temporo-frontal region above the Zygomatic arch.
- Stephanion: On the coronal suture at the superior temporal line.
- Bregma: This is the junction of the sagittal and coronal suture.
- Lambda: This is the junction of the sagittal and lambdoid suture.
- Inion: The end of Frankfurt plane at the occiput (Protuberance)
- Opisthion: The posterior margin of the foramen magnum.
- Asterion: Junction of lambdoid suture with parieto-mastoid, occipito-mastoid sutures.
- This lies over the tranverse-sigmoid sinuses.



**Fig. 1 Relationship between the Skull Markings and Cerebral Anatomy**  
**Taylor-Haughton lines (modified from Gray's Anatomy)**

### **Cerebrum (Anatomy of Anterior & Middle Fossa)**

This is generally divided into 5 lobes: frontal, parietal, occipital, temporal and insula. Each of them contains areas for motor sensory function and also association areas (e.g. the speech center is concentrated in two areas in the parietal and temporal lobes. These can be considered from the lateral-medial and also from basal surface.