

Large infarction of the MCA; clinic, diagnoses and therapy

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Intracranial Hypertension in Acute Ischemic Stroke

- Large MCA Infarction
- Large Cerebellar Infarction

Intracranial Hypertension in Acute Hemorrhagic Stroke

- Subarachnoid Hemorrhage
- Intracerebral Hemorrhage

MCA Infarction associated with Intracranial Hypertension: Synonyms

- Large MCA Infarction (LMI)
- Space Occupying MCA Infarction
- Total MCA Infarction
- Malignant MCA Infarction

Frequency of LMI

Oxford Comm. Stroke Project (1988) (Anterior Circ. Total and Partial)	15 %
Austin Hops. Stroke Registry (1995) (Total MCA Infarction)	3 %
Lausanne Stroke Registry (1998)	3,2 %

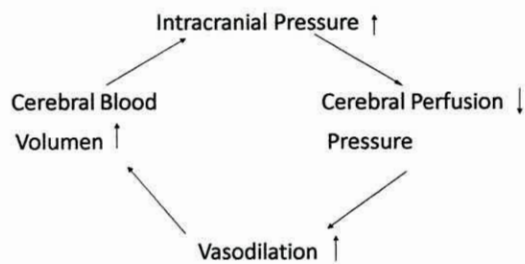
Mortality of LMI

MCA Infarction	10 - 25 %
Total MCA Infarction	39 - 78 %
Lausanne Stroke Reg. Com < 24h	22 %
ECASS Herniation Most Frequent Cause of Death < 7d	67 %

Etiology of LMI

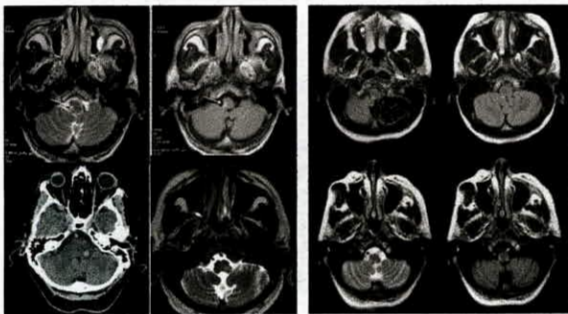
- Arterial Dissection
- ICA - Occlusion
- Atrial Fibrillation

Pathophysiology of LMI



Definition of LMI

- Progressive focal neurological Signs
 - Hemiplegia
 - Aphasia
 - Deviation conjugee
- Deterioration of consciousness
 - Midbrain Syndromes I. - IV.
 - Bulbar Brain Syndrom I., II
- CT- midline shift > 5mm
- Intracranial pressure > 30mmHg



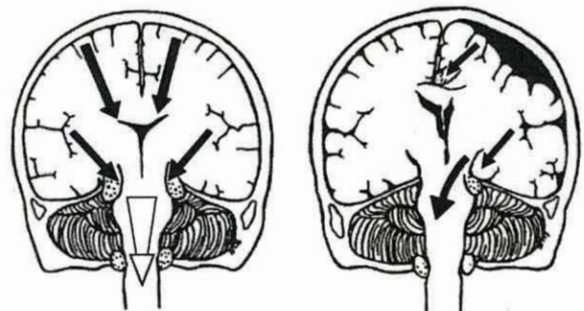
Predictors for LMI herniation

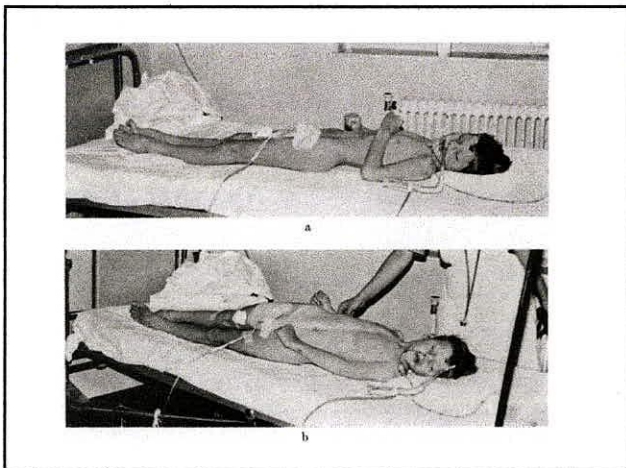
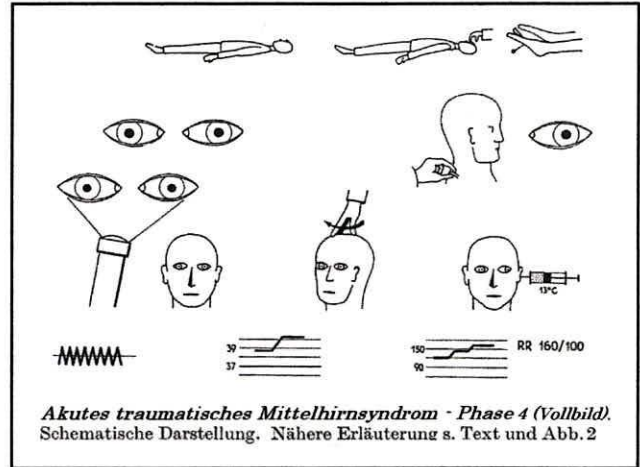
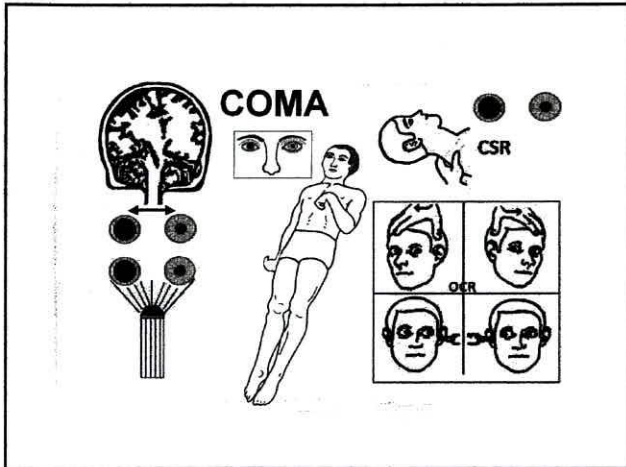
- Progression of neurological deficits
- Deterioration of consciousness
- Acuity of vessel occlusion
- Anatomy of circle of Willis
- Collaterals & anastomosis
- Time course of reperfusion
- CT criteria

CT predictors of LMI herniation

- Specificity ~ 90 %
 - MCA infarction > 2/3
 - Hyperdens MCA sign
 - Midline shift (Initially)
- Sensitivity ~ 80 %
 - Compressed subarachn. Space
 - Compressed ventricles

Pathomechanism of uncal and central (median) herniation





Hirnstammsyndrom: Synopsis									
STADIEN DER HIRNSTAMMSCHÄDEN NACH SUPRATENTORIELLER RAUM- FORDERUNG		MHS				BHS			
ZENTR. HERNIATION		I	II A	II B	III	IV	I	II	
VIGILÄTÄT		SCHWACHLORENZ	SOPOR	COMA	COMA	COMA	COMA	COMA	COMA
REAKTION		KEINE REAKTION	VERZÖGERT REAGIEREND	FEHLEND	FEHLEND	FEHLEND	FEHLEND	FEHLEND	FEHLEND
AKUSTISCHE REIZE		KEINE REAKTION	VERZÖGERT REAGIEREND	FEHLEND	FEHLEND	FEHLEND	FEHLEND	FEHLEND	FEHLEND
SCHMERZREIZ		KEINE REAKTION	VERZÖGERT REAGIEREND	FEHLEND	FEHLEND	FEHLEND	FEHLEND	FEHLEND	FEHLEND
STELLUNG		NORMAL	NORMAL	BEGINNENDE DIVERGENZ	DIVERGENZ	DIVERGENZ	DIVERGENZ	DIVERGENZ	DIVERGENZ
BULBUS -BEWEGUNG		NORMAL	NORMAL	BEGINNENDE DIVERGENZ	DIVERGENZ	DIVERGENZ	DIVERGENZ	DIVERGENZ	DIVERGENZ
PUPILLENWEITE		ISOTROP	ISOTROP	ISOTROP	ISOTROP	ISOTROP	ISOTROP	ISOTROP	ISOTROP
LICHTREAKTION		ISOTROP	ISOTROP	ISOTROP	ISOTROP	ISOTROP	ISOTROP	ISOTROP	ISOTROP
KÖRPERHALTUNG		NORMAL	NORMAL	BEGINNENDE DIVERGENZ	DIVERGENZ	DIVERGENZ	DIVERGENZ	DIVERGENZ	DIVERGENZ
SPONTAN- MOTORIK		NORMAL	NORMAL	BEGINNENDE DIVERGENZ	DIVERGENZ	DIVERGENZ	DIVERGENZ	DIVERGENZ	DIVERGENZ
TONUS		NORMAL	NORMAL	BEGINNENDE DIVERGENZ	DIVERGENZ	DIVERGENZ	DIVERGENZ	DIVERGENZ	DIVERGENZ
BABINSKI PHÄNOMEN		↓	↑	↑	↑	↑	↑	↑	↑
ORIGAT		ATMUNG	ATMUNG	ATMUNG	ATMUNG	ATMUNG	ATMUNG	ATMUNG	ATMUNG
VEGETATIV		PULS	LEICHT ERHÖHT	NORMAL	BESCHLEUNIGT	BESCHLEUNIGT	BESCHLEUNIGT	BESCHLEUNIGT	BESCHLEUNIGT
NICHT ORIGAT		RR	NORMAL	NORMAL	LEICHT ERHÖHT	ERHÖHT	NORMAL	ERNIEDRIGT	ERNIEDRIGT
KÖRPER-TEMPERATUR		NORMAL	NORMAL	LEICHT ERHÖHT	ERHÖHT	ERHÖHT	ERHÖHT	ERHÖHT	ERHÖHT

Monitoring of ICP

- Clinical
 - Coma scales ICS, GCS,
 - Midbrain & Bulbar Brain Syndrome
- Blood pressure monitoring
- Noninvasive Monitoring
 - CT/MRI
 - TCD
 - O₂ utilization
 - EEG, EP
 - SPECT
- Invasive ICP Monitoring
 - Fluid coupled system
 - Fiber optic system

Medical therapy of ↑ ICP

- Osmotic therapy
- Diuretic therapy
- Barbiturate
- Hyperventilation

"It is still unclear, whether medical therapy directed at lowering ICP offer benefit to patient outcome"

Frank, Neurology, 1995

Hypothermia

- Hyperthermia: Indicator for bad prognosis
- Hyperthermia: neuroprotective approach
- Body temperature is not brain temperature
- Temperature gradients
 - Ventricle/epidural -1C°
 - Ventricle/epidural/body -1,5C°
- Antipyretics, cooling blankets & devices

Craniotomy

- Small series up to 1995 n= 110 PTS
- Reduction of mortality
- Rat study (Forstinger 1995)
- Open prospective trial (Riecke et al 1995)

	CR	MED
n	32	21
Death	35%	76%
Sev. Disabil.	24%	80%

Craniotomy possible recommendations

- Young LMI patients
- Non dominant hemisphere
- Early decompression (~ 18 – 36h)
- Local ethical protocoll

Criteria for mechanical ventilation for acute stroke

- Decreased level of consciousness (Midbrain syndrome, GCS <10.....)
- Hyperventilation to decrease ICP↑
- Airway protection (aspiration, seizure
- Hypoventilation or apnoe (pCO₂ > 50 mmHG)
- Hypoxemia (pO₂ < 60 mmHg)

Satisfactory outcome in only 8-10% of stroke patients requiring

Criteria for intubation in stroke patients

GCS < 10	84 %
Hyperventilation (ICP)	1,5 %
Airway protection (aspiration)	0,8 %
Hypoventilation, apnoe pCO ₂ > 50 mmHg	6,1 %
Hypoxemia pO ₂ <60 mmHg, paO ₂ /FIO ₂ <200	4,6 %
Bulbar dysfunction	2,3 %

Bushnell et al. Neurology 1998

New therapeutical strategies for LMI and ↑ ICP

- Hypothermia
- Craniotomy

