

Surgical treatment of intradural extramedullary spinal tumours



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Spine tumours

- 15% of the primary tumours of the CNS affect the spine
- The spine manifestation appear around 10% of cancer patient (growing ↑)

Location:

- Extradural (55%)
- Intradural-extramedullary (40%)
- Intramedullary (5%)



Classification

- The classification of CNS tumors is based on the WHO histological criteria.
- In addition to morphological and immuno-histochemical examinations, molecular biological examinations (e.g. FISH; fluorescent in situ hybridization) play an increasing role in tumor analysis and therapy.

WHO CNS 5 2021 (simplified) classification

MOLECULAR GENETICS:
IDH1, 1p19q, ATRX
(MGMT METILATION)

NOS – No Genetic
examination

7.1.b. táblázat: Agydaganatok WHO (CNS 5, 2021) szerinti egyszerűsített klasszifikációja, a táblázatban egyes daganatoknál feltüntettük a morfológiai jegyek alapján lehetséges WHO fokozatbeosztásokat is (CNS WHO Grade)

GLIOMÁK, GLIONEURONÁLIS ÉS NEURONÁLIS DAGANATOK

Felnőttkori diffúz gliomák	
Astrocytoma, IDH mutáns	CNS WHO Gr 2,3,4
Oligodendroglioma, IDH mutáns, 1p/19 kodelációval	CNS WHO Gr 2,3,4
Glioblastoma, IDH vad-típus	CNS WHO Gr 4
Gyermekkori típusú diffúz kis malignitású (low-grade) gliomák	
Diffúz astrocytoma, MYB vagy MYBL-1 alterációval	CNS WHO Gr 1
Diffúz low-grade glioma, MAPK útvonal alterációval	
Angiocentrikus glioma	CNS WHO Gr 1
Gyermekkori típusú diffúz nagy malignitású (high-grade) gliomák	
Diffúz középvonalas (midline) glioma, H3 K27 alterációval	CNS WHO Gr 4
Diffúz hemisphaerialis glioma, H3 G34 mutációval	CNS WHO Gr 4
Diffúz gyermekkori típusú high-grade glioma, H3 és IDH vad típus	
Körülírt astrocytás gliomák	
Pilocytás astrocytoma	CNS WHO Gr 1
Subependymalis óriássejtes astrocytoma (SEGA)	CNS WHO Gr 1
Pleomorph xanthoastrocytoma	CNS WHO Gr 2, 3
Chordoid glioma	CNS WHO Gr 2
Astroblastoma, MN1-alterációval	

7.1.b. táblázat folytatása

GLIOMÁK, GLIONEURONÁLIS ÉS NEURONÁLIS DAGANATOK

Glioneuronális és neuronális tumorok	
Ganglioglioma	CNS WHO Gr 1, 3
Desmoplasticus infantilis ganglioglioma/astrocytoma	CNS WHO Gr 1
Dysembryoplasticus neuroepithelialis tumor (DNET)	CNS WHO Gr 1
Centralis és extraventricularis neurocytoma	CNS WHO Gr 2
Dysplasticus cerebellaris gangliocytoma (Lhermitte Duclos)	CNS WHO Gr 1
Ependyma eredetű tumorok	
Supratentorialis ependymoma	CNS WHO Gr 2, 3
Supratentorialis ependymoma, ZFTA-fúzióval	
Supratentorialis ependymoma, YAP1 fúzióval	
Hátsó scala ependymoma	CNS WHO Gr 2, 3
Hátsó scala ependymoma, PFA csoport	
Hátsó scala ependymoma, PFB csoport	
Spinális ependymoma	CNS WHO Gr 2,3
Spinális ependymoma, MYCN amplifikációval	
Myxopapillaris ependymoma	CNS WHO Gr 2

PLEXUS CHOROIDEUS TUMOROK

Plexus choroideus papilloma	CNS WHO Gr 1
Atípusos plexus choroideus papilloma	CNS WHO Gr 2
Plexus choroideus carcinoma	CNS WHO Gr 3

EMBRIONÁLIS TUMOROK

Medulloblastoma	CNS WHO Gr 4
Medulloblastoma, WNT-aktívált	
Medulloblastoma, SHH-aktívált, TP53 vad-típus	
Medulloblastoma, SHH-aktívált, TP53 mutációval	
Medulloblastoma, nem WNT/nem SHH aktívált	

Egyéb idegrendszeri embrinális tumorok

Atípusos teratoid/rhabdoid tumor (ATRT)	CNS WHO Gr 4
Központi idegrendszeri neuroblastoma	CNS WHO Gr 4

PINEALIS TUMOROK

Pinealocytoma	CNS WHO Gr 1
Köztes differenciáltságú pinealis parenchymális tumor	CNS WHO Gr 2, 3
Pinealoblastoma	CNS WHO Gr 4

WHO CNS 5 2021 (simplified) classification

118

7. fejezet Az agy daganatos megbetegedései

7.1.b. táblázat folytatása: Agydaganatok WHO (CNS 5, 2021) szerinti egyszerűsített klasszifikációja, a táblázatban egyes daganatoknál feltüntettük a morfológiai jegyek alapján lehetséges WHO fokozatbeosztásokat is (CNS WHO Grade)

AZ AGYIDEGEK ÉS A PARASPINALIS IDEGEK TUMORAI

Schwannoma	CNS WHO Gr 1
Neurofibroma	CNS WHO Gr 1
Melanocytás schwannoma	
Perineurinoma	CNS WHO Gr 1
Malignus melanocytás ideghüvely tumor	
Malignus perifériás ideghüvely tumor (MPNST)	
Paraganglioma	CNS WHO Gr 2, 3, 4 CNS WHO Gr 1

MENINGEOMÁK

Meningeoma	CNS WHO Gr 1, 2, 3
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MESENHCYMALIS, NEM MENINGOENDOTHELIALIS TUMOROK

Lágyrésztumorok	
Solitaer fibrosus tumor	CNS WHO Gr 1, 2, 3
Haemangioma és vasculáris malformációk	
Haemangioblastoma	CNS WHO Gr 1
Rhabdomyosarcoma	
Primer intracranialis sarcoma, DICER-1 mutációval	
Ewing-sarcoma	
Porc-csontszövet eredetű daganatok	
Mesenchymalis chondrosarcoma	
Chondrosarcoma	
Chordoma és rosszul differenciált chordoma	

MELANOCYTÁS TUMOROK

Diffúz melanocytás tumorok	
Diffúz meningealis melanocytomatosis és meningealis melanomatosis	
Körülírt melanocytás tumorok	
Meningealis melanocytoma és meningealis melanoma	

7.1.b. táblázat folytatása

VÉR- ÉS NYIROKEREDETŰ (HAEMATOLYMPHOID) DAGANATOK

Lymphomák

Központi idegrendszeri lymphomák
Központi idegrendszeri diffúz nagy B sejtés lymphoma
Immundeficienciához társuló központi idegrendszeri lymphoma
Lymphomatoid granulomatosis
Intravascularis B sejtés lymphoma

Egyéb ritka idegrendszeri lymphomák

Dura MALT lymphomája
Egyéb központi idegrendszeri low-grade B sejtés lymphoma
Anaplasticus nagy sejtés lymphoma (ALK+/ALK-)
T sejtés és NK/T sejtés lymphomák

Histiocyta eredetű tumorok

Langerhans-sejtés histiocytosis
Histiocytás sarcoma

CSÍRASEJTÉS TUMOROK

Érett teratoma
Éretlen teratoma
Germinoma
Embryonalis carcinoma
Yolk sac tumor
Choriocarcinoma
Kevert csírasejtés tumor

SELLARIS VIDÉK DAGANATAI

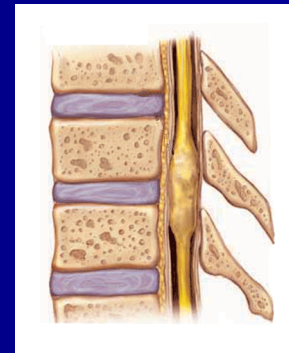
Adamantinomatosus craniopharyngioma	CNS WHO Gr 1
Papillaris craniopharyngioma	CNS WHO Gr 1
Pituicytoma, sellavidék granuláris sejtés tumora, orsósejtés oncocytoma	CNS WHO Gr 1
Hypophysis adenoma/adenohypophysis neuroendocrin tumora (PitNET)	
Hypophysis blastoma	

METASTASISOK

Az agy és a gerincvelő állományi áttétes daganatai
Az agyburkok áttétes daganatai

Location of spine tumours in the spinal canal

- segmental-lateral (confined to one side)
 - e.g. neurinoma, meningioma
- axial-longitudinal
 - e.g. intramedullary tu.
- segmental-axial
 - e.g. intramedullary cavernous haemangioma
- lateral-longitudinal
 - e.g. cauda ependymoma



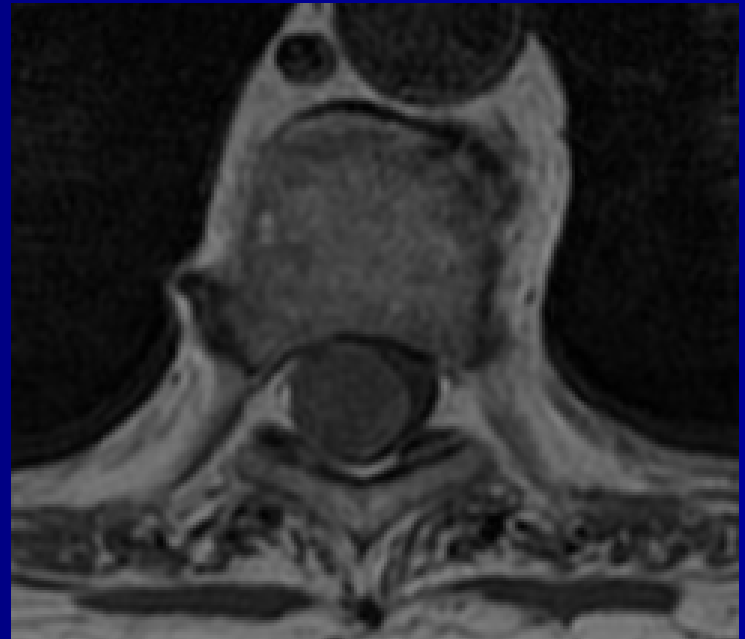
Intradural-extramedullary

- 80 % meningioma & neurinoma/neurofibroma
- 15 % filum terminale ependymoma
- 5 % etc. (paraganglioma, metastatic etc.)

Meningeoma

- Originate from arachnoid layer (or coming from fibroblast attached to dura and pia mater)
- 5th & 6th decade most frequent
- 75-85 % female
- 80 % dorsal spine
- 10 % extra and intradural

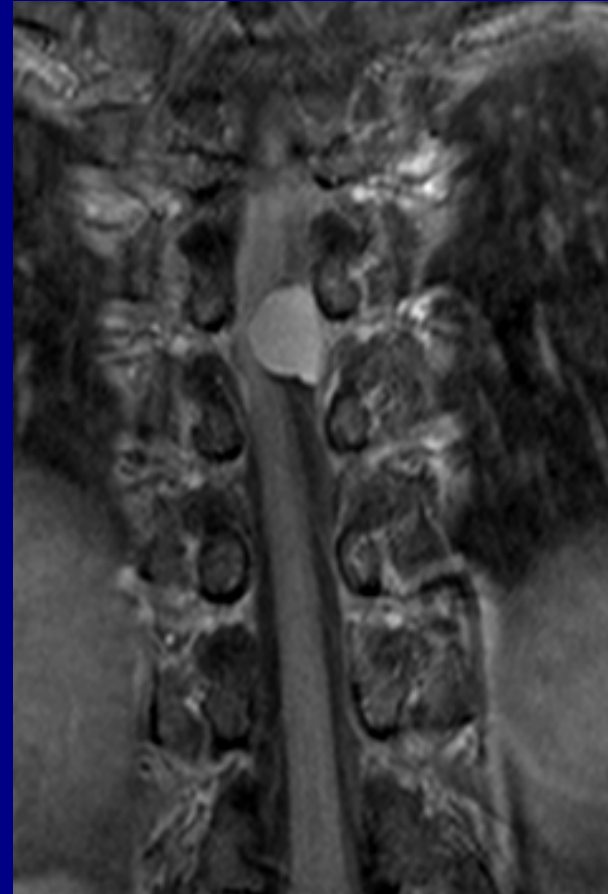
Intradural extramedullary tumours: meningeoma



Schwannoma & neurofibroma

- 25 % of intradural tumor
- 4th-6th decade
- 1:1 male-female
- 10-15 % spread into neuroforamen and extradurally
- 10 % epidural or paraspinal
- 1% intramedullar (perivascular nerve sheath)
- 2.5 % malignant (nerve sheath – 50% M. Recklinghausen)

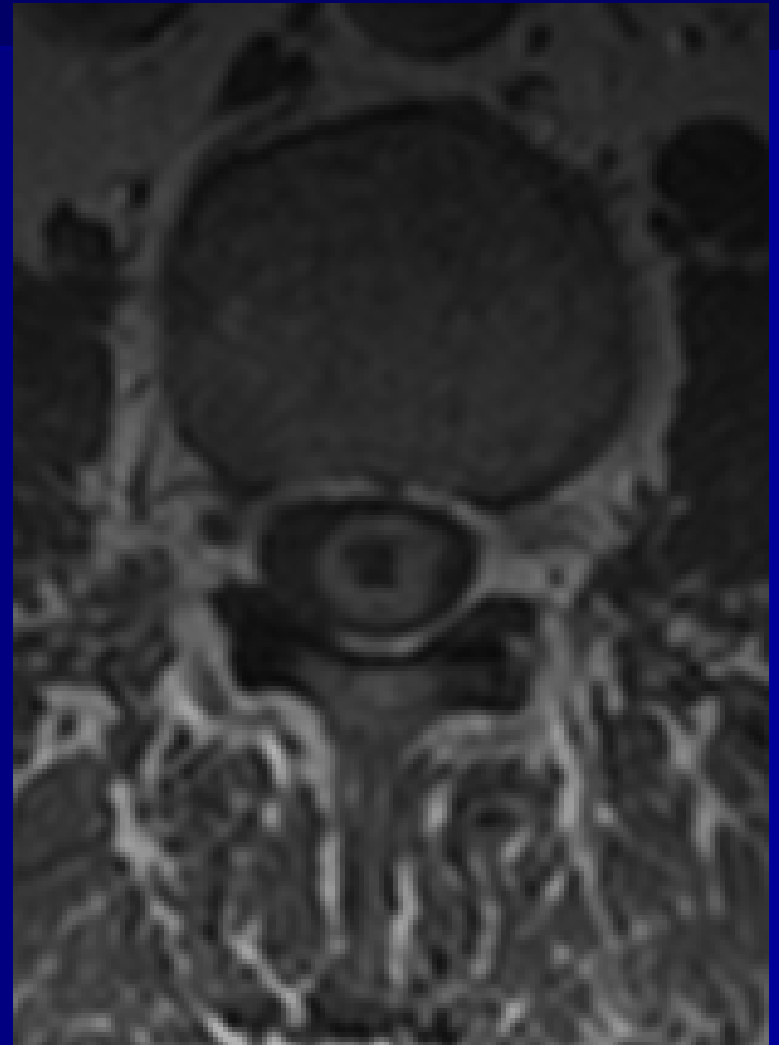
Intradural extramedullary tumours : neurinoma



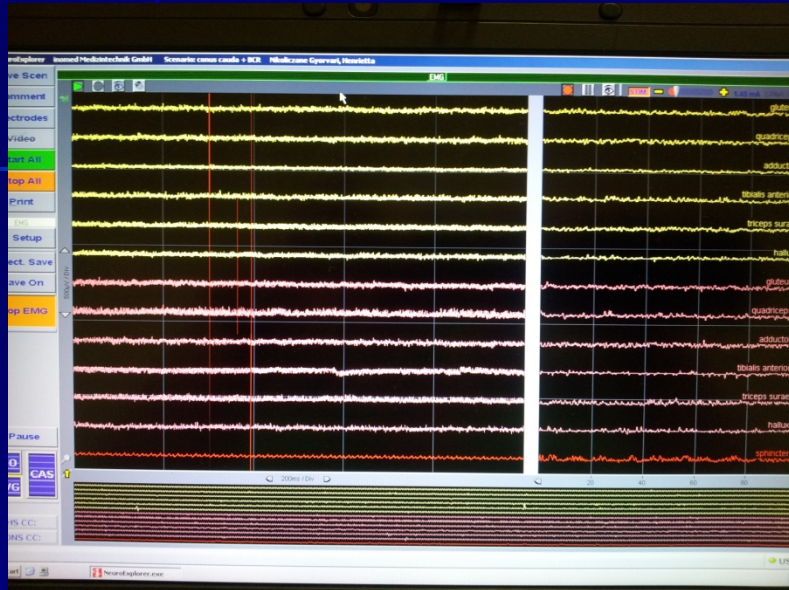
Filum terminale ependymoma

- Neuroectodermal derivation of filum terminale
- 40 % of ependymomas localised in the spinal canal
- 3th-5th decade
- 1:1 male-female
- Benign (in younger age can be more aggressive)

Myxopapillary ependymoma



Intraoperative electrofiziology

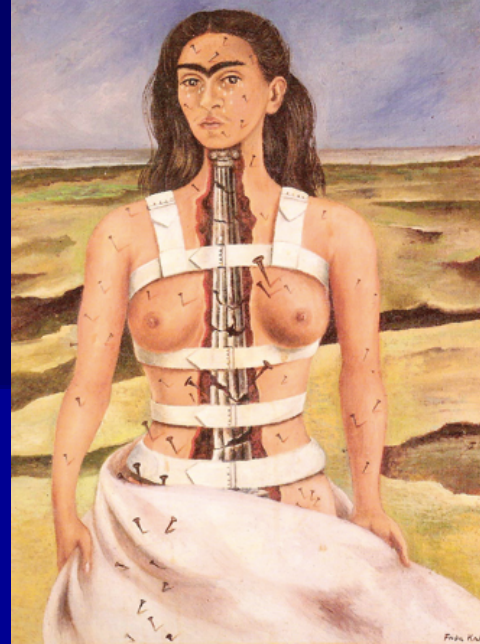


Intraoperative electrofiziology



Minimal invasivity

- allow to minimize resection of and injury to tissues not directly involved in the pathologic process
- possible to decrease the secondary damages
- These principles are valid under the surgical removal of the tumour, and the approach also.



Standard spinal canal approach

■ Multilevel laminectomies

Disadvantages:

- spinal deformities
- instability
- subluxation
- invasion of haematoma and scar tissue into the spinal canal
- lack of posterior bony protection of the spinal cord
- etc.



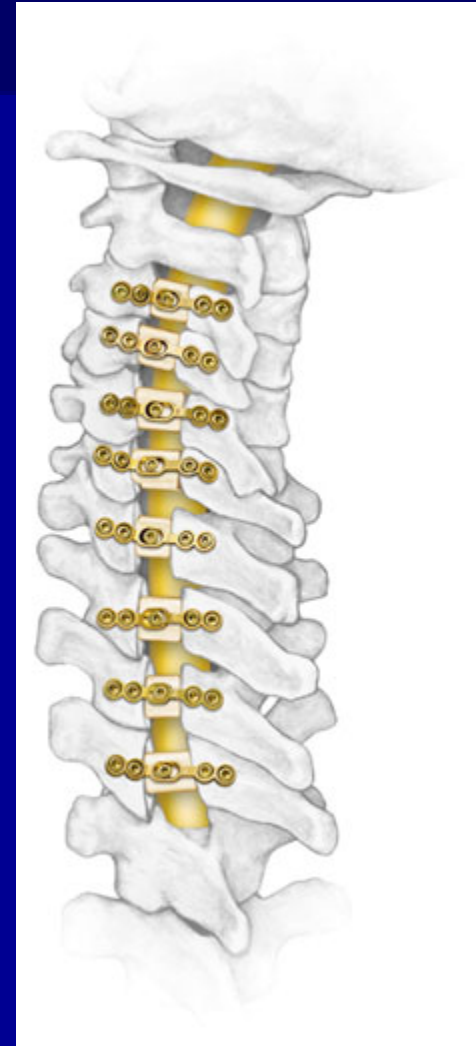
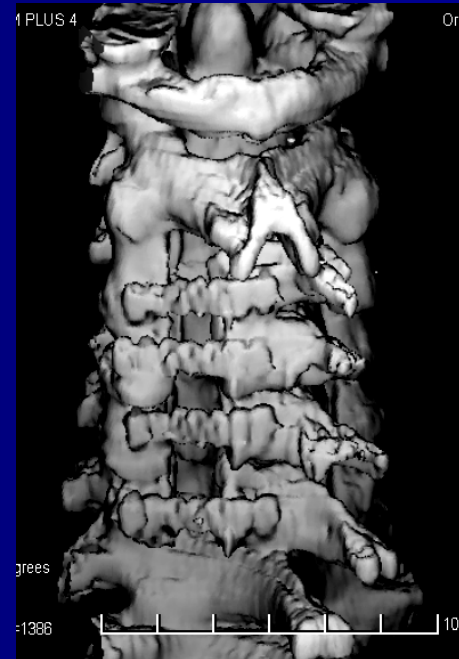
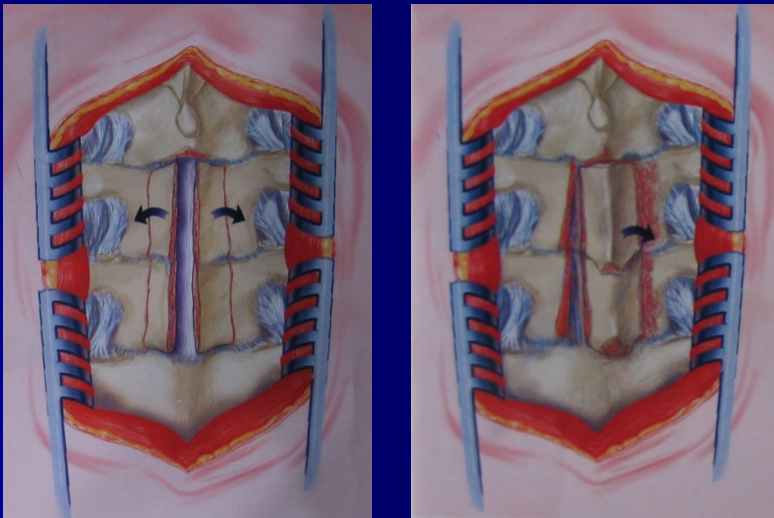
Postlaminectomy deformity



Correction is difficult or impossible

The alternative approaches

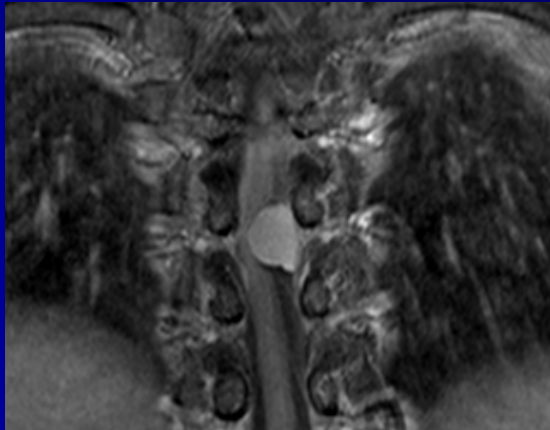
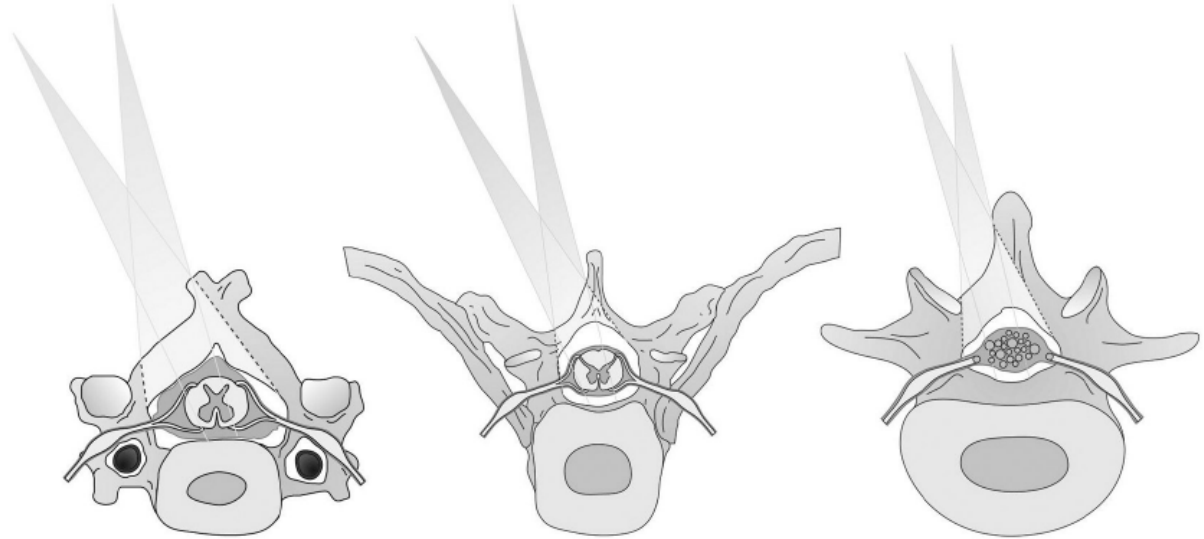
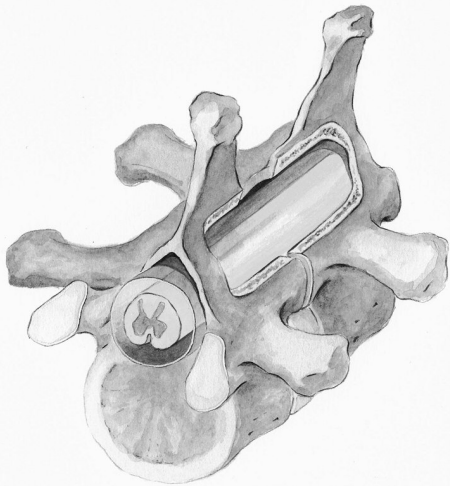
- Alternative laminectomies
- Laminotomies, laminoplasty
- Partial hemilaminectomy



The new minimal invasive surgical approaches to remove spine tumours

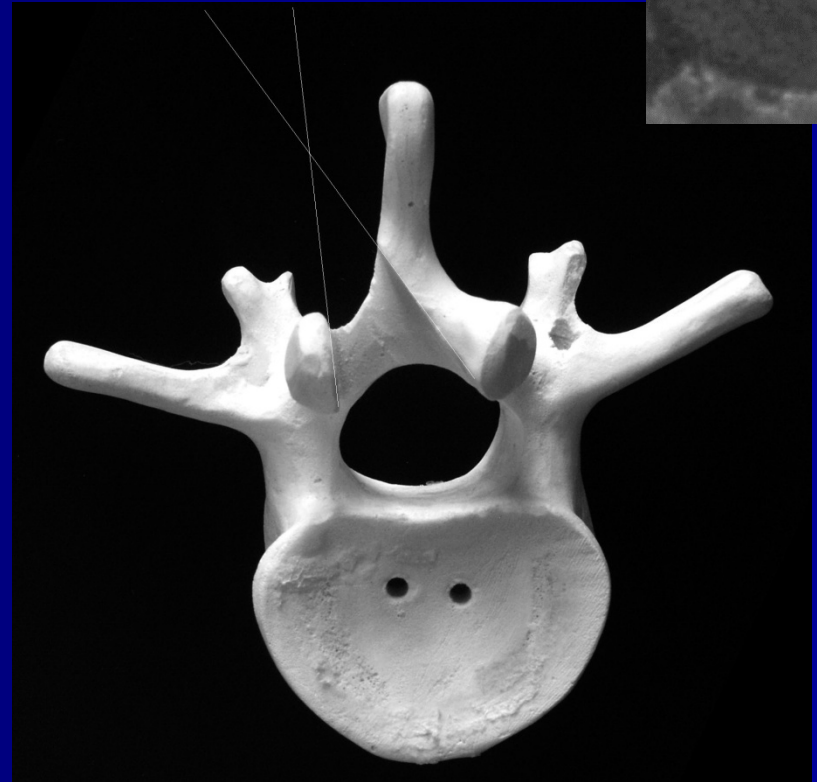
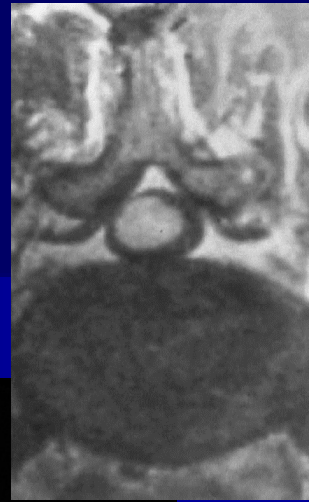
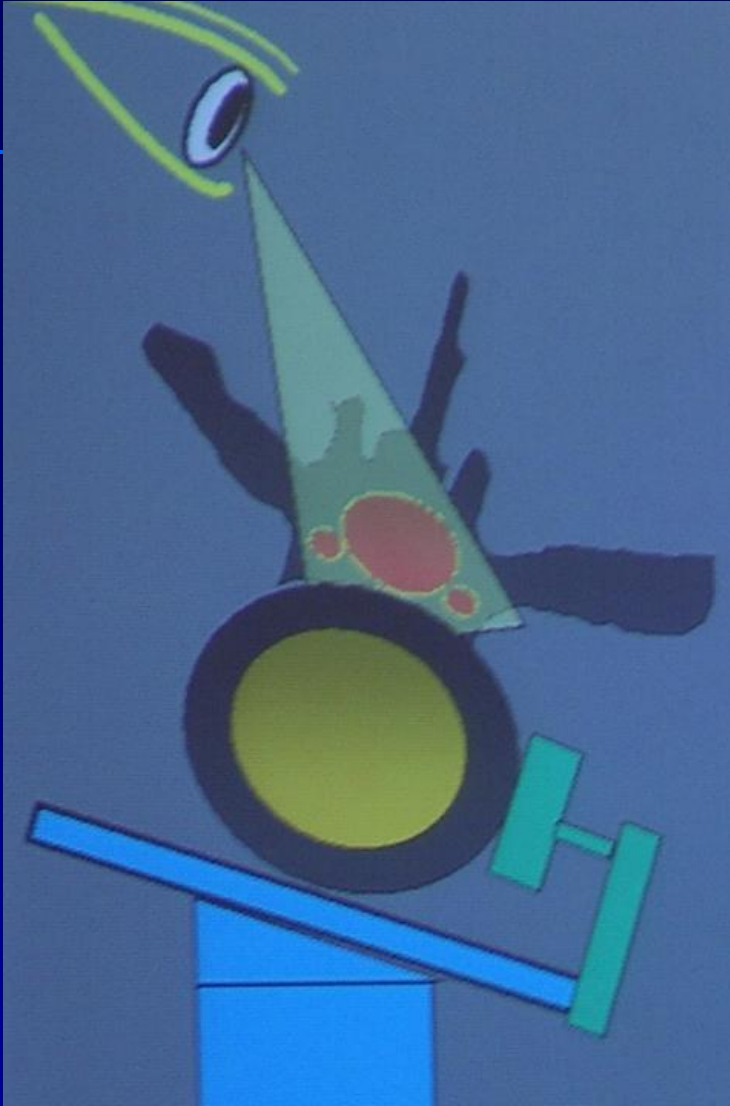


Laterally located pathologies : partial unilateral laminectomy

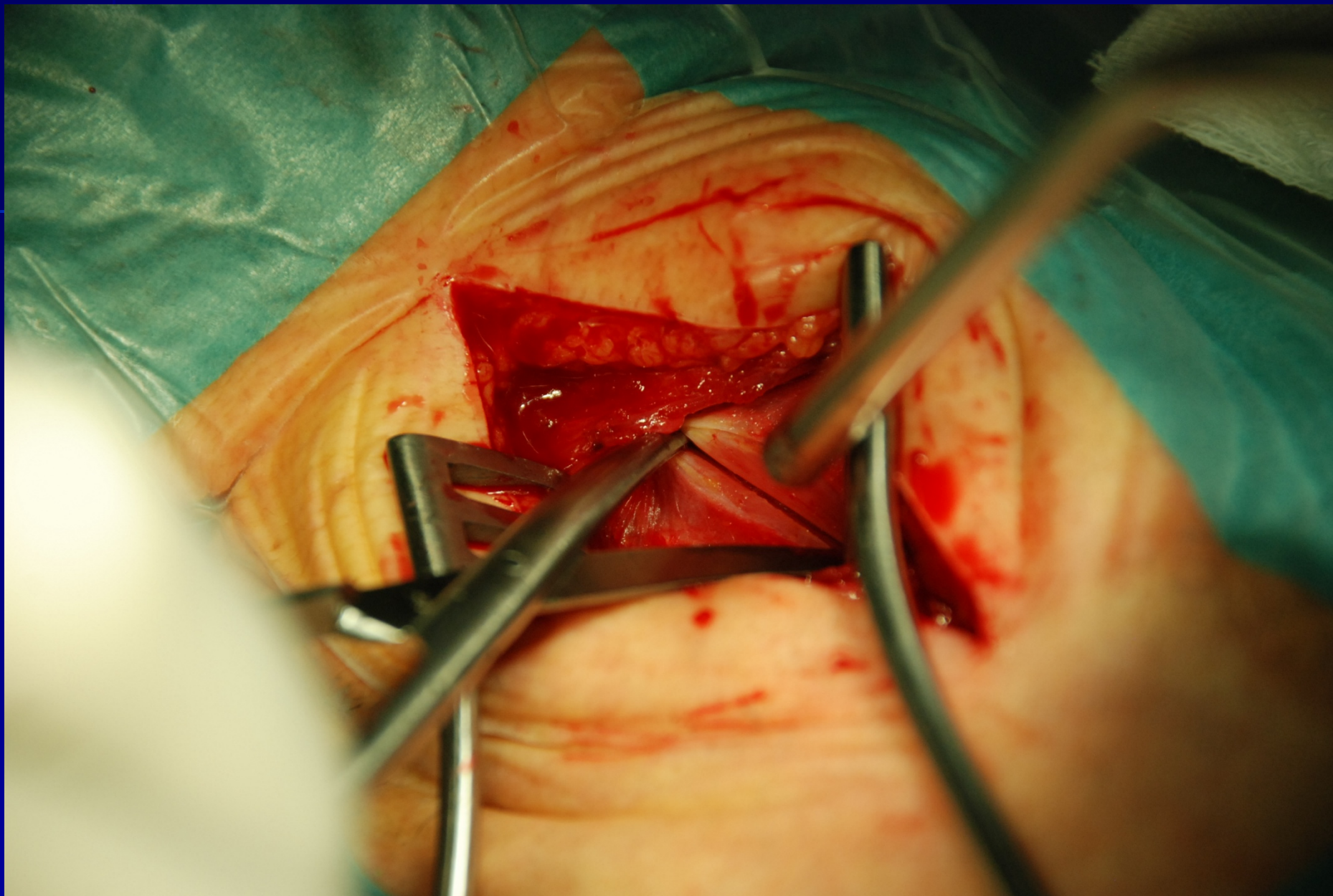


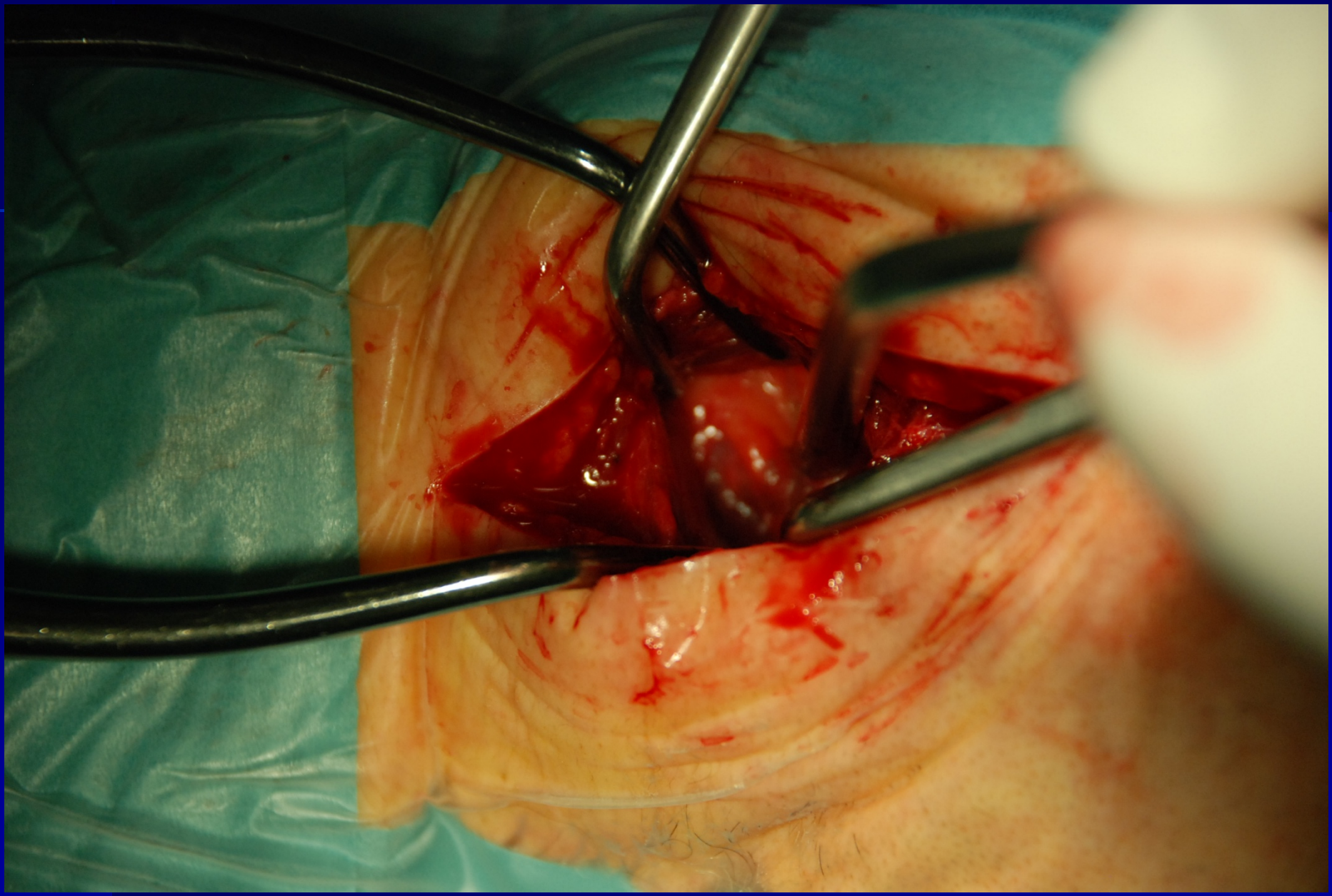
Applicable along the whole spine,
multiple „windows” if necessary

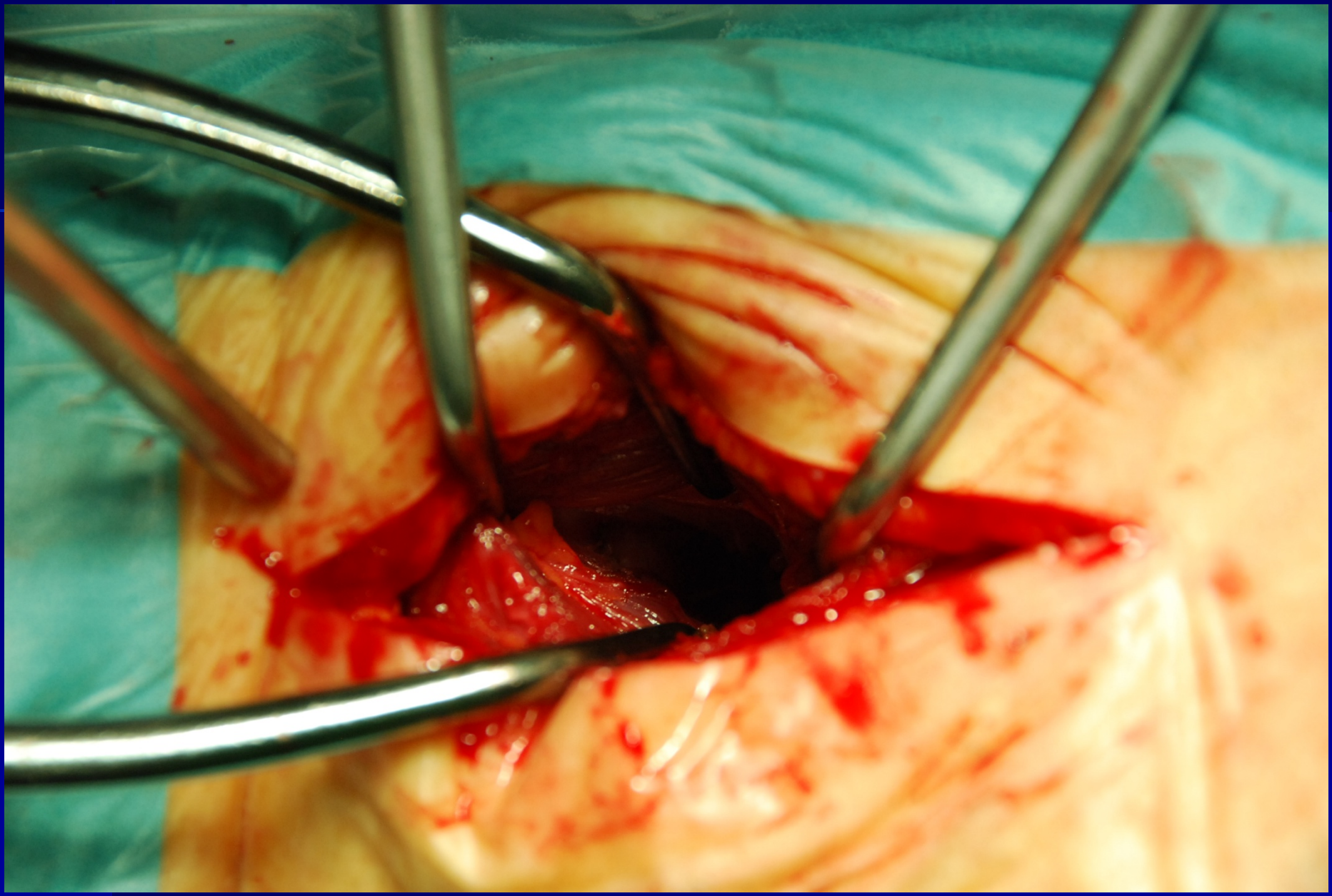
Technique



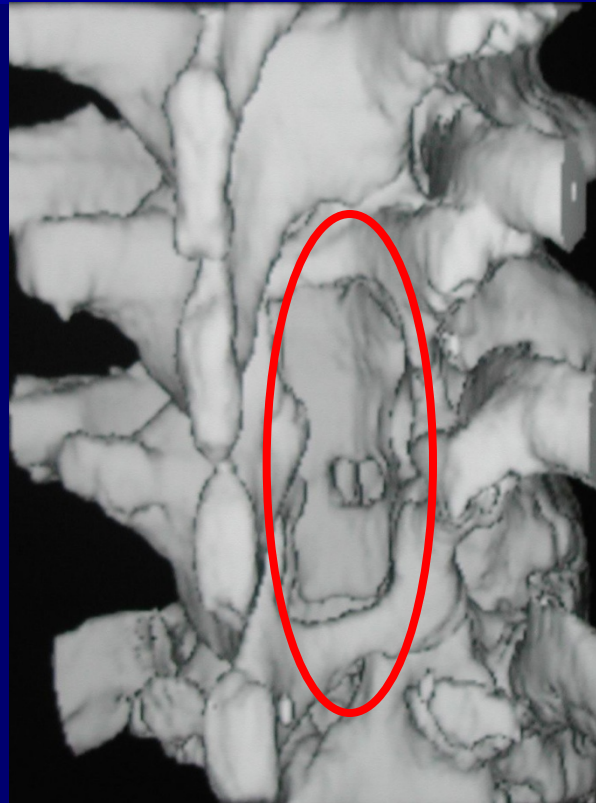
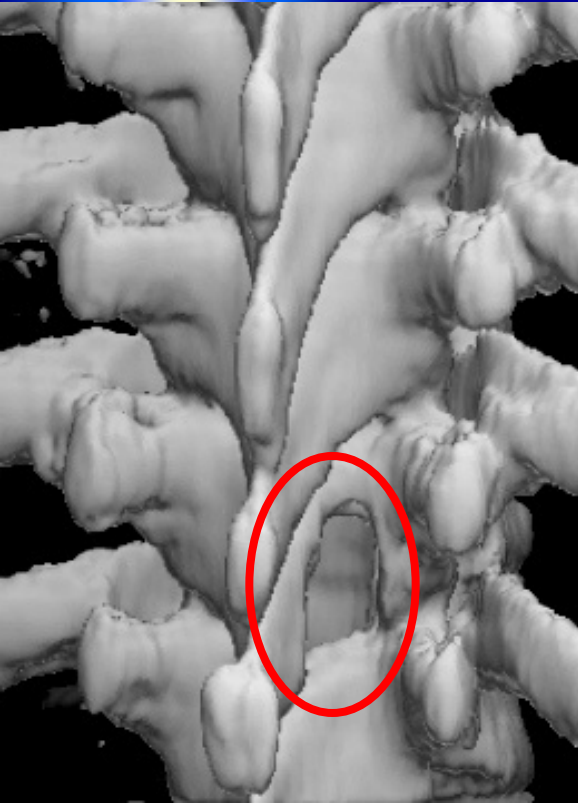






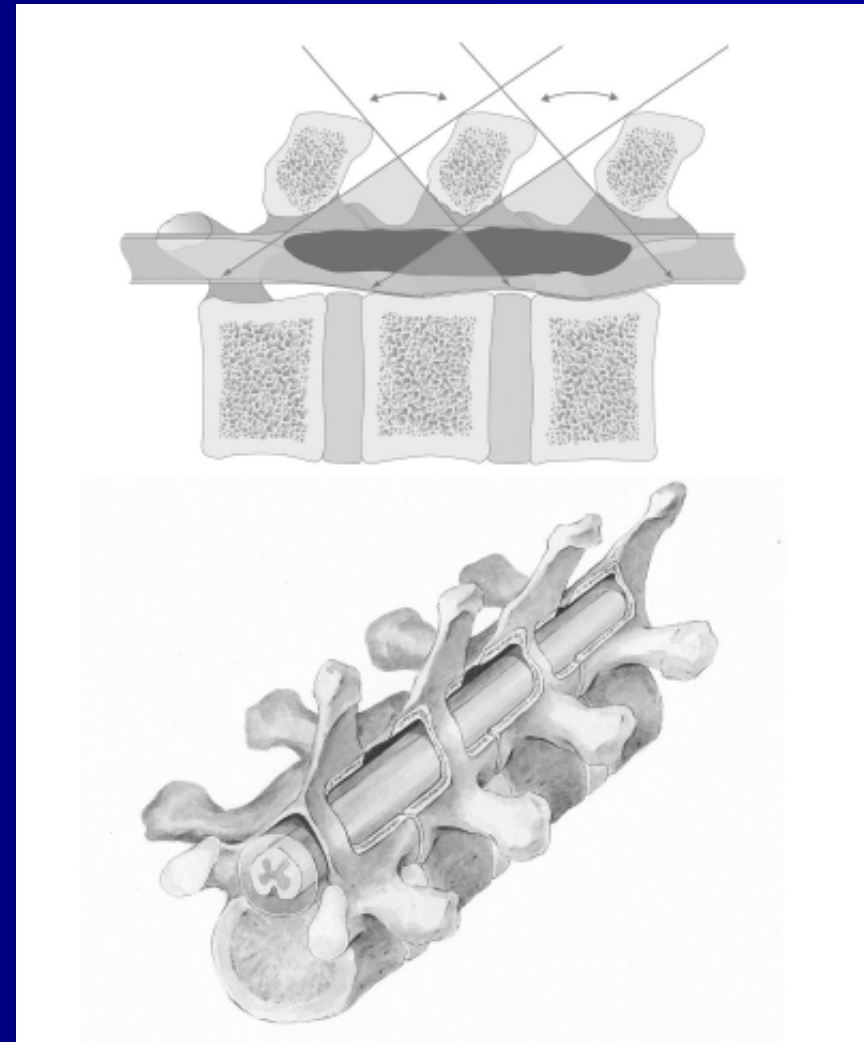


Partial unilateral laminectomy

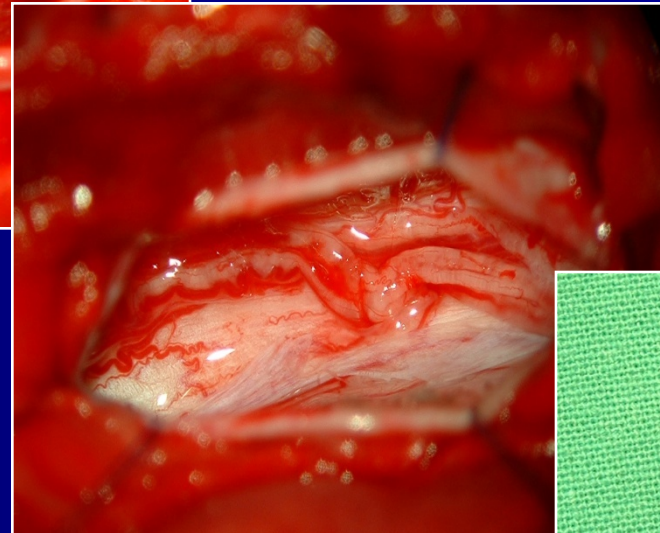
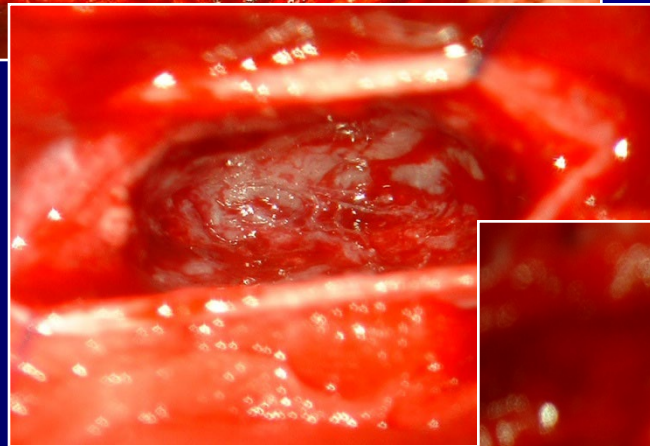
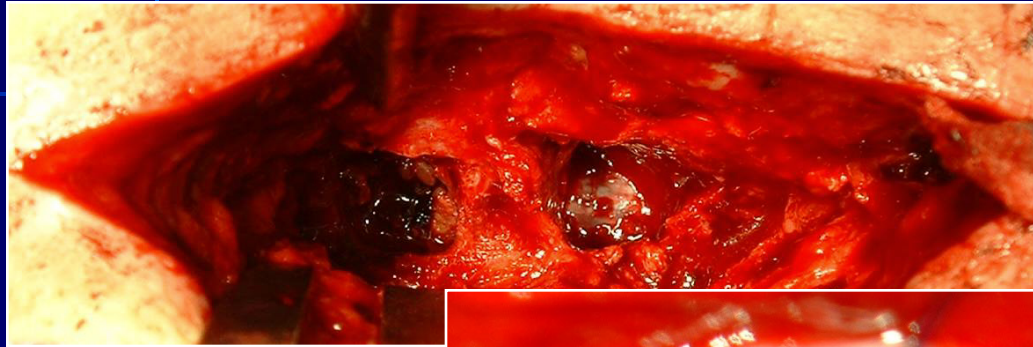


The bone removal depend on the localization of the lesion (pre- & intraoperative localization)

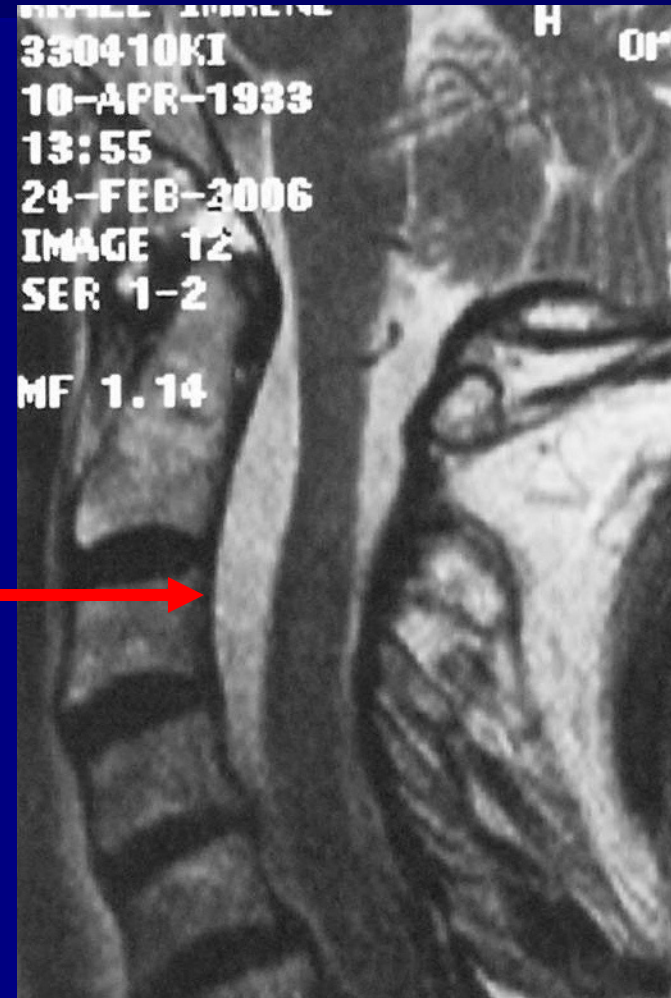
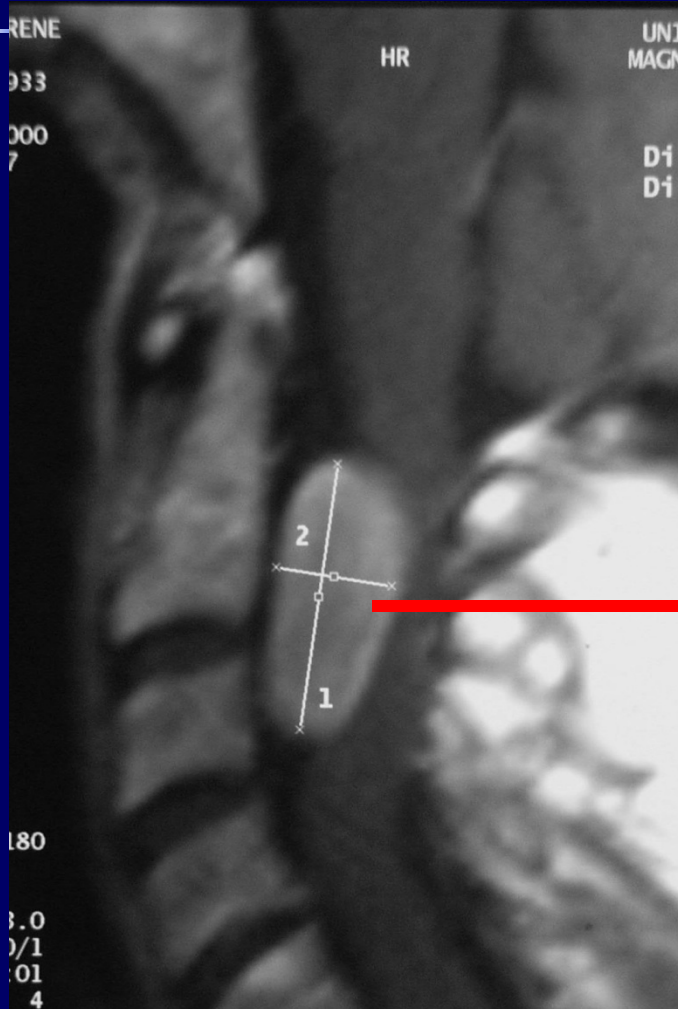
Multilevel partial unilateral laminectomy: *laterally-longitudinally located pathologies*



Hemi-semi laminectomy



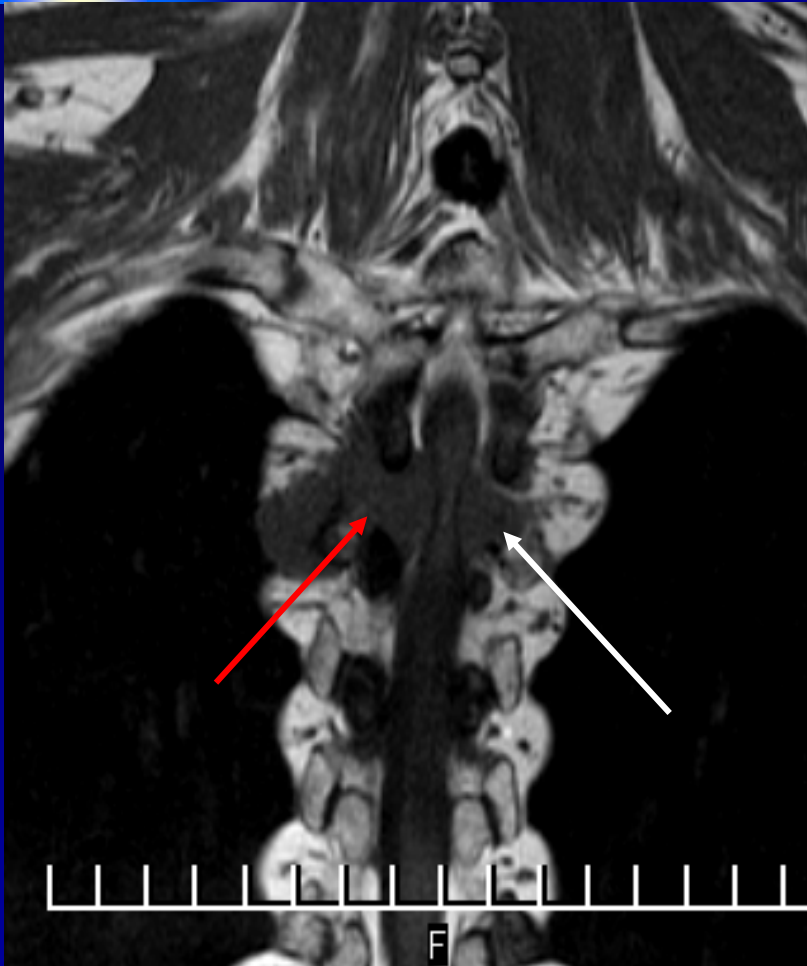
Tumour removal: meningeoma



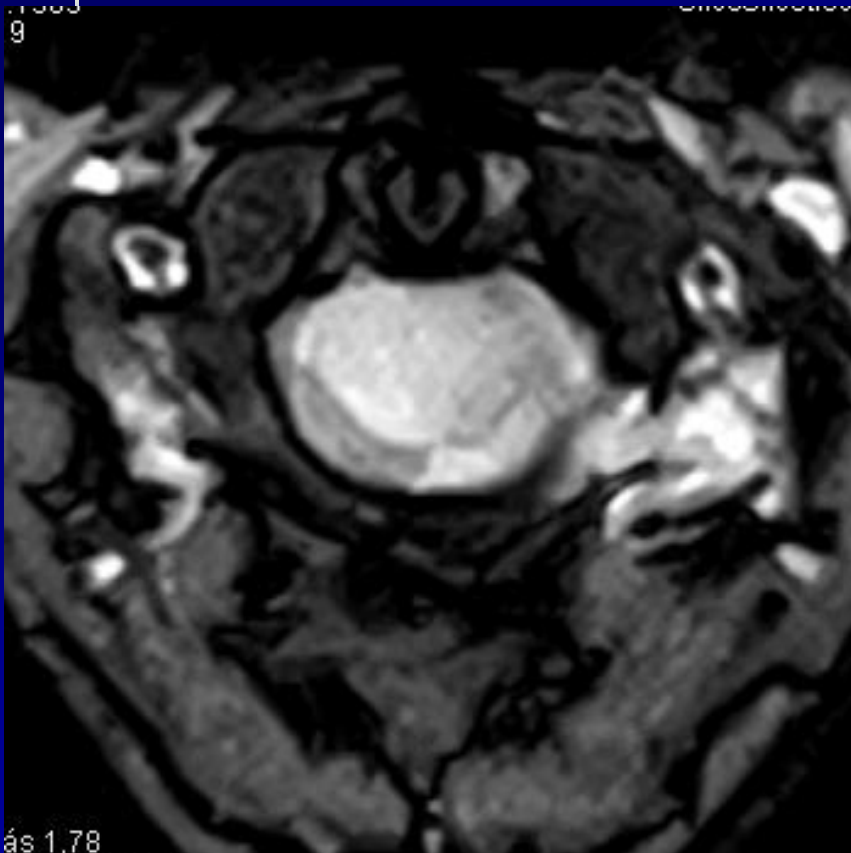
Tumour removal : meningeoma



The tumour confined to both side



CI-II neurinoma



C1-II neurinoma

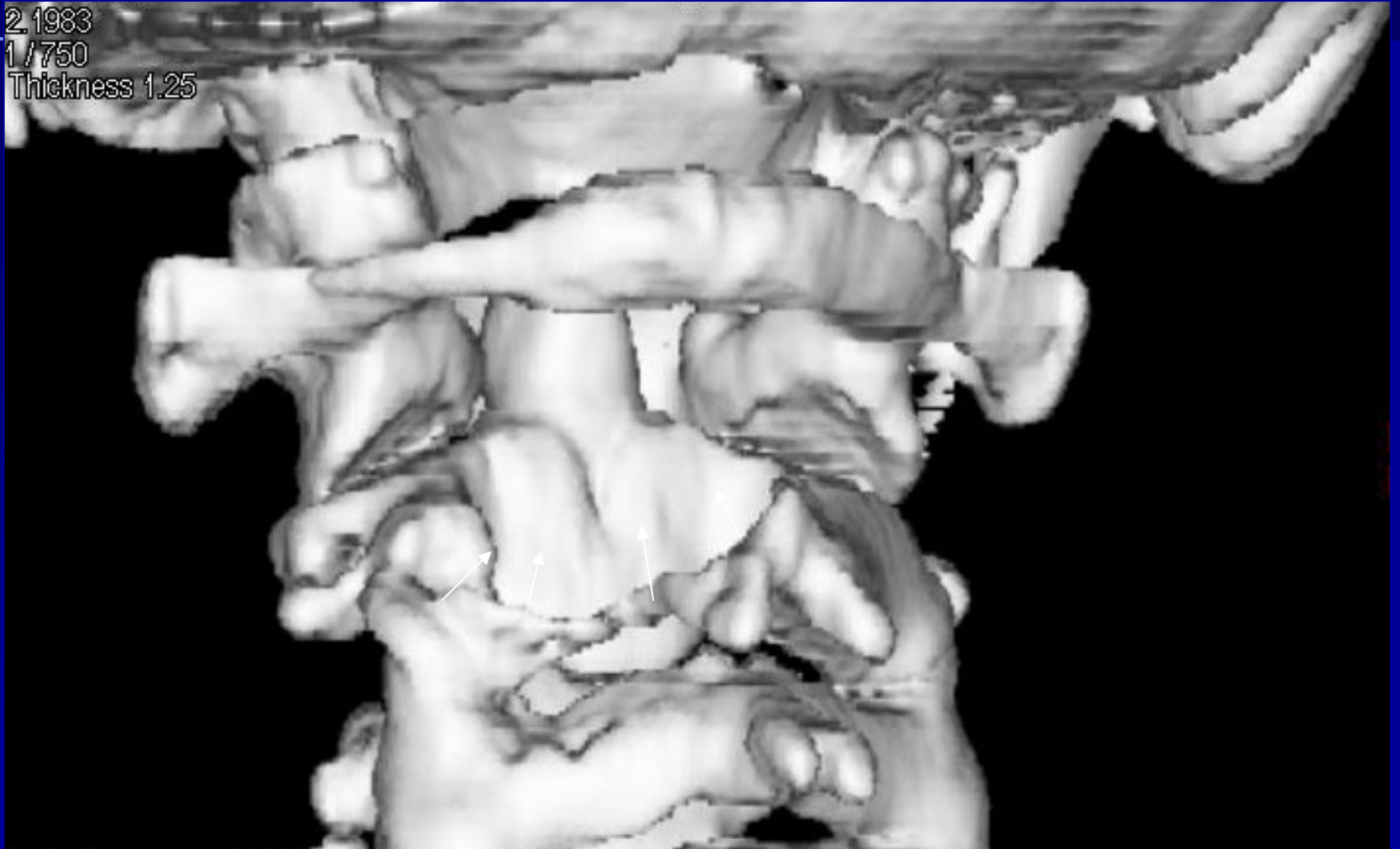


C1-II neurinoma



CII neurinoma postoperative CT

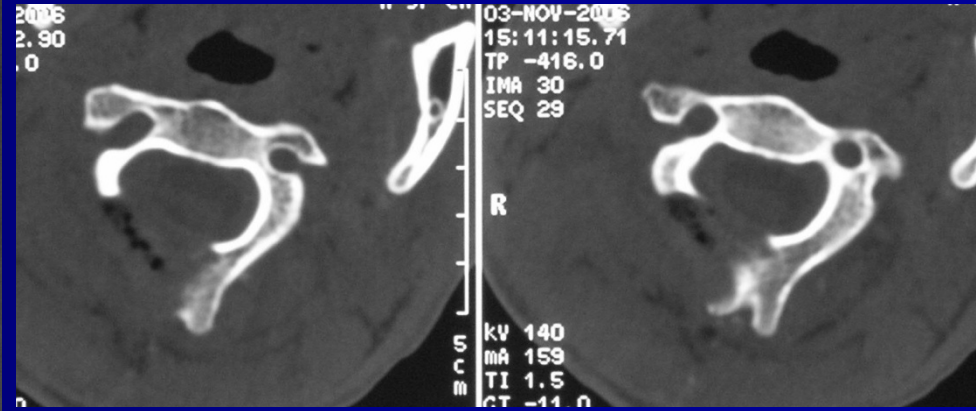
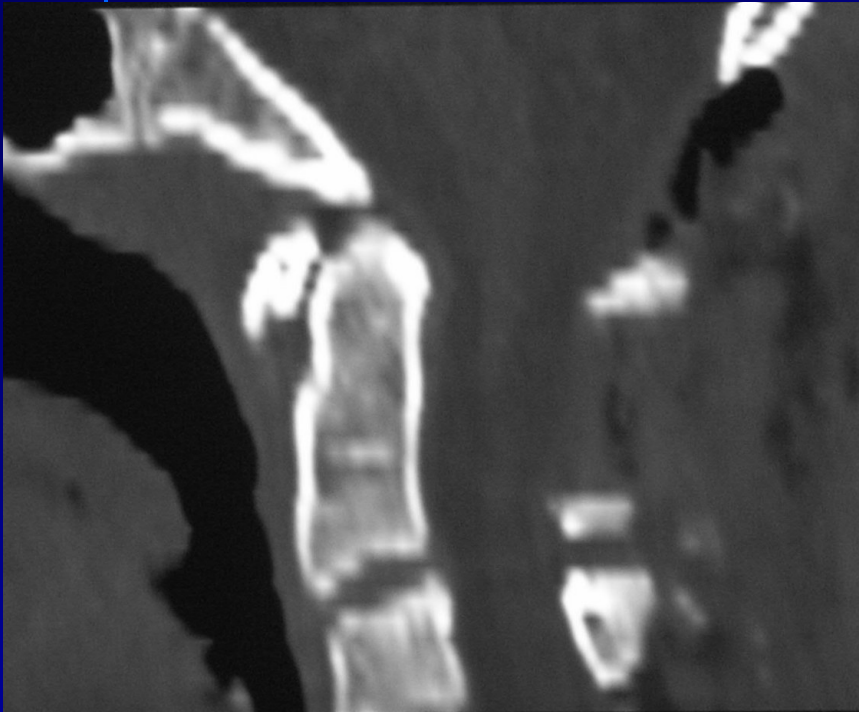
2.1983
1/750
Thickness 1.25



CII meningeoma

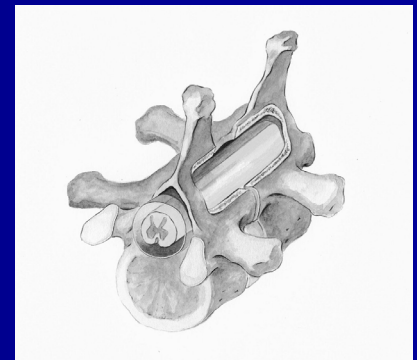


CII meningeoma



Hemi-semi laminectomy

- The unilateral partial hemilaminectomy (named hemi-semi laminectomy) approach suitable for the mainly laterally located intra- or extradural lesions, confined to one side



Tumours extending into the neuroforamen

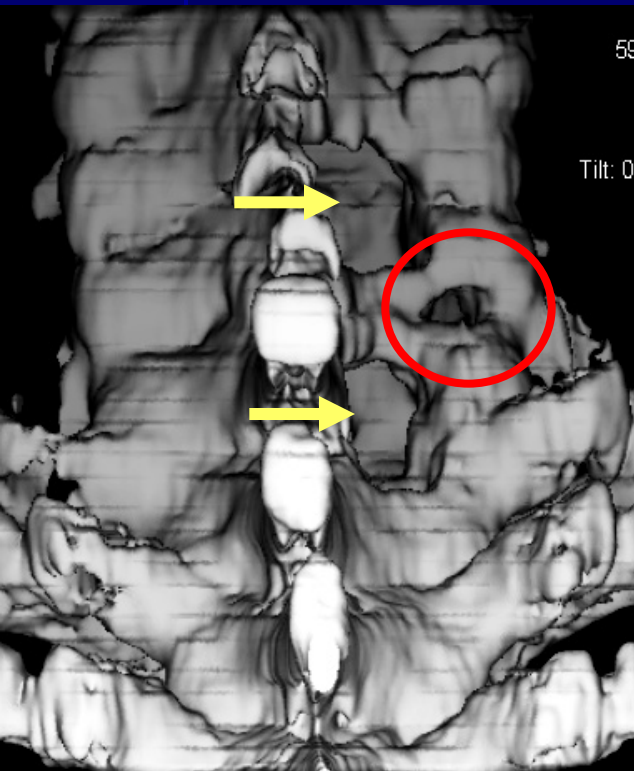


approximately 15 % extend along the cervical nerve root inside the foramen and extraforaminally

Modified hemi-semi laminectomy

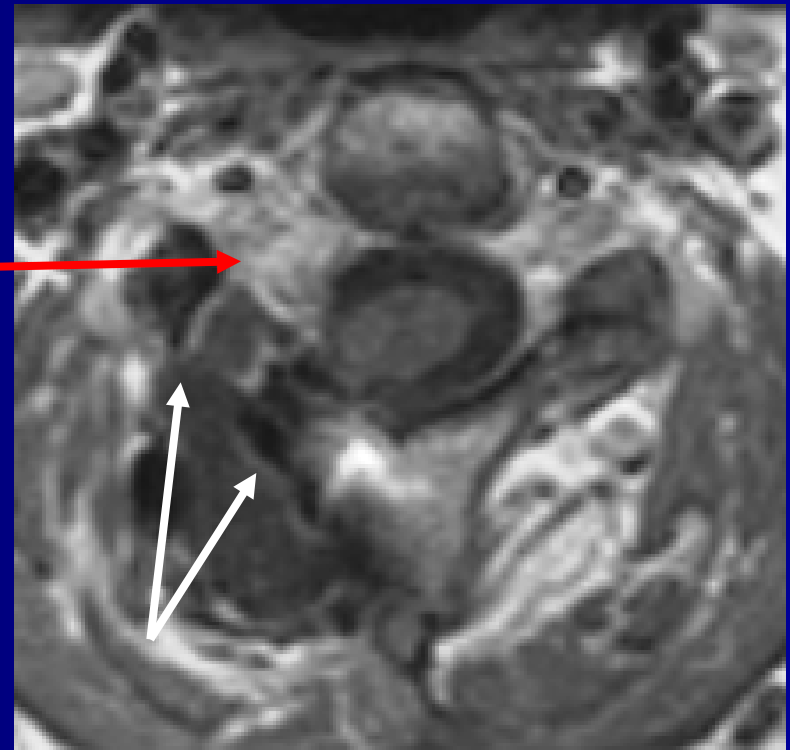
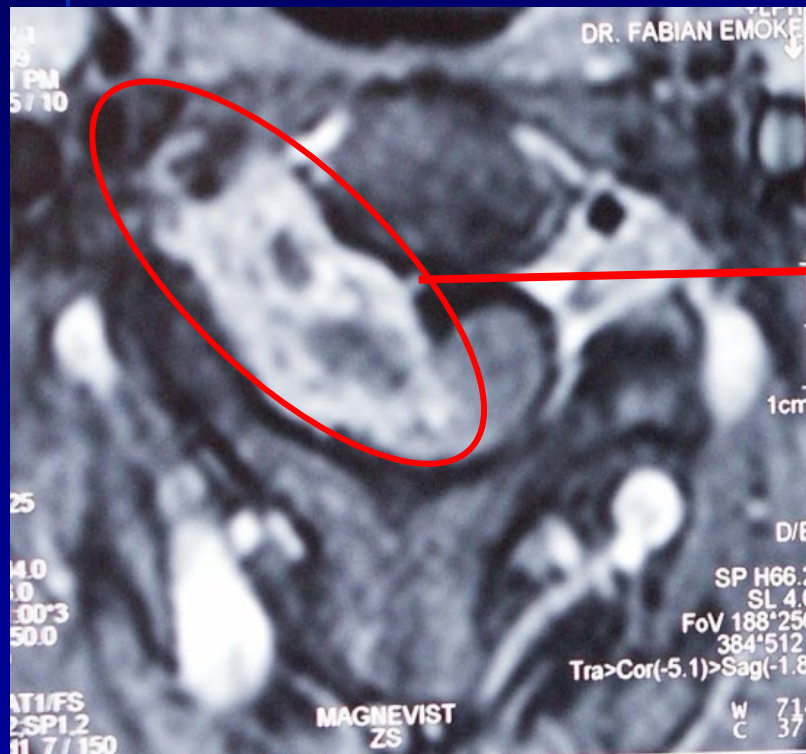
Supraforaminal „burr hole”

technique: no facetectomy



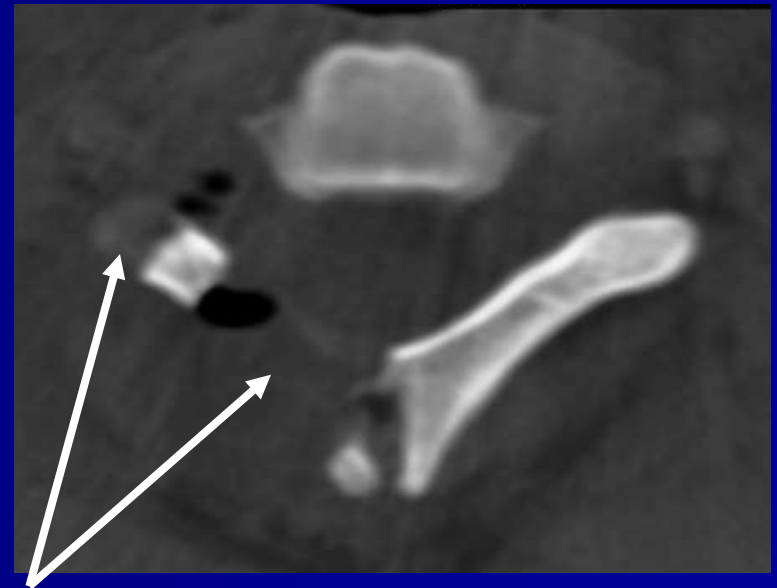
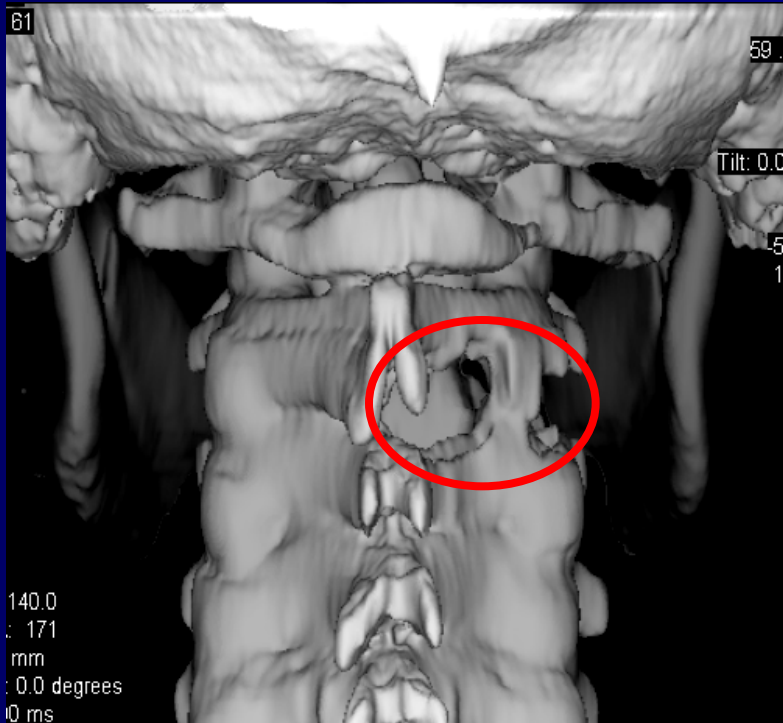
Tilt: 0.0
3
64
125

Tumour removal



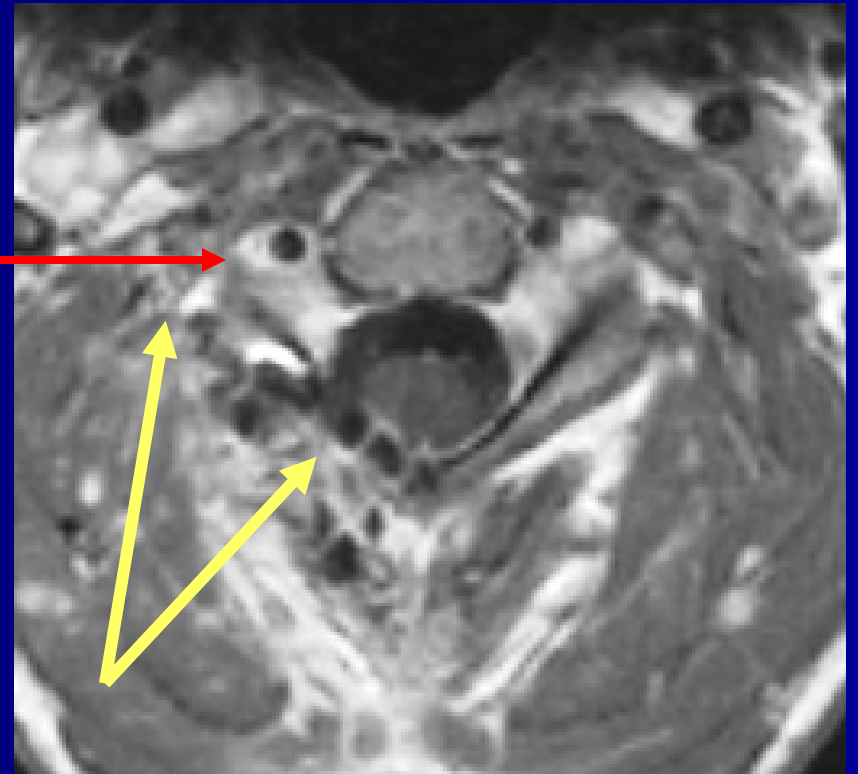
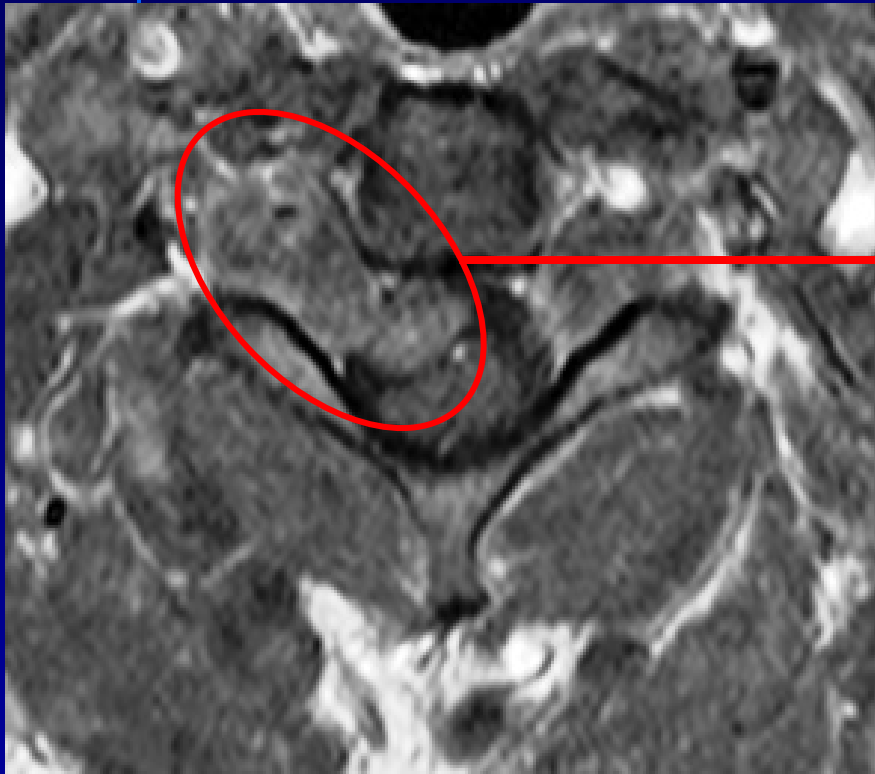
Modified hemi-semi laminectomy

„Open tunnel” technique
partial facetectomy



extent of extraforaminal
component

Tumour removal

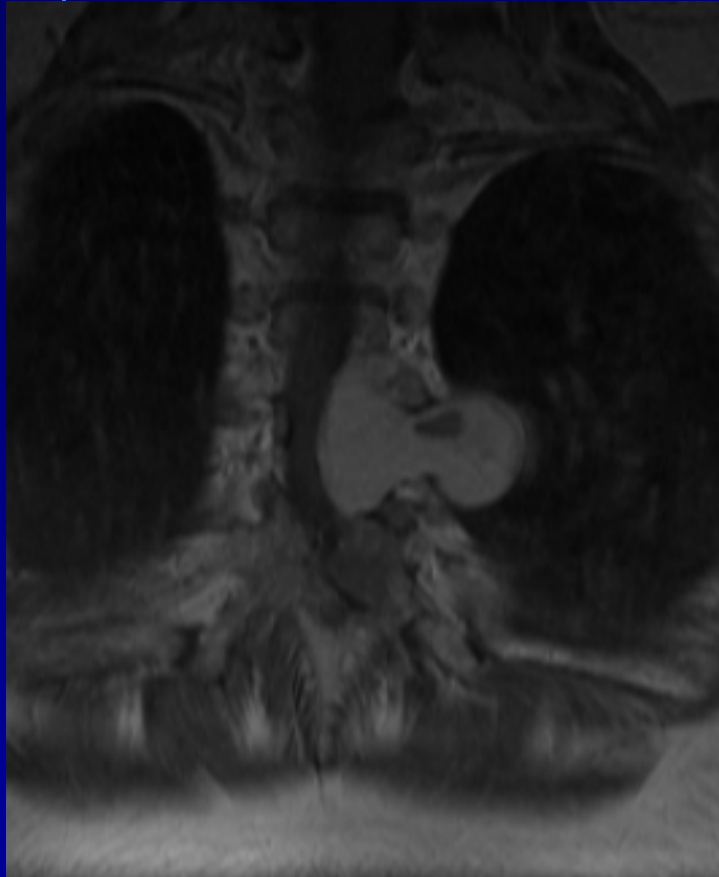


Supraforaminal „burr hole” and „open tunnel” technic

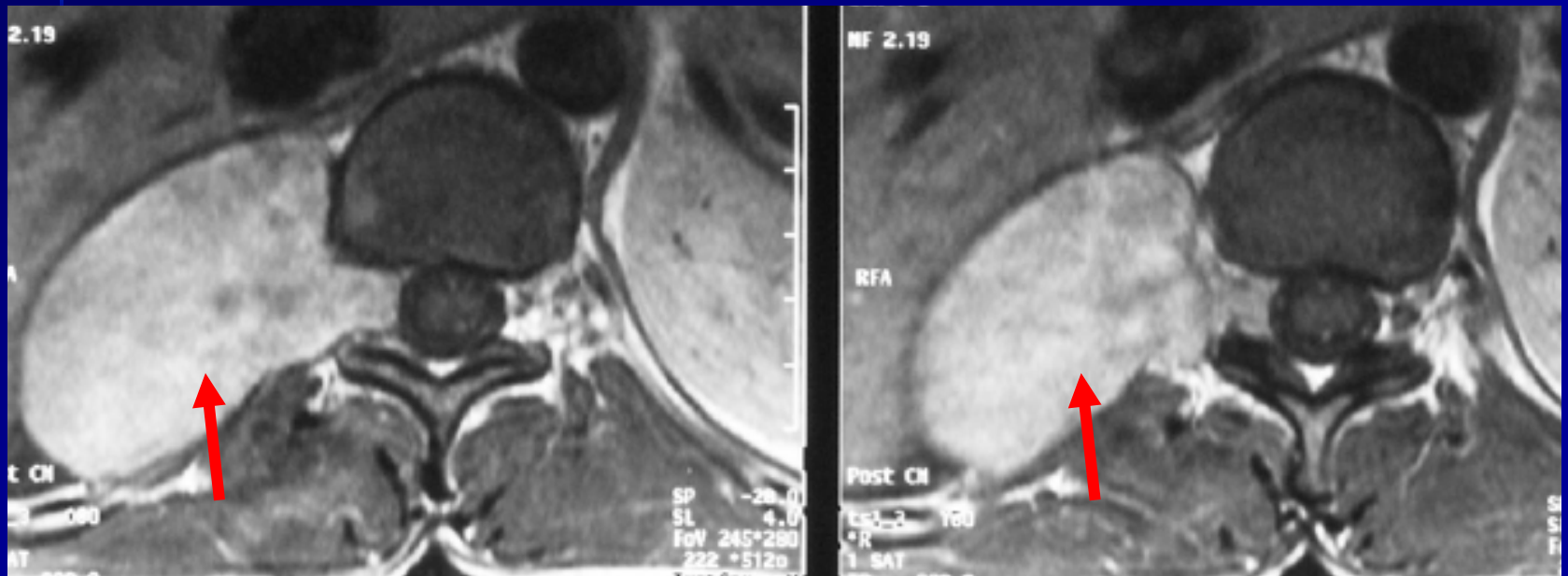
- Suitable approach for tumours extending into the neuroforamen, and extraforaminally



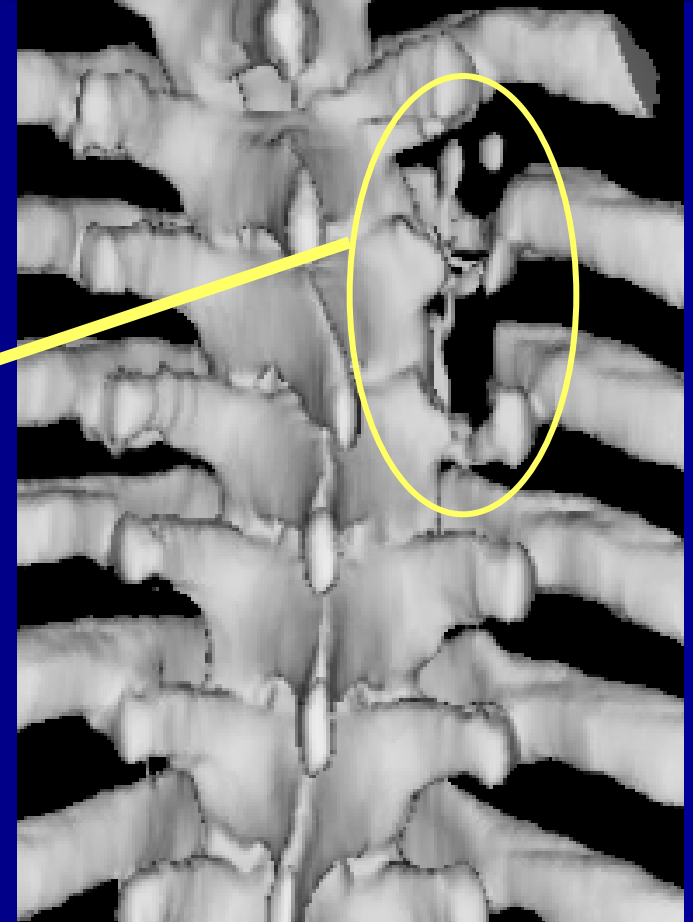
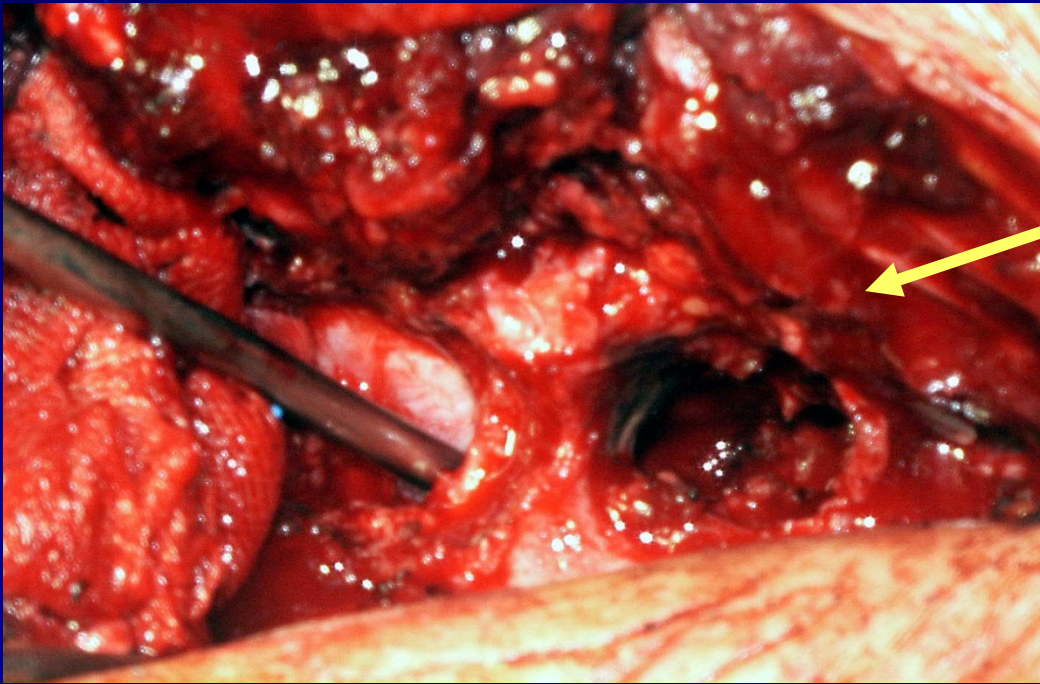
Neurofibroma (shape of a sandglass)



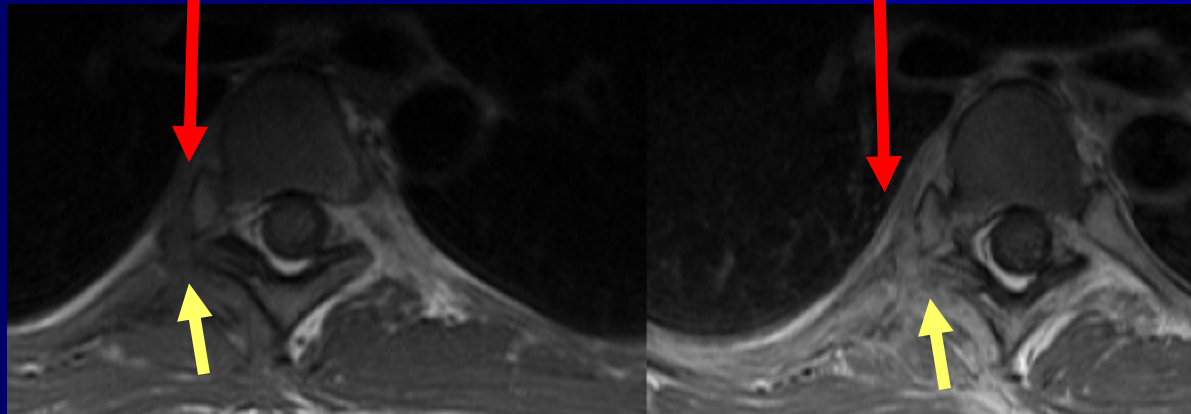
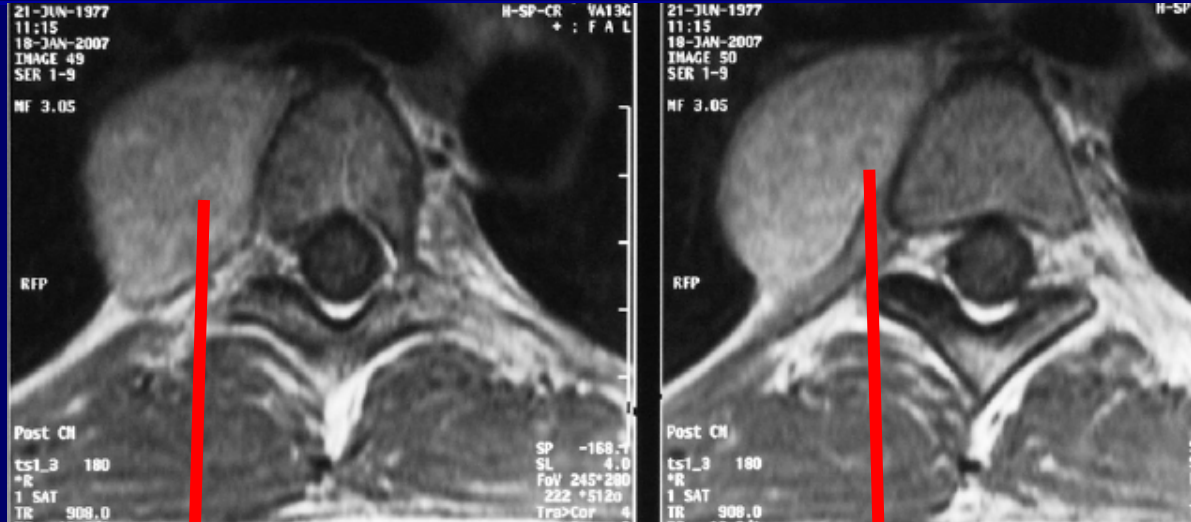
Tumours extending paraspinally



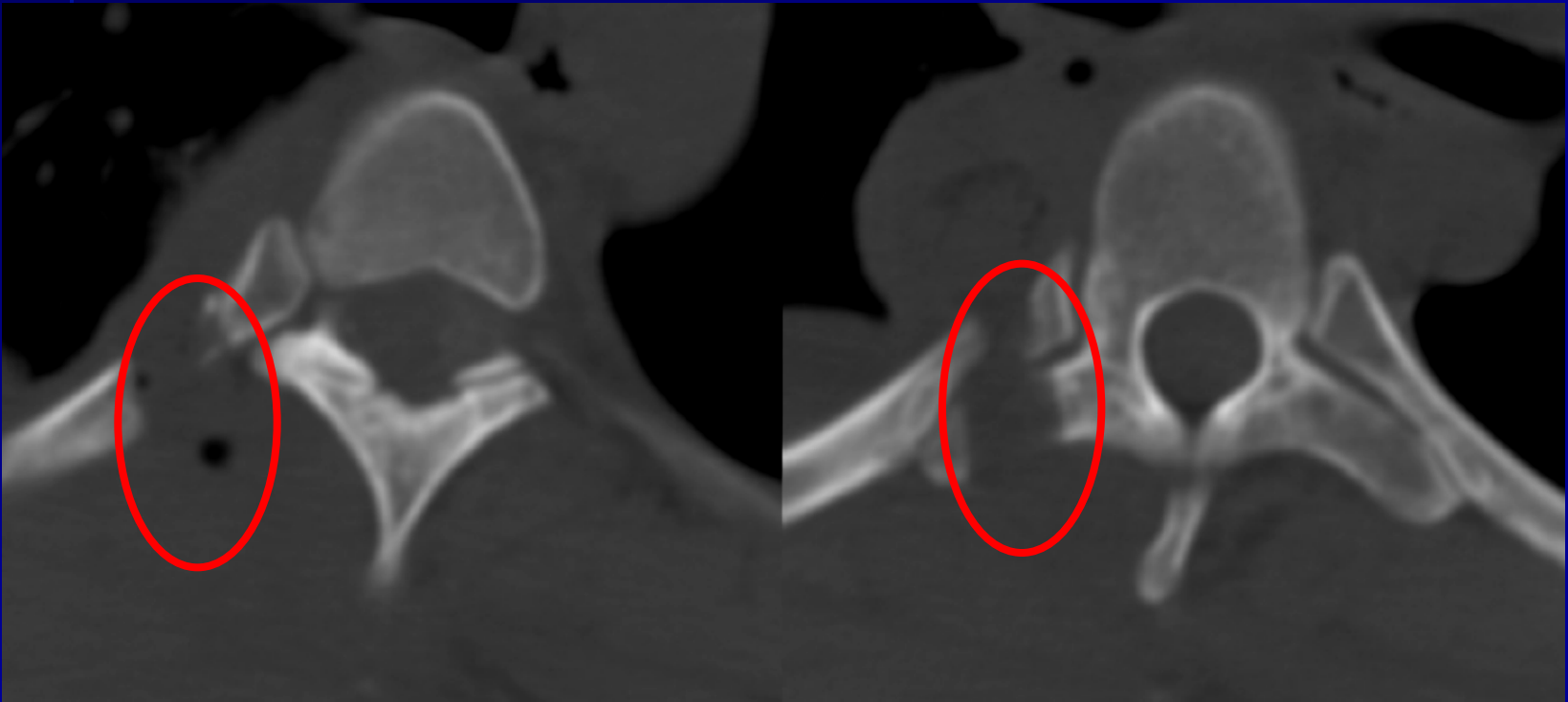
Tumor removal



Tumor removal



Paraspinal approach



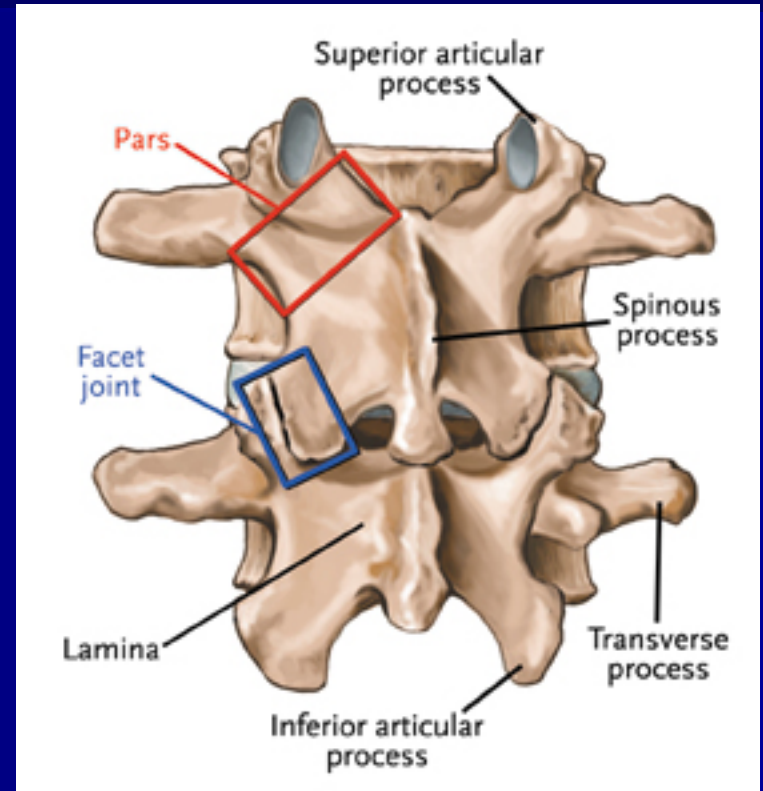
Advantages

Less bone removal

Sparing with facet joint



Static stability improvement



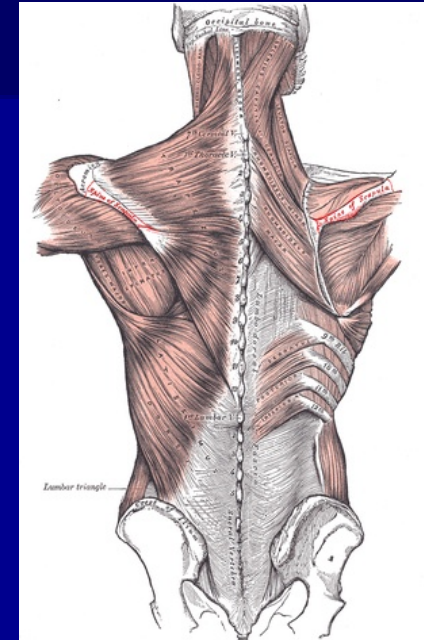
Advantages

No contralateral muscle detachment and no touch of supra- and interspinosus ligaments

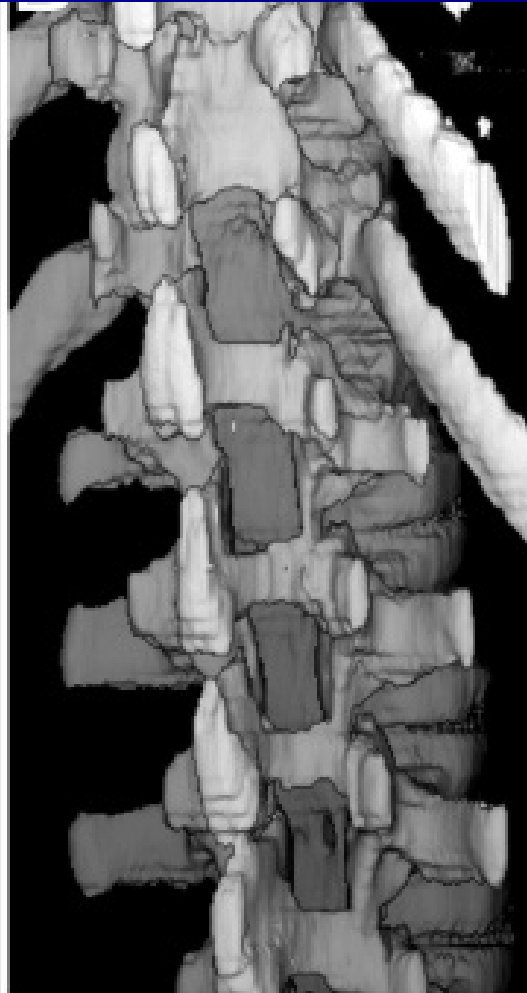


Dynamic stability improvement

- Cosmetic (incision to be limited to the immediate region of exploration of the spinal canal, normal posterior median furrow)



*Laterally longitudinally located
pathologies -
multi hemi-semi laminectomy*



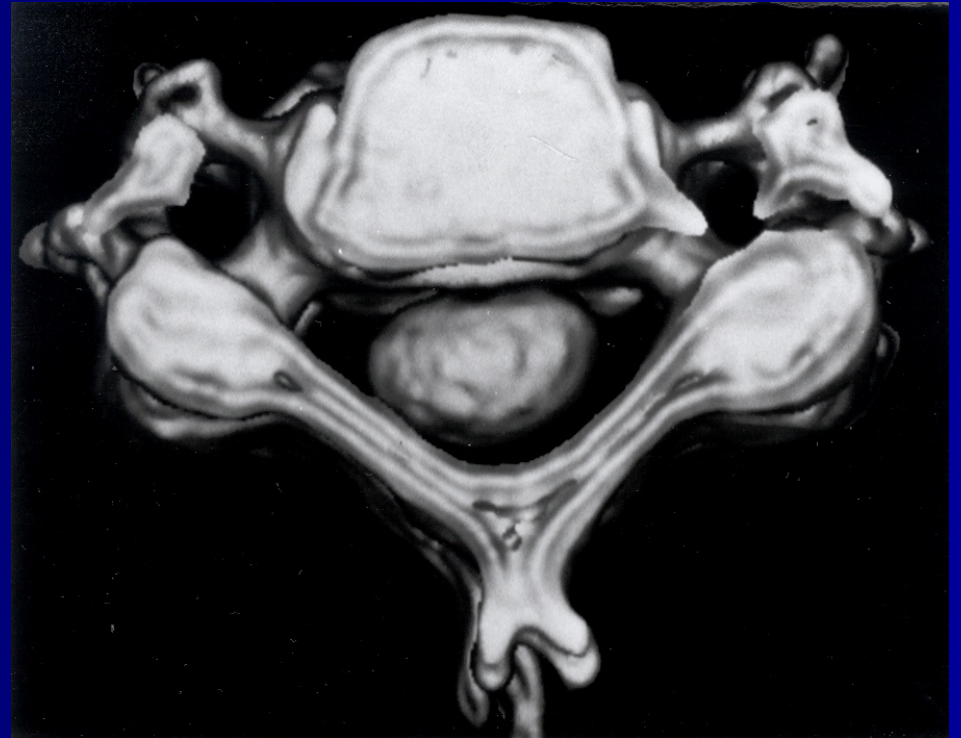
Multi hemi-semi laminectomy



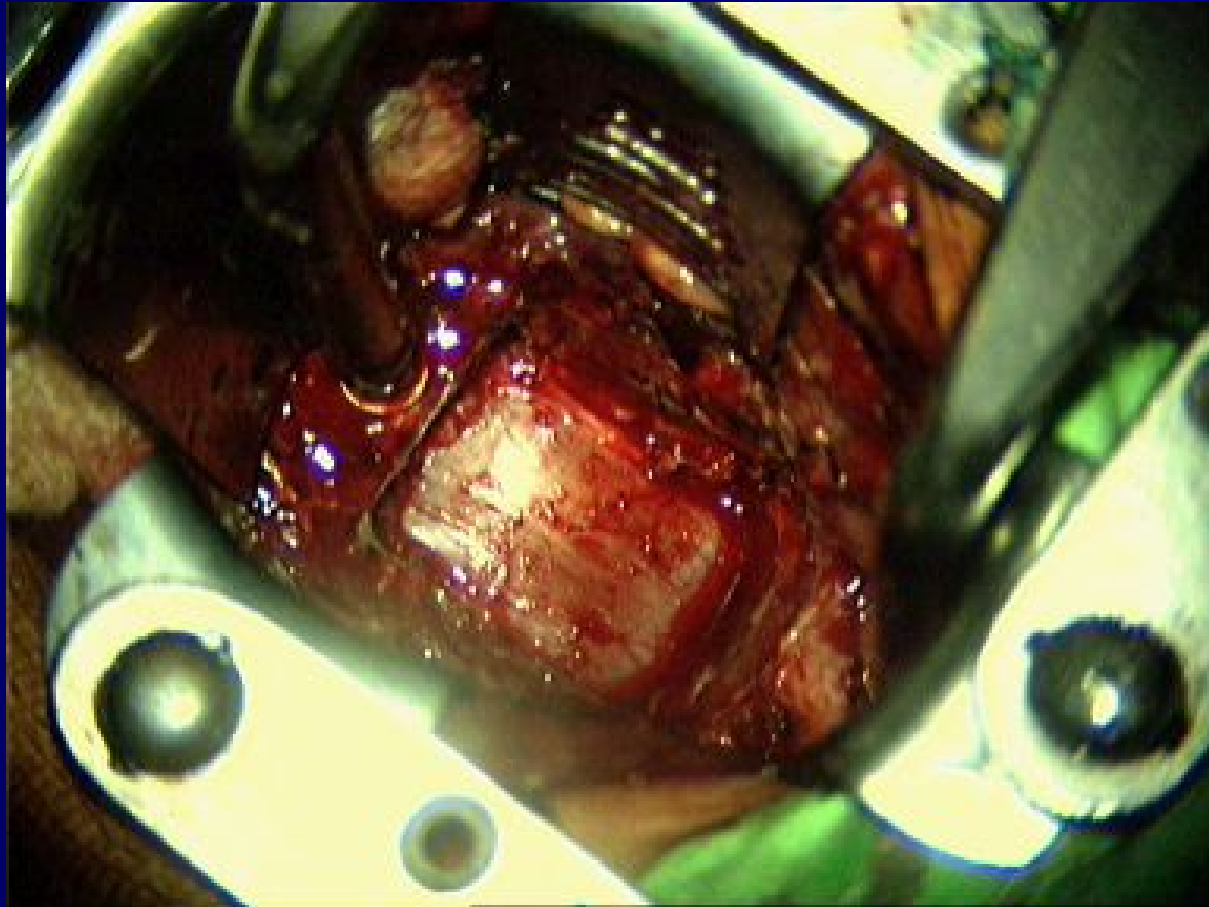
The surgical removal of
intradural, ventrally located
tumours in the spinal canal



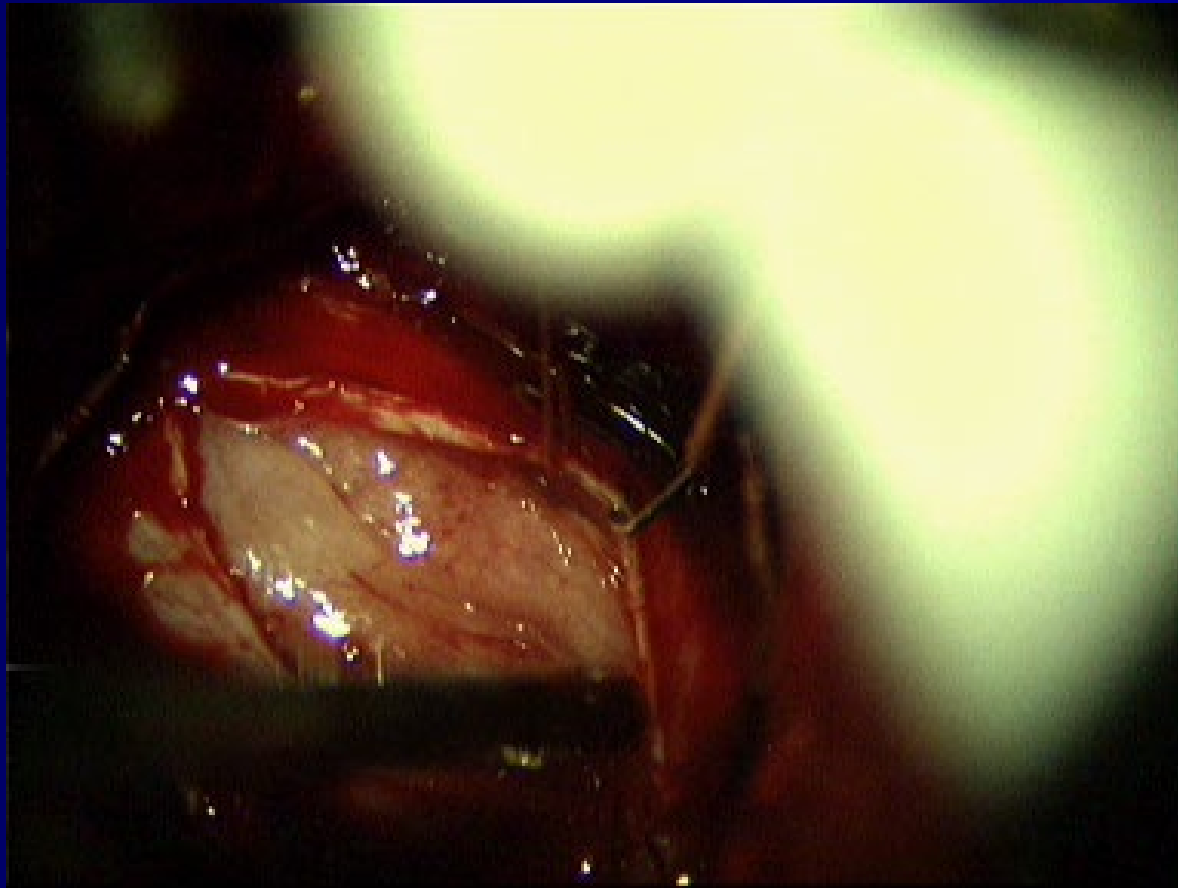
C V ventrally located meningeoma



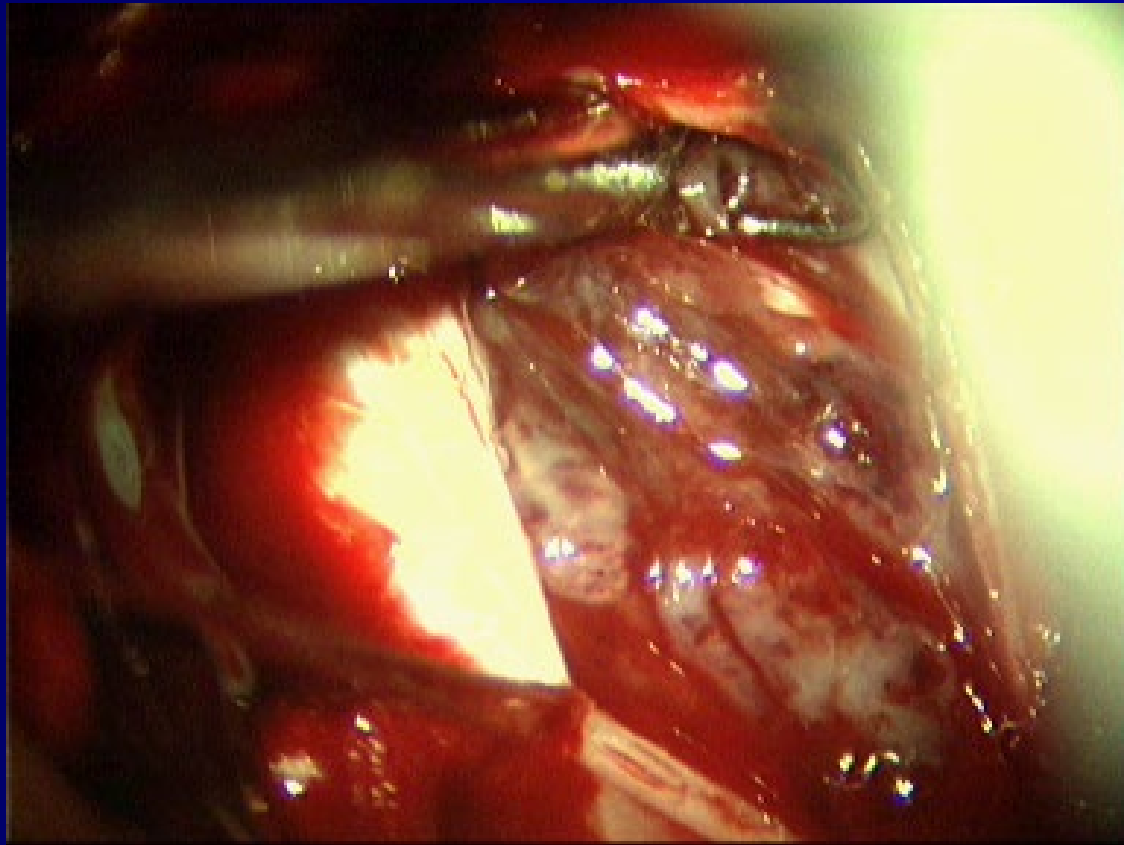
Corpectomy



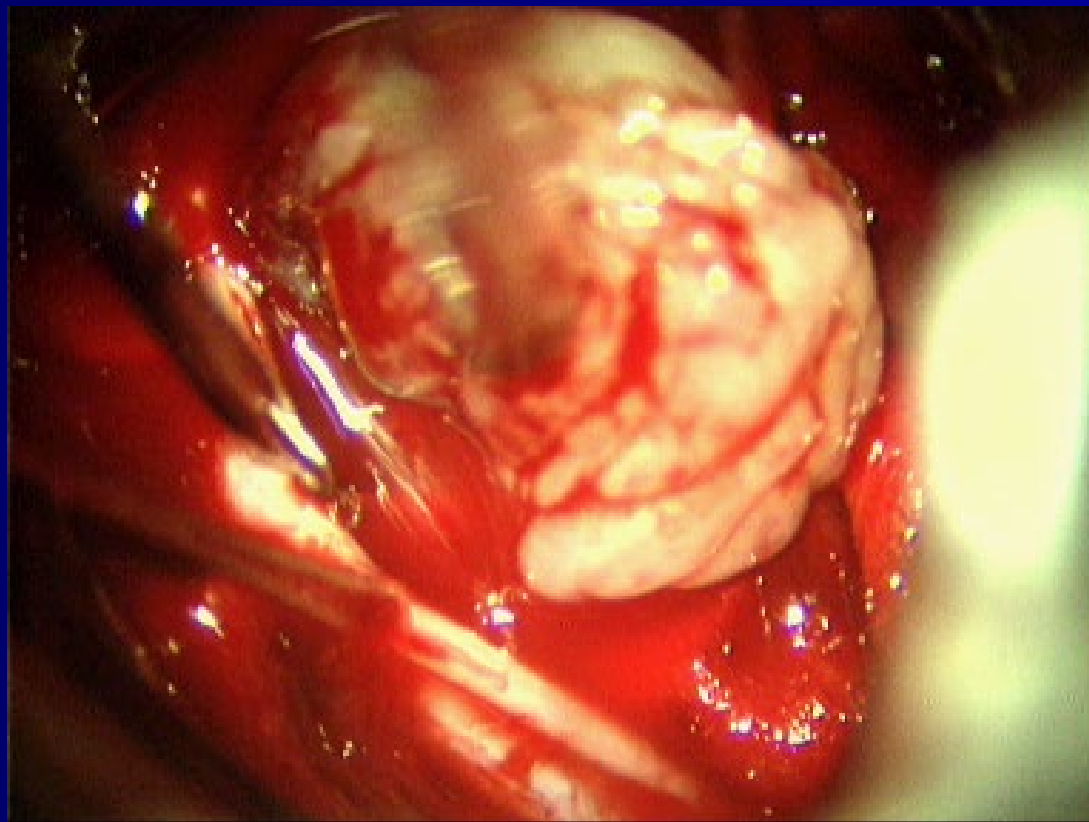
Dural opening



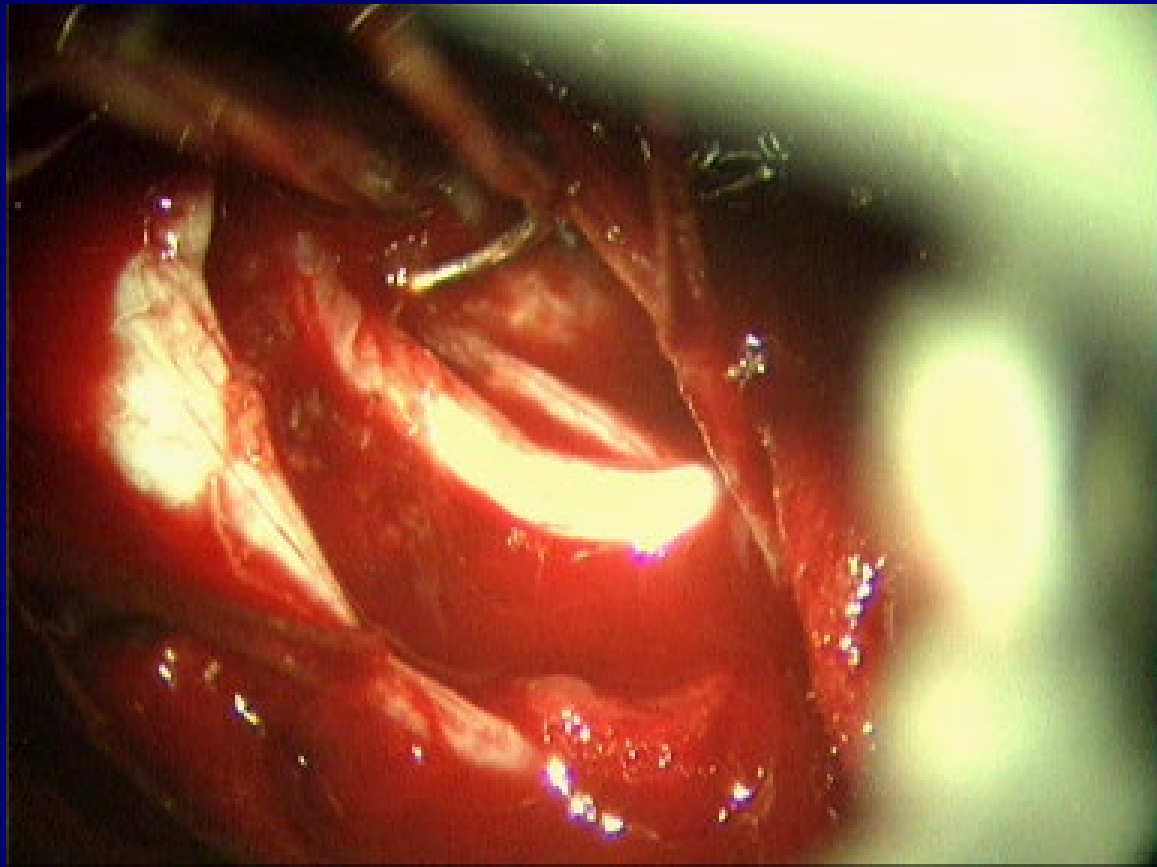
Tumor removal



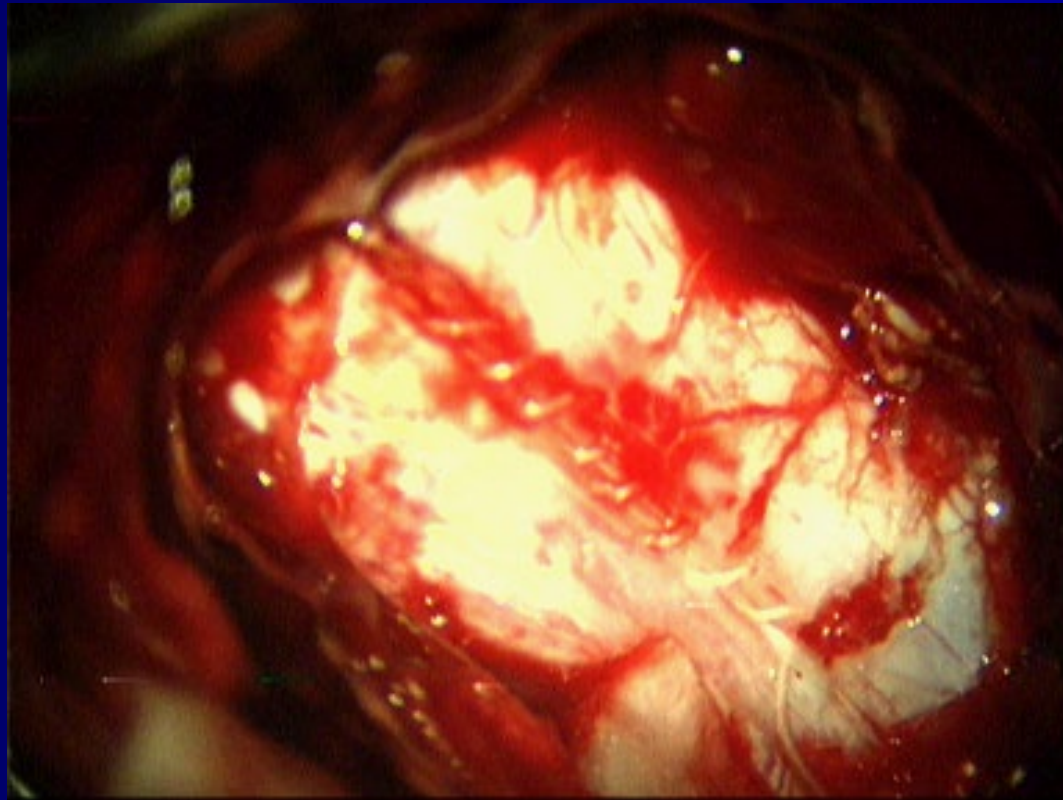
Tumor removal



Tumor removal



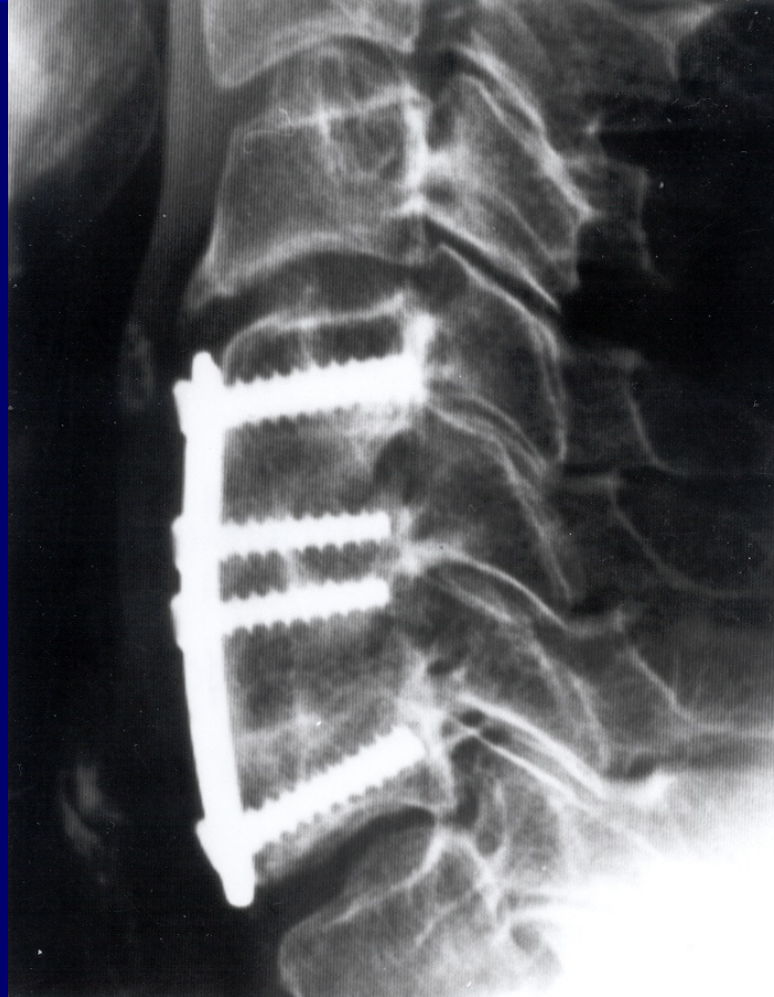
Dural closure



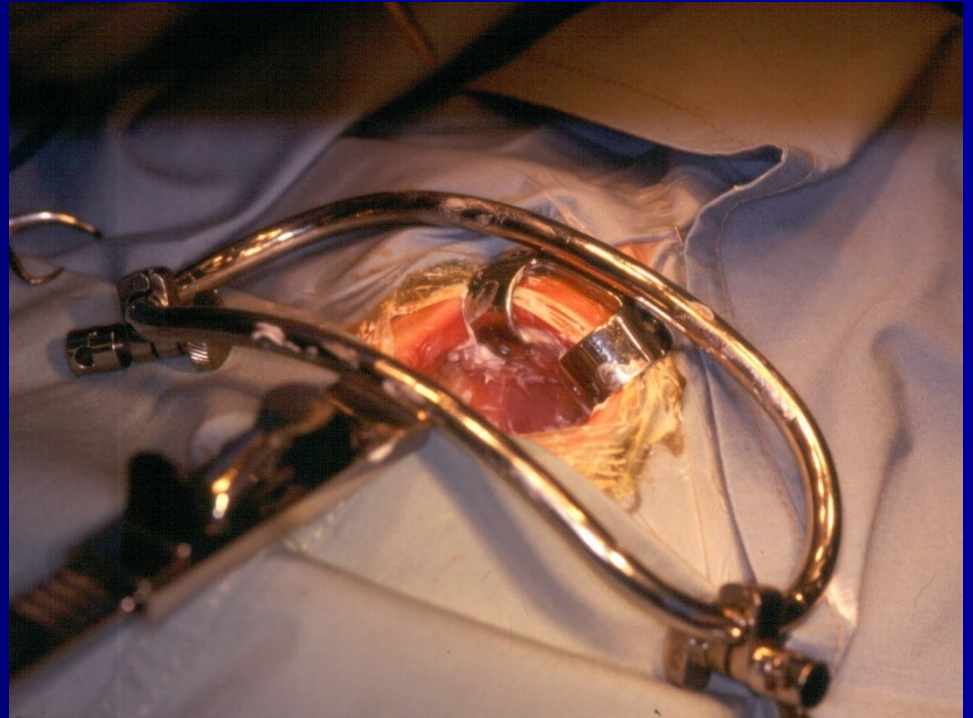
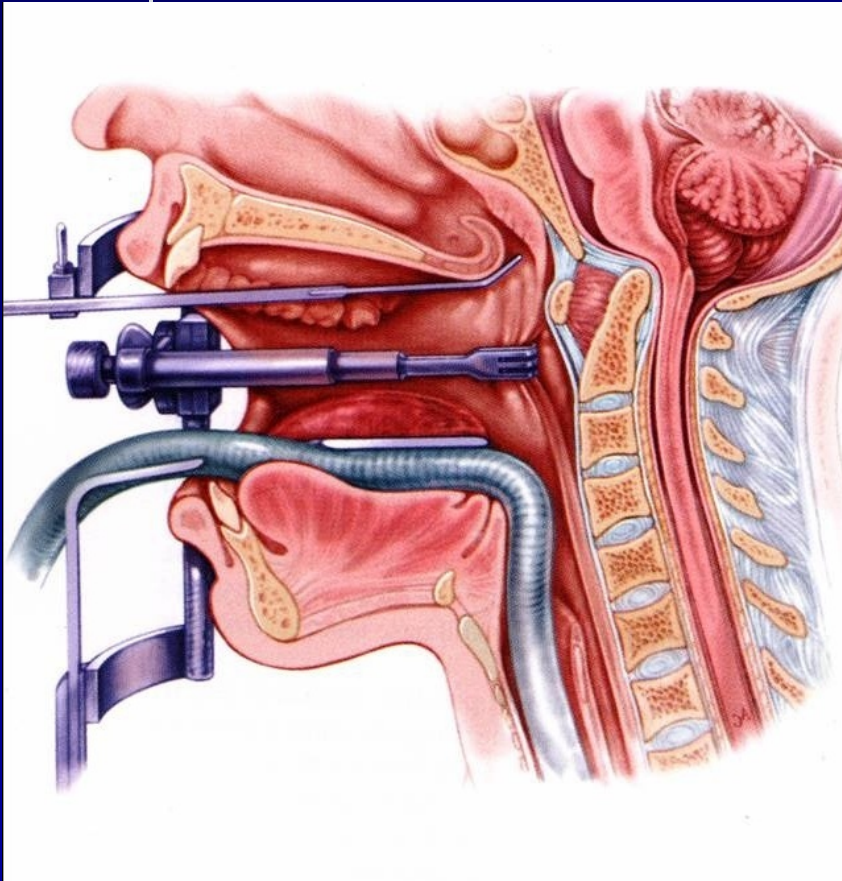
Postoperative MR



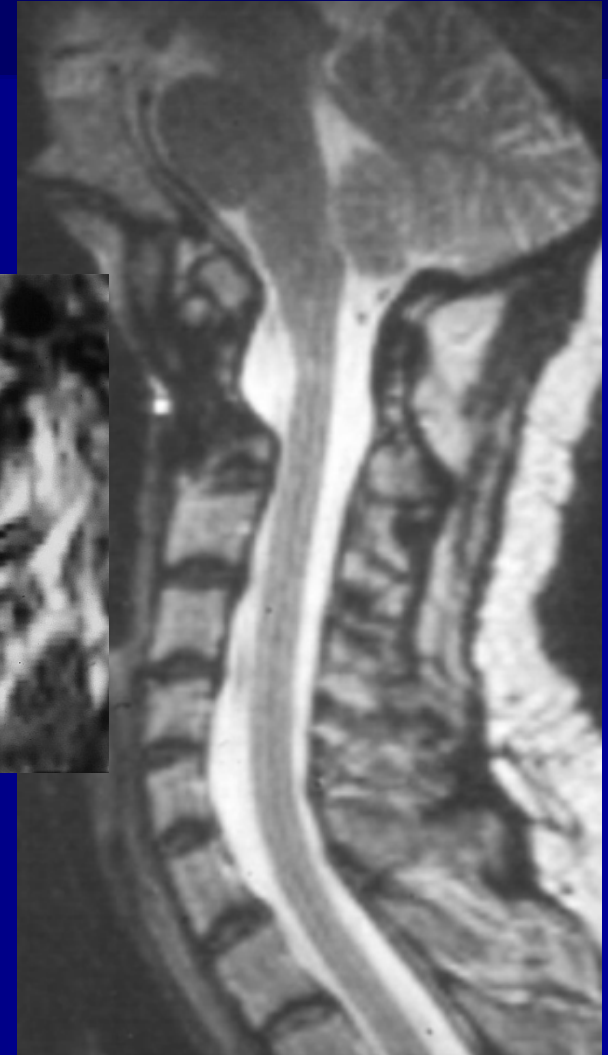
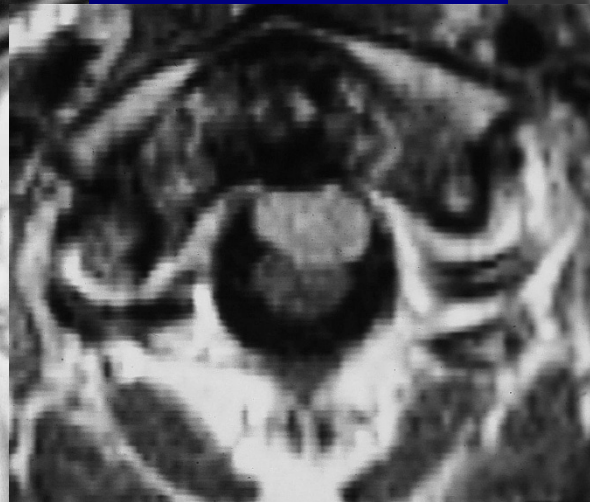
X-ray 2 years later



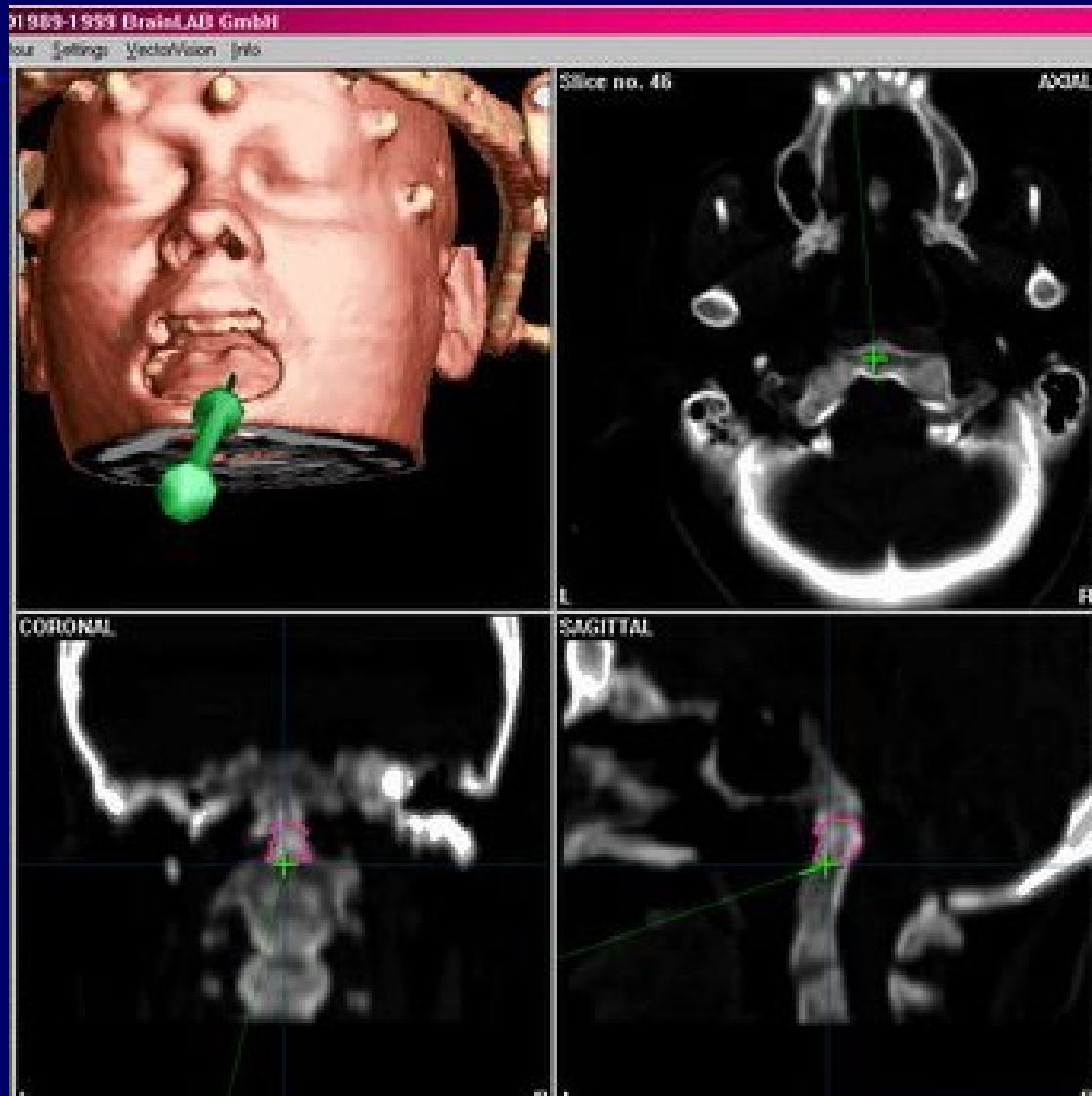
Transoral approaches



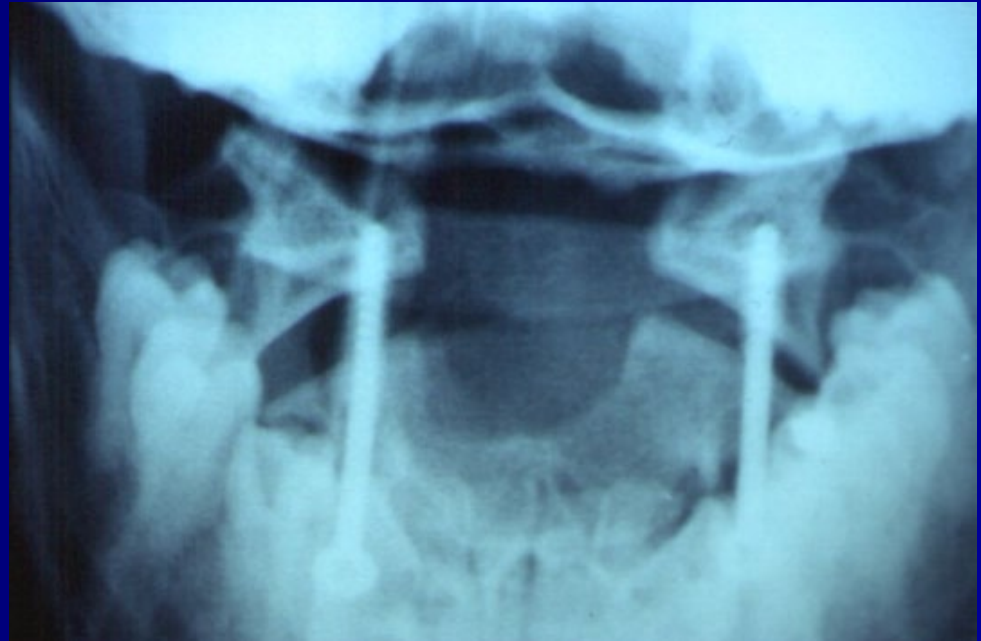
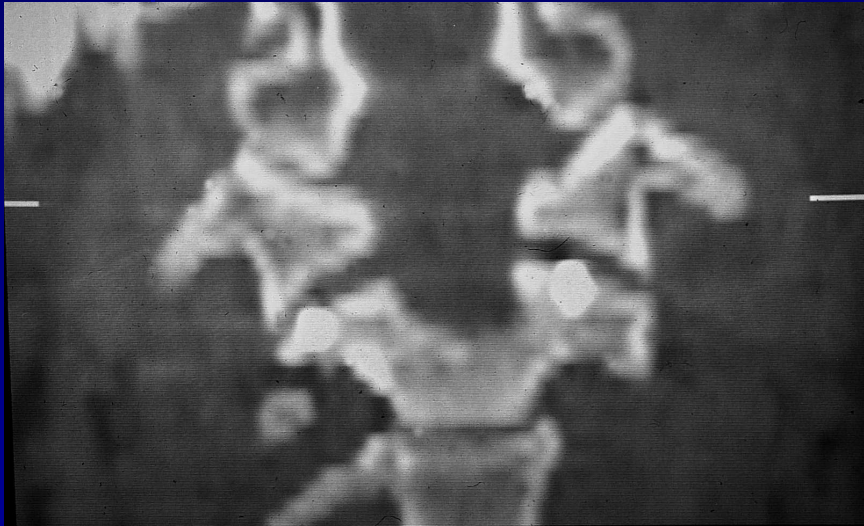
CC junction – intradural tumour (meningeoma)



Navigation assisted approach

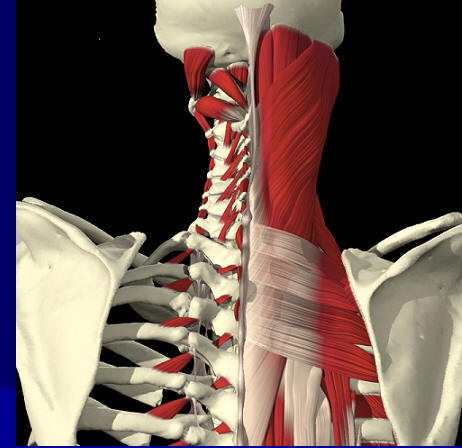


CC junction – intradural tumour (meningeoma)





Summary



The novel minimally invasive techniques enables surgeons to obtain a sufficient field for exploring different spinal pathologies with preservation of the posterior structures of the spine and the attachments of the muscles.



Thank you for your attention!