VERTEBRAL SPINE DYSFUNCTION AND NEUROLOGICAL DISTURBANCES

F. Gerstenbrand, Vienna, St. Golaszewski, Salzburg, G. Pichler, Graz

The term vertebral spine goes back to the description period of the anatomy. As a consequence of the central position in the human body, the spinal column should be called the human axis organ. The functional center of the axis organ for position and the movements of the body is located in the brain stem using the postural and the turning reflexes, basically influenced and directed by the proprioceptive system. Main receptors of the proprioceptive system are in the foot sole supported by the mechanoreceptors of the joints, the muscles of the extremities and the trunk as well as the receptors in the vertebral spine. The human axis organ is the basis for the static and kinetic functions of the human body.

The axis organ is carrying the body with fixed extremities plus the head with the human brain. The cervical spine is responsible for the free movements of the head with the visual and acoustic system. The inner organs and the thorax with the breathing system are fixed on the axis organ. The spinal cord is located in the spinal channel. During phylogenesis the upright position of the human race and the following development of manhood in the surrounding world is based on the change from the bridge-bow-construction of quadrupeds to the lattice tower system, using the arc function of the vertebral bodies carrying the whole body with the help of the filigree vertebral bones and the vulnerable discs, but supported by an excellently constructed muscle system of neck, back and abdomen.

The functional overload due to the non-physiological body position of modern men, "the homo-sedens" generates continuous damage to all parts of the vertebral spine. Psychological facts are influencing position and movement of the body creating dysfunctions, inducing a continuous impact on the vertebral spine. Degenerative changes of vertebrates, discs and vertebral joints are the result.

Regional disturbances and degenerative changes of the vertebral spine are developing typical complaints with well-known and omnipresent clinical symptoms, distinguished in radicular and pseudoradicular symptoms, referred pain syndrome as well as spinal cord deficits and cauda symptoms. Important is the differentiation between the radicular syndrome and pseudoradicular symptoms, as well as the referred pain syndrome caused by inner organ lesions. The spondylogenic cervical myelopathy as a sequence of a vertebrostenosis in the cervical spine is unfortunately ignored in many cases. A special problem represents the diagnosis and the treatment of a spondylolisthesis especially in the lumbar spine region.

A local trauma of the spinal column especially in the cervical part, called "whiplash injury" leads to typical acute symptoms, in some cases followed by chronic complains accompanied by degenerative changes of the vertebral spine, sometimes in the lumbar region too.

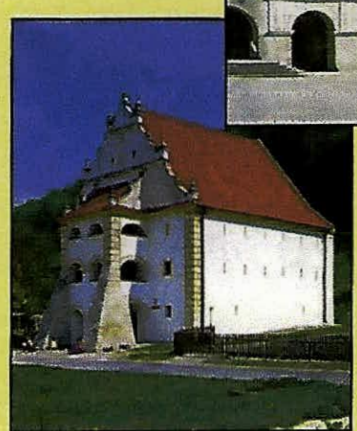
The methods of the manual therapy have to be used in the neurological examination for exact diagnosis, in addition with X-ray using the functional X-ray of cervical and lumbar spine, in most cases completed by the magnetic resonance, in spinal cord lesions with electrophysiological methods. The treatment program must be carefully prepared, using the different physiotherapeutic methods executed by special trained physiotherapists, combined with other physical methods. For surgery indications a careful consultation between the different specialists is necessary.

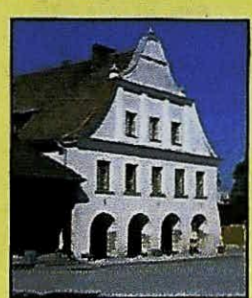
International Danube Symposium
for Neurological Sciences and Continuing Education
in collaboration with
Lublin Branch of Polish Neurological Society
Department of Neurology
Medical University of Lublin

VI WARSZTATY SZKOLENIOWO-NAUKOWE
6TH TEACHING COURSE

Stwardnienie Rozsiane
Padaczka
Bóle i zawroty głowy
Neurorehabilitacja

Multiple Sclerosis
Epilepsy
Headache, Vertigo
and Neurorehabilitation





June 10-11 2010

Kazimierz Dolny

POLAND

PROGRAM
FINAL PROGRAMME

www.danube2010.skolamed.pl

6th Danube Teaching Course" Multiple Sclerosis – Epilepsy - Headache and Vertigo - Neurorehabilitation (Kazimierz Dolny, Poland, 10-11 June, 2010) *(by Professor Zbigniew Stelmasiak)*

SCIENTIFIC PROGRAMME

June 10, 2010 (Thursday)

9.00-9.30 OPENING CEREMONY

Z. Stelmasiak, F. Gerstenbrand, L. Vécsei

9.30 – 11.00 Danube Lectures:

Chairpersons: F. Gerstenbrand, L. Vécsei, K. Rejdak

9.30 – 10.00 A. Korczyn – Evidence based/biased medicine
10.00 – 10.30 L. Vécsei – Migraine is a neuronal disorder: therapeutic considerations
10.30 – 11.00 D. Russell – The treatment of acute ischemic stroke – now and the future
11.00 – 11.30 Coffee-break

11.30 – 13.00 Neurorehabilitation

Chairpersons: F. Gerstenbrand, J.Opara

11.30 – 12.00 F. Gerstenbrand – The vertebral spine neurological disturbance (Danube Lecture)
12.00 – 12.30 E. M.Hagen – Clinical outcomes after spinal cord injuries
12.30 – 13.00 K. Domańska-Janik – Fate instability of stem cells – therapeutic implication in neurology
13.00 – 14.00 Lunch-break

14.00 – 15.15 MS diagostic and new trends in therapy

Chairpersons: K. Selmaj, J. Kotowicz

14.00 – 14.25 K. Selmaj – Perspective of MS therapy
14.25 – 14.50 J. Losy – The role of CSF examination in the diagnostic of MS
14.50 – 15.15 J. Kotowicz – Electrodiagnostics in MS
15.15 – 15.35 Coffee-break

15.35 – 16.50 MS therapy

Chairpersons: J. Losy, H. Bartosik-Psujek

15.35 – 16.00 Z. Stelmasiak – Oral therapies in multiple sclerosis
16.00 – 16.25 H. Bartosik-Psujek – Immonomodulatory therapy of MS – current standards
16.25 – 16.50 K. Mitosek – Szewczyk – Treatment of aggressive MS forms
16.50 – 17.10 Coffee-break

17.10 – 18.50 Headache and vertigo

Chairpersons: T. M. Domżał, A. Stępień, K. Mitosek-Szewczyk

17.10 – 17.35 A. Stępień – Migraine as a risk factor of cardiovascular diseases
17.35 – 18.00 T.M. Domżał – Cervical vertigo – does it really exist?
18.00 – 18.25 A. Szczepańska-Szerej – The issues of vertigo diagnostic
18.25 – 18. 50 J. Wojczal – Ultrasound in vertigo

June 11, 2010 (Friday)

09.30 – 10.50 Epilepsy surgery

Chairpersons: T.Trojanowski, D. Ryglewicz, K. Rejdak

09.30 – 10.00 G. Bauer – How to establish the epilepsy surgery unit (Danube Lecture)
10.00 – 10.25 P. Kunert – Surgical options for intractable epilepsy
10.25 – 10.50 A. Rysz – Clinical autcomes after epilepsy surgery
10.50 – 11.10 Coffee-break

11.10 – 12.50 Epilepsy therapy

Chairpersons: J.Jędrzejczak, B. Chmielewska

11.10 – 11.35 B. Chmielewska – How to select the first drug in epilepsy therapy
11.35 – 12.00 S. Czuczwar – Antiepileptic drug monitoring – is it always necessary?
12.00 – 12.25 J. Jędrzejczak – New look at definition of drug resistant epilepsy
12.25 – 12.50 K. Rejdak – New trends in epilepsy treatment
12.50 – 13.50 Lunch-break

13.50 – 15.30 Epilepsy Syndromes – diagnostic and therapy

Chairpersons: J.Majkowski, Z.Stelmasiak, K. Rejdak

13.50 – 14.15 I. Halczuk – Epilepsy in menopause
14.15 – 14.40 K. Niedzielska – Partial seizures – proper diagnosis and treatment. Patent with Juvenile myoclonic epilepsy
14.40 – 15.05 M. Mazurkiewicz-Bełdzińska – Big child?
15.05 – 15.30 B. Steinborn – Mały dorosły? Small adult?
15.30 – 15.50 Coffee-break

15.50 – 17.30 Epilepsy and coexisting disorders

Chairpersons: D. Ryglewicz, M.Mazurkiewicz-Bełdzińska, I. Halczuk

15.50 – 16.15 D. Ryglewicz – Epilepsy and somatic diseases in adult population
16.15 – 16.40 B. Błaszczyk – Epilepsy and cognitive impairment
16.40 – 17.05 P. Dropko – Periodic pattern recorded in EEG examination in patients hospitalized in the neurological intensive care unit
17.05 – 17.30 B. Kaczyńska – Haładyj – Psychiatric disorders in children and adolescents with epilepsy

Vertebral Spine Dysfunction and Neurological Disturbances

F. Gerstenbrand[1), 2)], St. Golaszewski[3)], G. Pichler[4)],

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[2)] Karl Landsteiner Institute for Neurorehabilitation and Space Neurology
[3)] Department for Neurology, Christian Doppler Universität ‚Salzburg
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6th Teaching Course Multiple Sclerosis, Epilepsy, Headache, Vertigo and Neurorehabilitation

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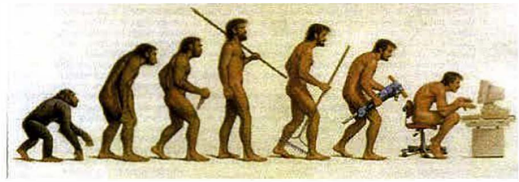
Introduction



Evolution from „Homo erectus" to „Homo sedens"

Vertebral column – term of the description period of anatomy

Human axis organ – central organ of the human body

Human axis organ I
Functions

- Carrying the weight of the human body
- Carrying the human head with brain and important sensory organs
- Responsible for movements of the head in all dimensions
- Fixation of shoulder girdle and the upper extremities
- Fixation of pelvis with the lower limbs
- Fixation of inner organs:
  - chest with cardiorespiratory organs
  - abdominal organs

Human axis organ II

Regulated by postural and turning reflexes of the midbrain pontine center

- Basis for all movements of the human body in the gravity field
- Adaptation of the human body in the gravity field
- Readaption of the body position by postural and turning reflexes due to the vestibular apparatus and the receptors of cervical spine, lumbar and thoracic spine

Development of the axis organ, the vertebral column

- Tunicata, external skeleton
- Development of Chorda dorsalis (amphioxus)
- Development of cartilage fish
- Development of the vertebral column

Development of the vertebral column

- Horizontal position of the vertebral column
  - bone fish, amphibians, reptiles
    - → arch bridge construction, partial developed
  - terrestrial tetrapods (mammals, aquatic mammals)
    - → arch bridge construction, full developed
- Vertical position of the vertebral column
  - human being
    - → lattice tower construction

Tetrapods
arch bridge construction

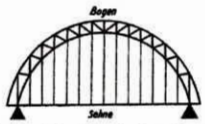


Abb. 6. Schema des Konstruktionsprinzips der Säugerwirbelsäule. Nach SLIJPER.

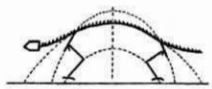


Abb. 4. Schema der Wirbelsäule eines primitiven Säugetieres. Nach BÖKER.

- Bow consists of two parts: upper belt and lower belt
  - Upper belt: vertebral arch, spine of vertebra, ligaments, back muscles
  - Lower belt: vertebral body, vertebral disc, ligaments, short and long tendons
- bow string: cranial fixed by the rips (chest), caudal fixed by abdominal muscles

Tetrapods
scheme of the arch bridge construction

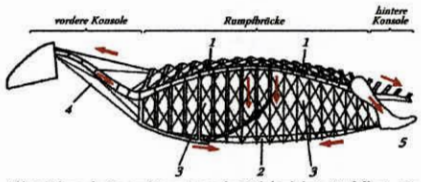


Abb. 7. Schema des Konstruktionsprinzips der Wirbelsäule beim Vierfüßler: 1. Wirbelsäule in Form einer flachen Kyphose; 2. Sehne in Form der langen ventralen Rumpfmuskeln; 3. Querverstrebungen in Form der Rippen und schrägen Rumpfmuskeln

1: Flat kyphosis of spine
2: Bow string long ventral trunk muscles
3: Rips (chest) and diagonal trunk muscles
4: Anterior console
5: Posterior console

Vertebral column in tetrapods

- Fixation of the extremities for standing and locomotion
- Support in jumping
- Fixation of inner organs
- Fixation of rips and the diaphragm for respiration
- Cervical spine
  - Carrying the head with brain, sensory organs including vestibular apparatus
  - Responsible for free movement of the head
  - Receptors for gravity (neck muscles, tendons, cervical joints)
- Tail, used for balance (special motion receptors)
- Change of balance, continuous regulated by postural reflexes of midbrain

Tetrapods
Spine maximal integrated in the running movement, galloping dog - high speed possible

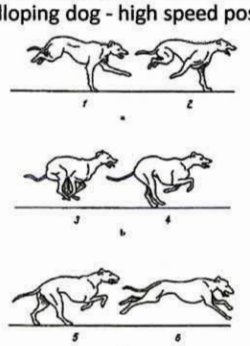
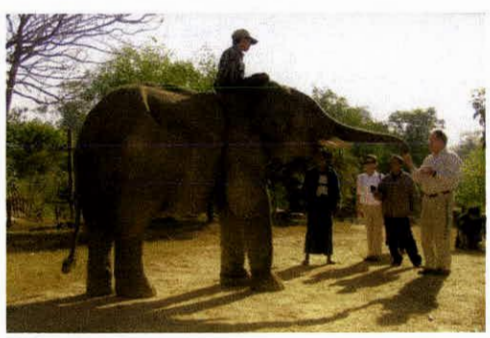


Abb. 8a-c. Bewegungsfolge eines galoppierenden Hundes mit maximaler Beteiligung der Wirbelsäule

'Great' vertebrates
tetrapod and bipeds in normal gravity



Vertebral column change in special biotopes

passing lordosis in the lumbar region

Lithocranium Walleri

a) Arch Bridge construction

b) Lordosis during feeding

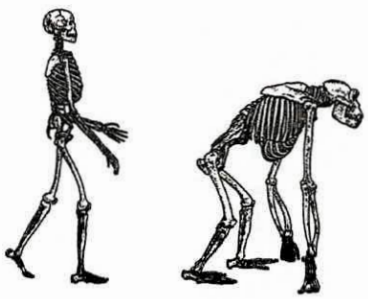
Lift-grasp-climbing position

development of neck and lumbar lordosis
dome construction of vertebral spine

Arch bridge construction
changing to lattice tower construction

Abb. 12. Lordose (schematisch) beim Aufrichten im Zuge des Stemm-Greif-Kletterns.

Lattice tower position

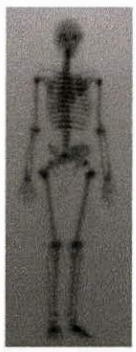


a) Human: lattice tower position

b) Gorilla: lattice tower position, rest of vault bridge construction

a) b)

Homo erectus, lattice tower position dome function of the vertebrates



Cervical lordosis
thoracic kyphosis
thoracic-lumbar lordosis
fixed kyphosis of sacrum

Design of the human vertebral column, uncompleted, Koch 1964

Vulnerability of the human vertebral spine

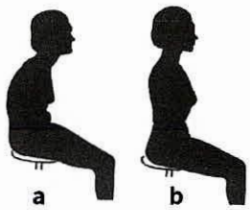
unfinished development of lattice tower position,
high vulnerability of axis-dens-system

- Overload due to non-physiological position (industrial life)
- typical symptoms of cervical spine dysfunction, less thoracic region
- psychological factors, regional dysfunction of vertebral spine, mainly upper part
- motion trauma of cervical spine (whiplash injury), sometimes including other parts of vertebral spine, typical acute symptoms, in some patients long-lasting dysfunction, sometimes defect states

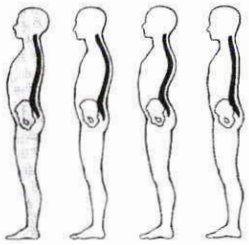
Cause of Disturbances of the Vertebral Spine

- Overload
- Malposition
- Malstereotypes
- Vertebral muscle dysfunction
- Hyper mobility
- Vertebral muscle disturbance (lesion)
- Local lesions (traumatic, inflammatory)

Malposition



a) Humpback
b) Normal position



a) Normal position
b) Humpback
c) Humpback, lumbal hyper lordosis
d) Flat back

Malposition

- Insufficient muscles of neck, back and abdominal muscles
- Overweight

H. Tilscher: Die Wirbelsäule der Frau. Verlagshaus der Ärzte, Wien, 2005

Pelvic Types after Gutmann

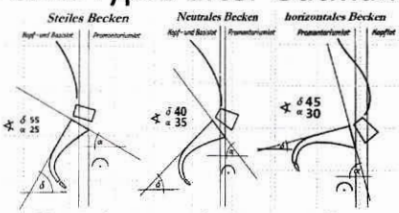


Abb. 9: Beckentypen nach Gutmann – steiles (links), neutrales (mitte), horizontales (rechts) Becken. Der Winkel zwischen dem Kreuzbein und der Horizontalen ist für die Haltungsart sowie die dadurch verursachten Beschwerden wichtig.

Vertical, neutral, horizontal

Quelle:
H. Tilscher: Die Wirbelsäule der Frau. Verlagshaus der Ärzte, Wien, 2005

Change Between Supporting and Free Leg

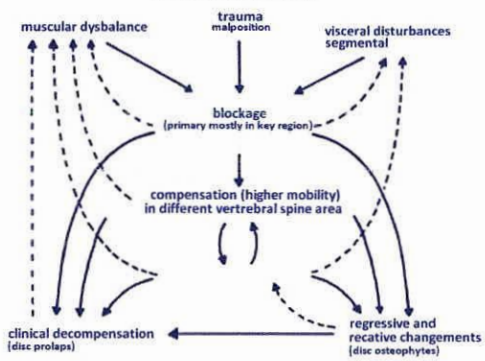
- Malposition
- Malstereotypes
- Overloading of lumbar spine, partly insufficient back muscles

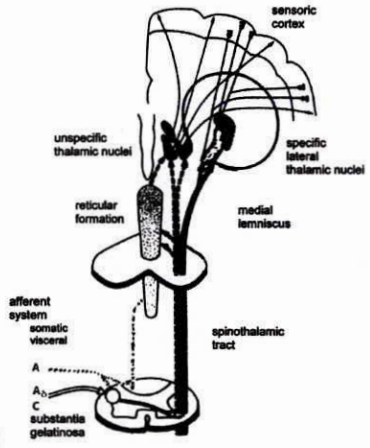
Quelle:
H. Tilscher: Die Wirbelsäule der Frau. Verlagshaus der Ärzte, Wien, 2005

Malposition - Malfunction

- Professional violinist
- Malposition
- Malfunction

Pathophysiology of vertebragenic disturbances





Vertebragenic Disturbances Sensoric Pathways

Vertebragenic Dysfunction/Malfunction Neurological manifestations

- Acute decompensation symptoms
  - Lumbago, stiff neck syndrome
    - Protection mechanism, local
- Lesion of vertebral roots
- Lesion of spinal cord
- Disturbances of blood circulation in nervous structure
  (spinal cord, nervous roots, cauda)

Lumbago

- Severe back pain, acute attack, lumbar – lower thoracic region
- Stretched position in lower part of vertebral spine – "Improvisationshaltung"
- Total immobilization of the body
- Radicular symptoms in 15%
- Pseudo-radicular symptoms in 30%
- Etiology: Acute disc lesion, herniation
- Protection mechanism for local process

Stiff Neck Syndrome

- Acute attack of severe neck pain
- Stretched - torsion position of the neck
- Immobilization of head movement
- Pseudo-radicular symptoms C2, C3, C4
- Radicular symptoms C4 – C6
- Acute lesion cervical spine (herniation, etc.)
- Protection mechanism for local process

Radicular Syndrome

- Pain in the dermatome
  - Dragging, drilling, most intensive
- Sensory disturbances in the dermatome
  - Hypalgesia, analgesia
- Paresis, atrophy in the myotome
  - Hyporeflexia, areflexia
- No vegetative disturbances

Pseudoradicular Syndrome

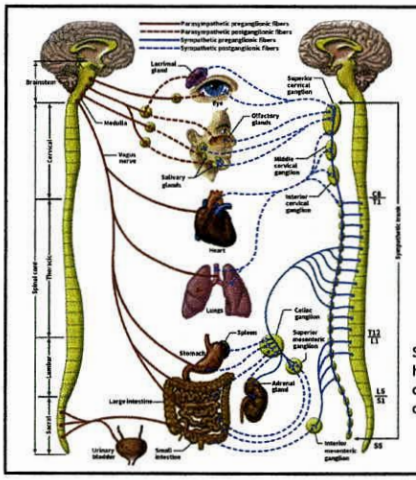
- Pain in one or several dermatomes
  - One/both sides, blunt – diffuse
- Dysesthesia, hyperalgesia in the affected dermatome
  - no sensory deficits
- No motoric deficits
  - Increased muscle tonus in the myotome
  - Increased tendon reflexes possible
- Vegetative disturbances
  - Hyperhidrosis, piloerection, Kibler phenomenon
- Blockage in the affected movement segment

Visceral Referred Pain Syndrome

- Affection of inner organs
- Affection of joints
  - in the extremities
  - of vertebral spine

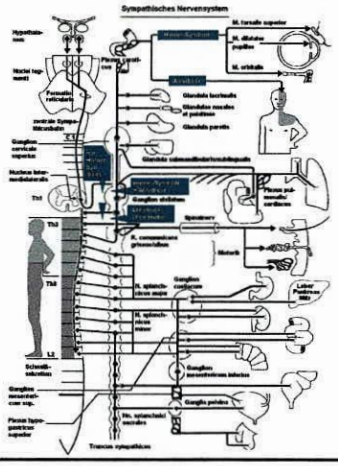
Visceral referred pain syndrome affection of inner organs

- Pain in "Head zones" belonging to the affected organ
  - Burning sensation
- Hypalgesia/dysesthesia in the associated dermatome
  - No sensory disturbances
- No motoric dysfunction
  - Painful muscle spasm in the enterotome – myotome
    - maximum in the "MacKenzie zone"
- Vegetative disturbances in the associated dermatome
  - Hyperhidrosis, Kibler phenomenon, piloerection
- Signs of local irritation, functional disturbances of the damaged organ
- Protection mechanism



Scheme of pre- and postganglionic sympathetic / parasympathetic connections

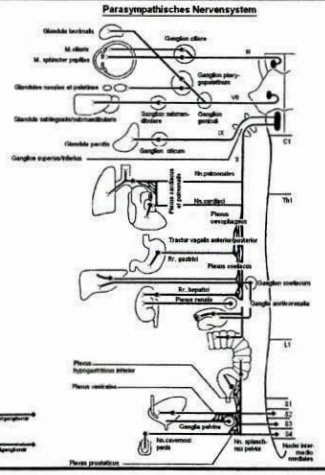
Source: http://www.nutrimaxorganic.com/products/elgucare/spinal_disorders.html



Scheme of pre- and postganglionic sympathetic connections

Segmental projection

Source: Kurzlehrbuch Neurologie, Mumenthaler, Mattle, 2006



Scheme of pre- and postganglionar parasympathicus connections

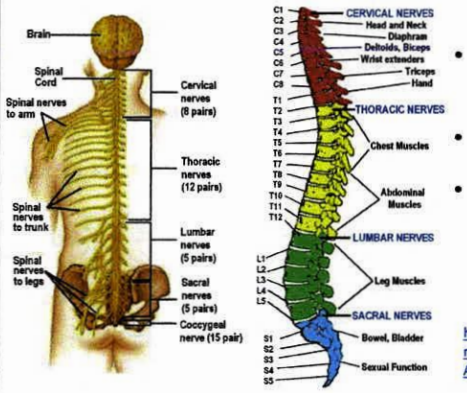
Segmental projection

Source: Kurzlehrbuch Neurologie, Mumenthaler, Mattle, 2006

Visceral Referred Pain Syndrome
Affection of Joints in the Movement Organs
Extremities, Vertebral Spine

- Pain in the dermatome of the affected joint
- Hyperalgesia/dysesthesia in the affected dermatome
- No paresis
  - Increased muscle tonus of the affected muscles
  - Tendinopathia, myogelosis, tendomyosis
- Pressure pain in the affected joint
- Joint blockage, in movement pains
- Vegetative disturbances possible

Human Vertebral Spine



- Motoric connections
- Lattice tower position
- Vault system

http://universe-review.ca/R10-16-ANS.htm

Most Affected Areas of the Vertebral Spine

1. Cervical spine
2. Thoracic spine
3. Lumbar spine

Atlas, the titan giant

Means: „Who is carrying"

Son of Lapetos and of the okeanide Klymene

Carrying the globe

Special function of cervical spine turning movements in 3 dim.

Development of the Atlas-Axis-system

Three steps:

1. development of 2 condyls on os occipitale (amphibias),
2. development of a second level, the atlas-axis-joint, rebuilding of dens by loss of the first disc (tetrapods),
3. special axis-dens-system, great autonomy, but highly vulnerable in human beings

Dysfunction of Cervical Spine Neurological Manifestations

- Cervicogenic headache
- Cervical syndromes
- Vertebrobasilar insufficiency
- Cervical vertebrostenosis

Cervical Syndromes

- Upper cervical syndrome
  - C2, connection to N. trigeminus
    - C1 no posterior root
- Middle cervical syndrome
  - C3, C4, C5
- Lower cervical syndrome
  - C6, C7, C8, D1

Upper Cervical Syndrome

- Headache, cervicogenic type
  - Blunt – diffuse
  - Helm feeling
  - "band around the head"
  - Face pain - pseudo-trigeminal pain
- Cervicalgia
  - Neck pain
- Vertigo (turning of the surrounding)
- Vertebrobasilar insufficiency attacks (VBI) possible
- Migraine cervicale attacks possible

Middle Cervical Syndrome

- Pseudo-radicular symptoms C3, C4, C5
  - Pain in the affected dermatome
    - Dysesthesia, hyperalgesia
  - Vegetative symptoms, heart sensations
    - Palpitation
    - Tachyarrhythmia
      - Suspicious heart infarct
    - Tachycardia
    - Disturbance of diaphragm, high level position

Lower Cervical Syndrome

- Pseudoradicular symptoms C6, C7, C8, D1
- Pain in the affected dermatome
- Dysesthesia, hyperalgesia

- Synonym: shoulder-arm-syndrome

Cervicogenic headache Symptomatology

- Pressure headache, from neck region to occipital, mostly to the forehead, both sides, seldom one side,
- Helm-feeling, sometimes ring-shaped feeling
- Pressure feeling retro bulbar
- Increase of pain during coughing, unpleasant position of head and body, during fever state
- Initiation due to external influence
  local cooling, trauma of vertebral spine, etc.
- Additional pain symptoms:
  - pain distribution in C2 with dysesthesia
  - atypical face pain
  - pseudo-trigeminal pain

Cervicogenic headache Differential diagnosis (I)

- Tension headache, real form
- Occipital neuralgia
- Migraine (different forms), Migraine cervicale
- Cluster headache
- Vasomotor headache:
  Ice cream headache, coughing headache
- Overload headache
- Orgasm headache

Cervicogenic headache Differential diagnosis (II)

- Meningeal headache
- Headache due to cerebrovascular disturbances: hypertensive attack
- Arteritis temporalis
- Carotidynia
- Neck-tongue-syndrome
- Eagle-Syndrome
- Ganglion geniculi neuralgia

Vertebrobasilar Insufficiency (VBI)

- Symptoms
  - Headache, bilateral, neck pain (cervicalgia)
  - Vertigo, turning feeling
  - Cerebellar disturbances, possible
  - Visual disturbances (double vision)
  - Tinnitus
  - Drop-attacks, cardiac syncope
  - Amnestic episodes
- Differential diagnosis
  - Mechanical irritation of the cranio-cervical region

X-ray Cervical Spine

female patient, 47ª

Diagnosis: cervicogenic headache

a) Retroflexion, blockage upper part, dysbalance occipito-atlanto-axial joint

b) Anteroflexion, blockage in upper part and lower part of cervical spine

Cervical MRI

Female patient, 47ª

Diagnosis: cervicogen headache

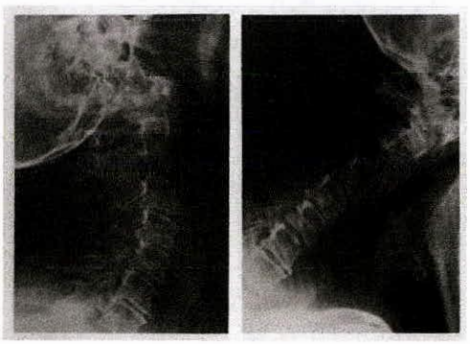
Stretch-position of cervical spine, mostly upper part, multisegmental disc protrusion, incipient vertebrostenosis C5/C6

Spondylogenic Cervicale Myelopathia

- Symptoms
  - Flaccid paresis of spreading hands
  - Atrophy of hand muscles both sides
  - Spastic paraparesis of legs
  - Dissociated sensory disturbance C6 downwards
  - Epicritic disturbances, legs, trunk, upper extremities
  - Bladder dysfunction, urge to urinate
  - Bowel dysfunction
  - Vertebrostenosis cervical spine, middle part
- Differential diagnosis
  - A. spinalis anterior Syndrome

Vertebrostenosis

Change in various head position



Cervical Vertebrostenosis

- MRI, cervical (T2)
- Disc protusion C5/C6 and C6/C7

  Stretched position lower part of cervical spine

Cervical Vertebrostenosis

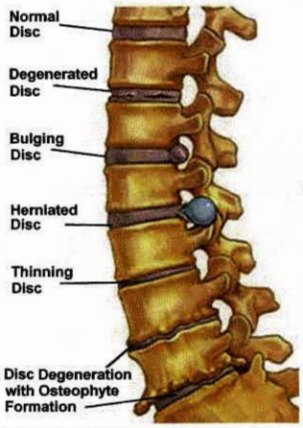
- Myelography
- Disc protrusion C4/C5, C5/C6

Cervical Vertebrostenosis

- Severe spondylogenic cervical myelopathy, vertebrostenosis C5/C6, C6/C7
- Local lesion in the myelon C6
- Cervical MRI (T2)

Problems of the Lumbar Spine

- Carrying the body weight
- Malposition
- Malfunction
- Malstereotypes
- Muscle malfunction
- Spondylolisthesis



Disc Problems of the Lumbar Spine

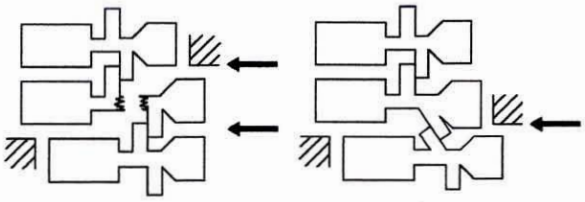
Symptoms of Disturbances of the Lumbar Spine

- Radicular symptoms according to the affected disc, herniation
- Pseudoradicular symptoms associated to the affected disc
- Conus-Cauda symptoms, affection of L1/ L2
- Cauda lesion, disc affection lower lumbar spine

Spondylolisthesis, Vertebrostenosis of Lumbar Spine

- Symptoms associated with the affected segments
  - Radicular symptoms (uni-rad., multi-rad.)
  - Cauda symptoms – Conus-cauda symptoms
  - Pseudoradicular symptoms
- Deflection lumbalium
- Differential diagnosis
  - Local process in the spinal channel

Scheme of Spondylosis



Pseudo spondylosis Real spondylosis

Source:
H. Tilscher, G. Skorpik, Neuroorthopädie 4, Springer Verlag, 1988

Spondylolisthesis

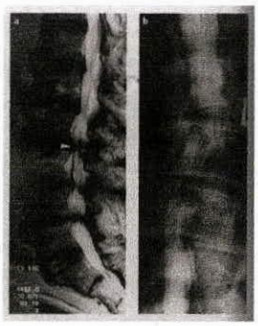
Pat. H.F., female, 44ª

Functional myelogram

Radicular syndrome

Increased bulging effect in reclination

Lumbar Disc Herniation Vertebrostenosis



- Lumbar Disc herniation L3/L4, L4/L5
  Nervous root compression L2/L3 (arrow)
- Diagnosis: Claudicatio
- a) MRT (T1)
- b) myelography
- 70ª old patient

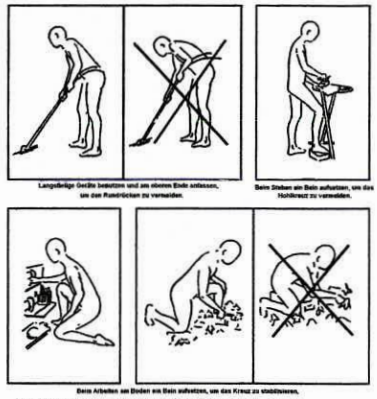
Thoracic Vertebral Spine Problems

- Disc prolapse
  - Radicular lesion
  - Spinal cord lesion
  - Pseudoradicular symptoms
- Disc protrusion
  - Pseudoradicular symptoms, correlated
  - Visceral referred pain syndrome caused by joint lesion
- Differential diagnosis
  - Visceral referred pain syndrome, inner organ affection

Treatment

- Restoration of the malposition, mal stereotypes, disturbed movement
- Reorganization of posture of vertebral spine, the axis organ
- Reorganization of the muscles supporting the vertebral spine
- Tools:
  - Physiotherapeutic methods
  - Surgical treatment only the last choice

Vertebral Spine - Prophylaxis



Source: J. Krämer, Prophylaxe von Wirbelsäulenschäden am Arbeitsplatz, in: Neuroorthopädie 4, 1988

Isometric Excercises

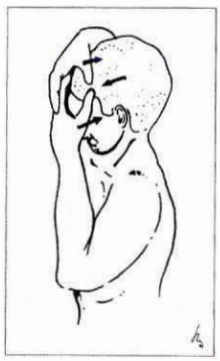


Abb. 81 Isometrische Kräftigungsübungen gegen die eigenen Hände

Abb. 82 Isometrische Kräftigungsübungen gegen ein Handtuch

Source: Degenerative Erkrankungen der Halswirbelsäule, Goldhahn et al, 1994

Special Exercises for the Vertebral Spine

a) left side: wrong execution
b) right side: correct execution

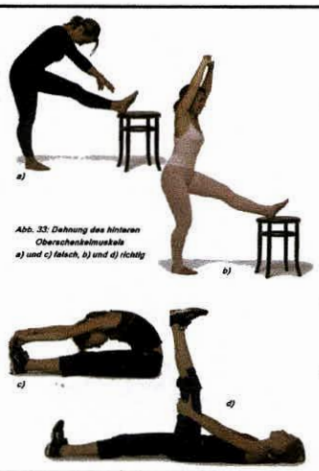


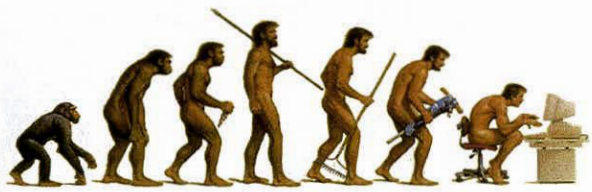
Abb. 33: Dehnung des hinteren Oberschenkelmuskels
a) und c) falsch, b) und d) richtig

Special Exercises for Stretching the Backside Thigh Muscle and Lumbar Spine

- a) and c): wrong execution
- b)and d): correct execution

From tetrapods to homo sedens

high vulnerability of the cervical spine to direct impacts and to malfunction due to industrial life



from „Homo erectus" to „Homo sedens"