

VISUALIZATION CHALLENGES IN VASCULAR NEUROSURGERY

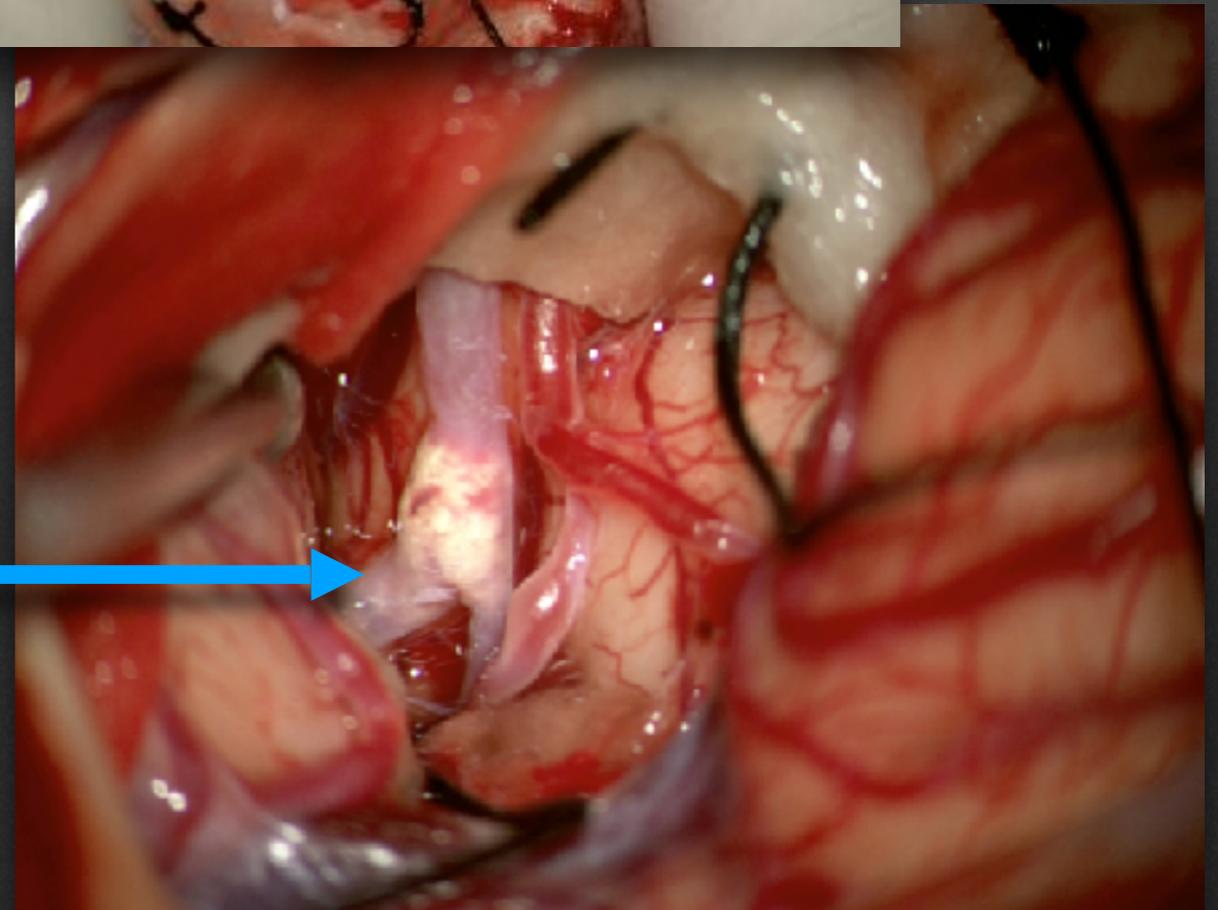
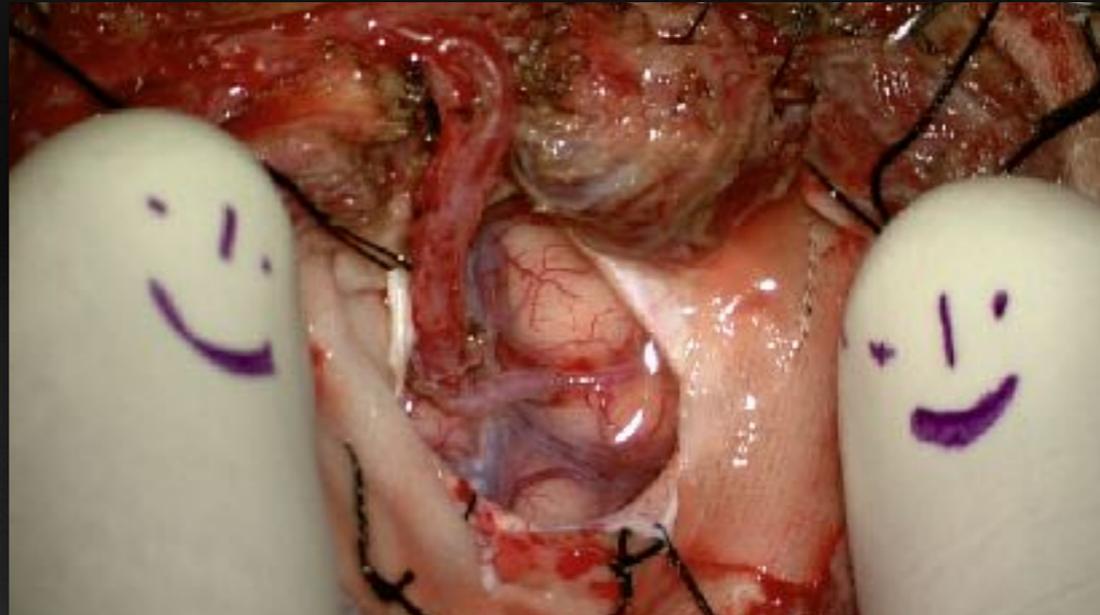
ČESKÉ BUDĚJOVICE
(BUDWEIS) 
experience



Dr. Martin Bombic, Gliwice, Poland, 16 January, 2023

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- AN (incl. previously coiled)
- EC-IC
- AVMs
- cavernomas
- carotid endarterectomies
- URGENT EMBOLECTOMIES !



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[Oper Neurosurg \(Hagerstown\)](#). 2019 Aug; 17(2): E54–E55.

PMCID: PMC6636250

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PMID: [30715551](https://pubmed.ncbi.nlm.nih.gov/30715551/)

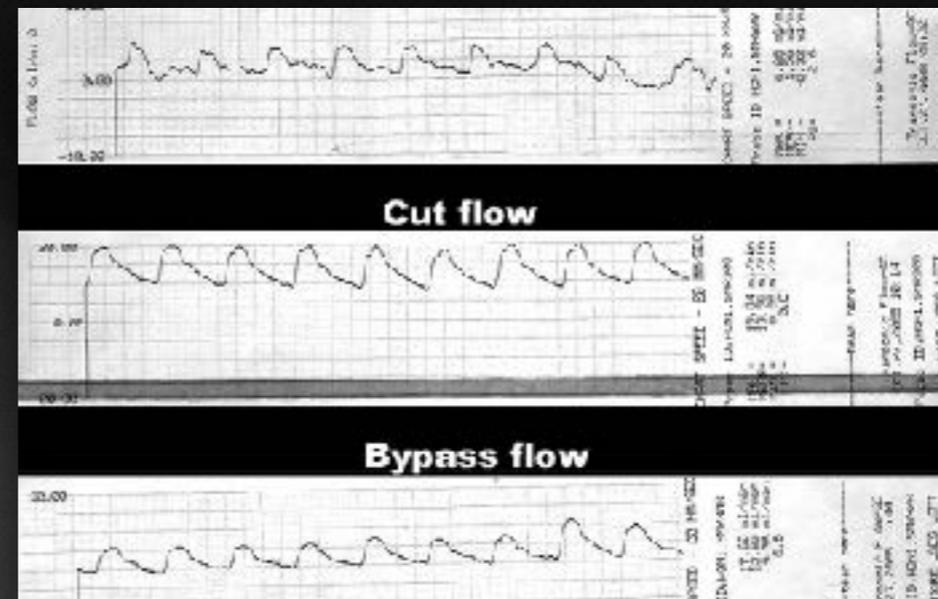
Urgent Middle Cerebral Artery Embolectomy of Calcified Embolus After Intravenous Thrombolysis: 2-Dimensional Operative Video

[Jiri Fiedler](#), MD, PhD,^{1,2} [Svatopluk Ostry](#), MD, PhD,^{3,4} [Martin Bombic](#), MD,¹ [Ludek Sterba](#), MD,⁵ and [Petr Kostal](#), MD^{1,2}

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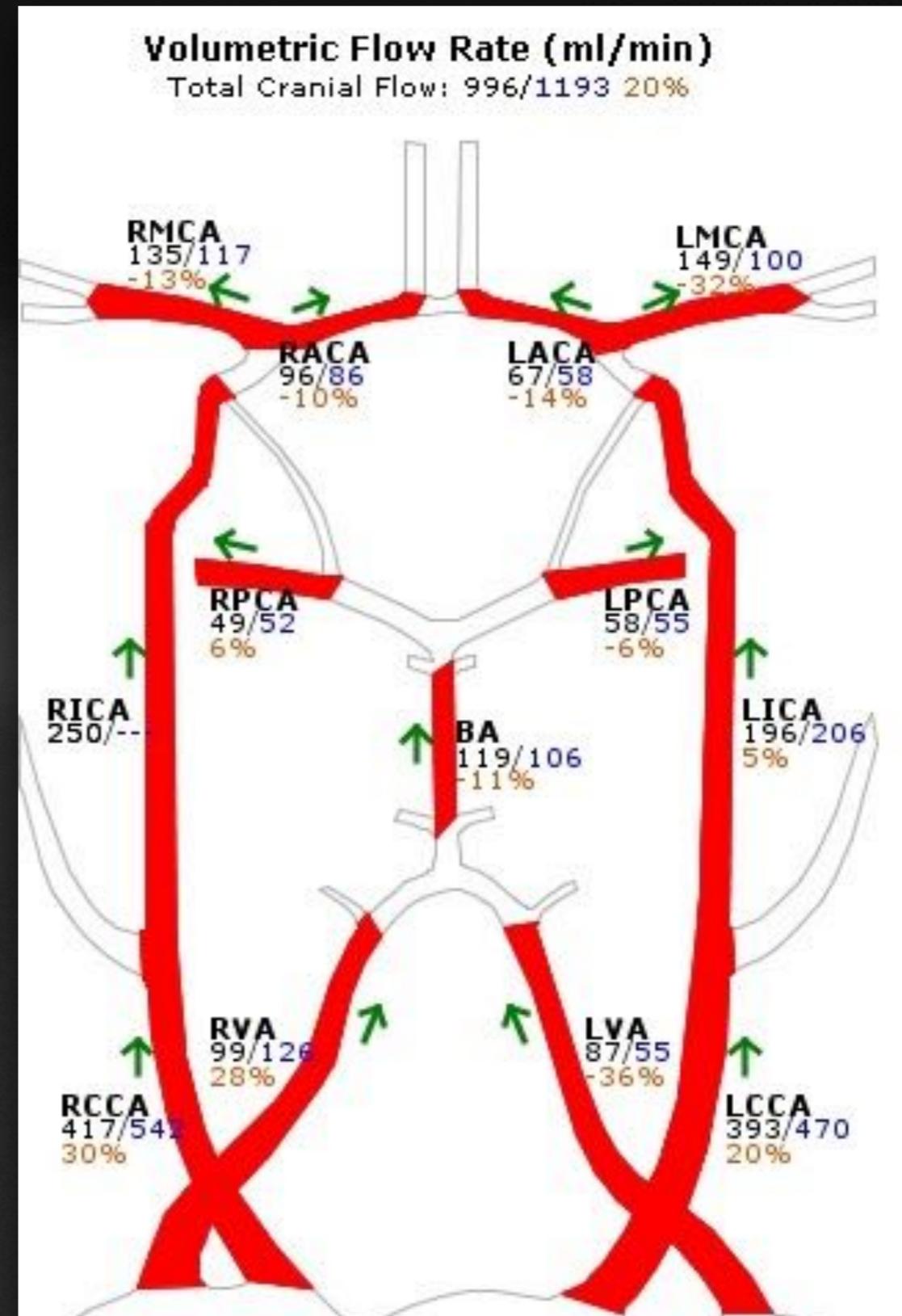
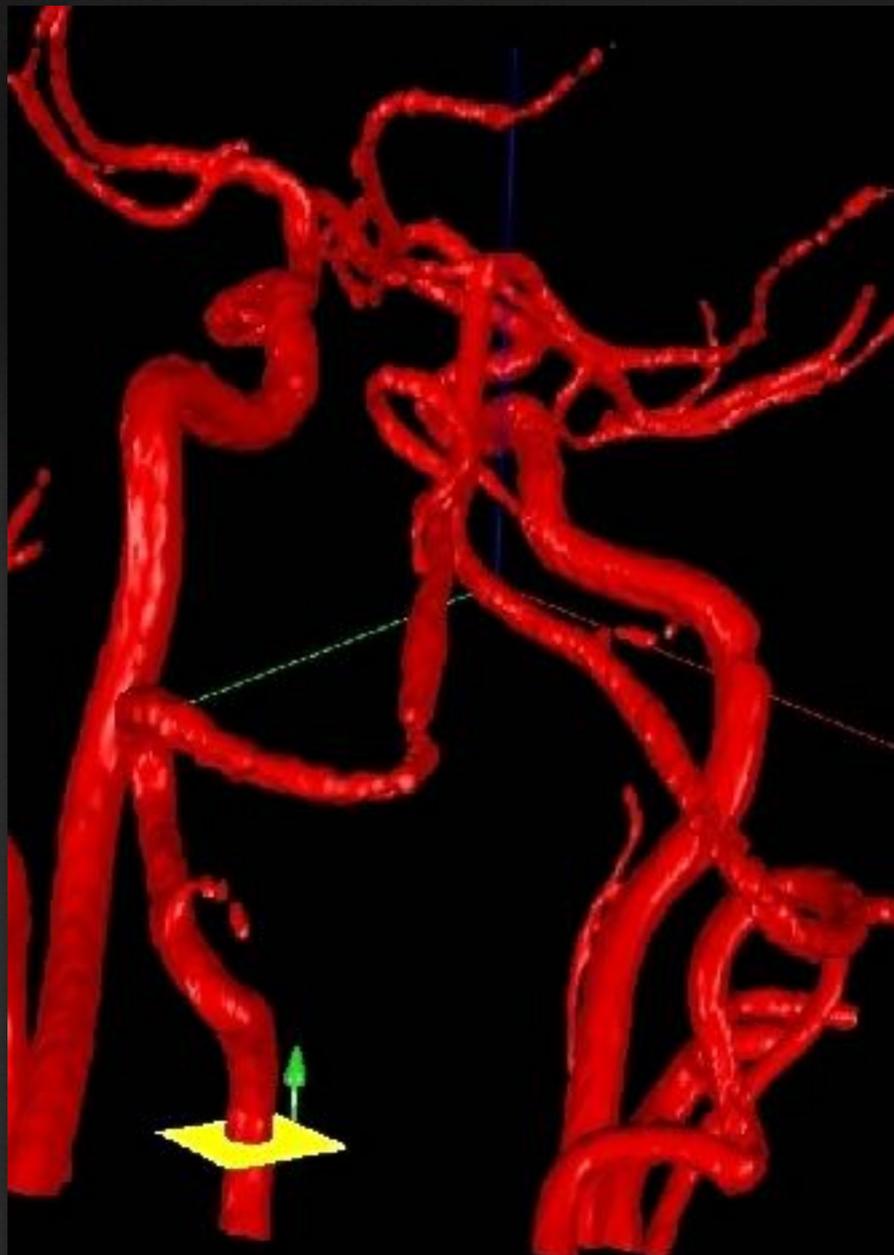
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- **WFNS official educational and training centre for vascular neurosurgery**
- **flowmeter, ICG**
- **iMRI**
- **neuromonitoring**
- **dedicated anesthetists**
- **training LAB**
- **angiosuite (2023)**



quantitative MRA for flow quantification (NOVA)

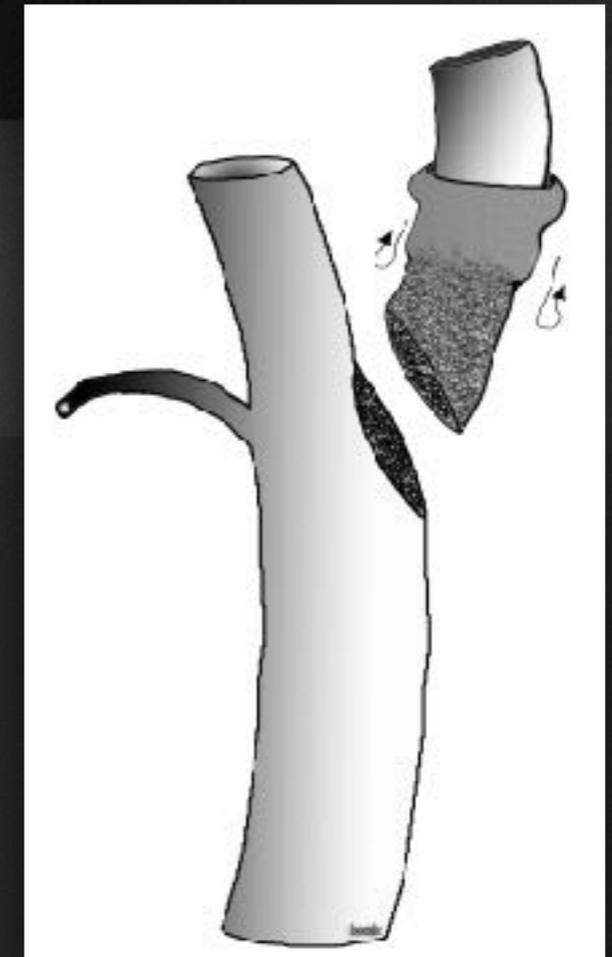
- flow in ml/min



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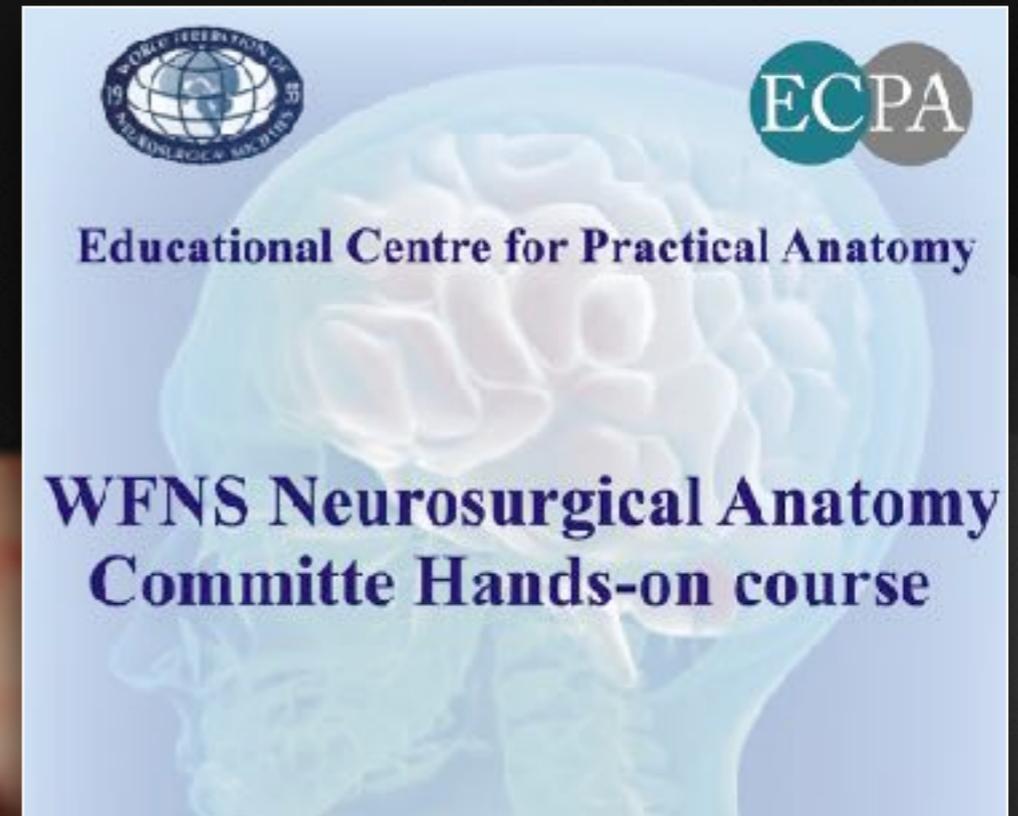
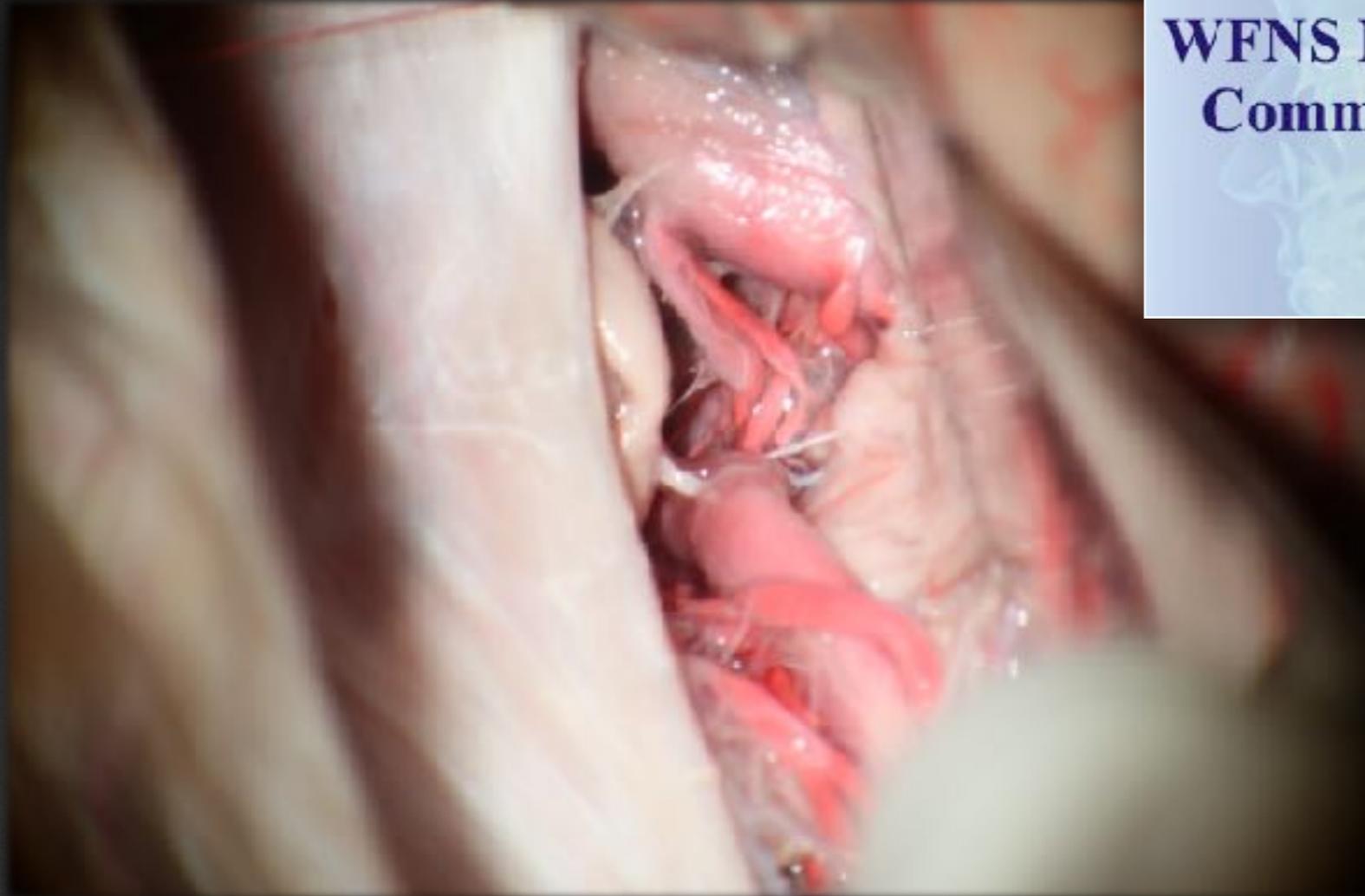
Microvascular Neurosurgical Workshop

- bypass hands-on
- live surgeries



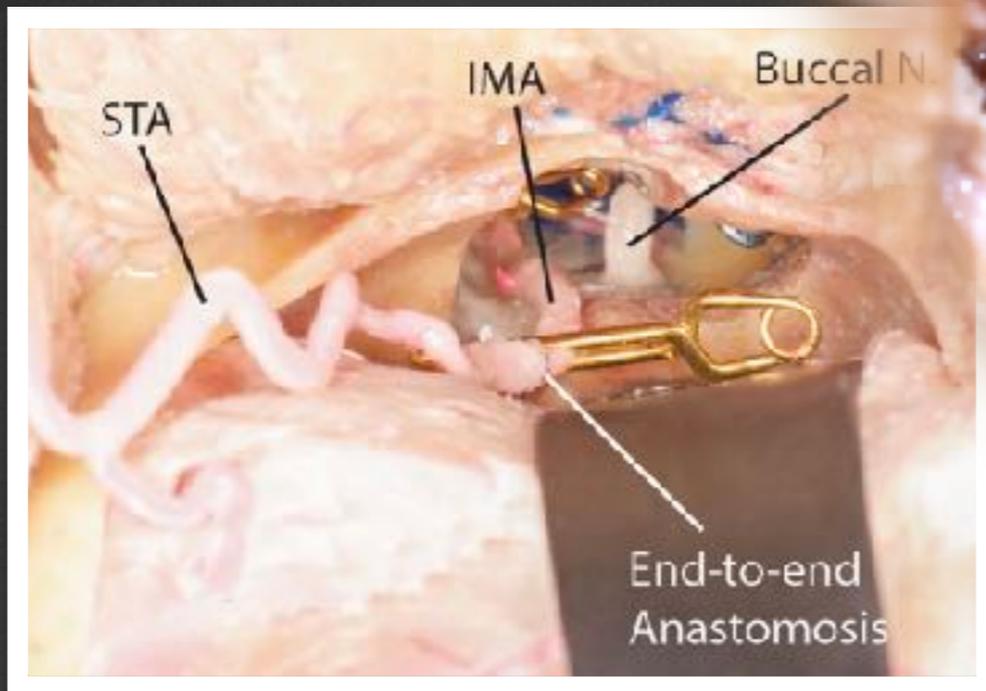
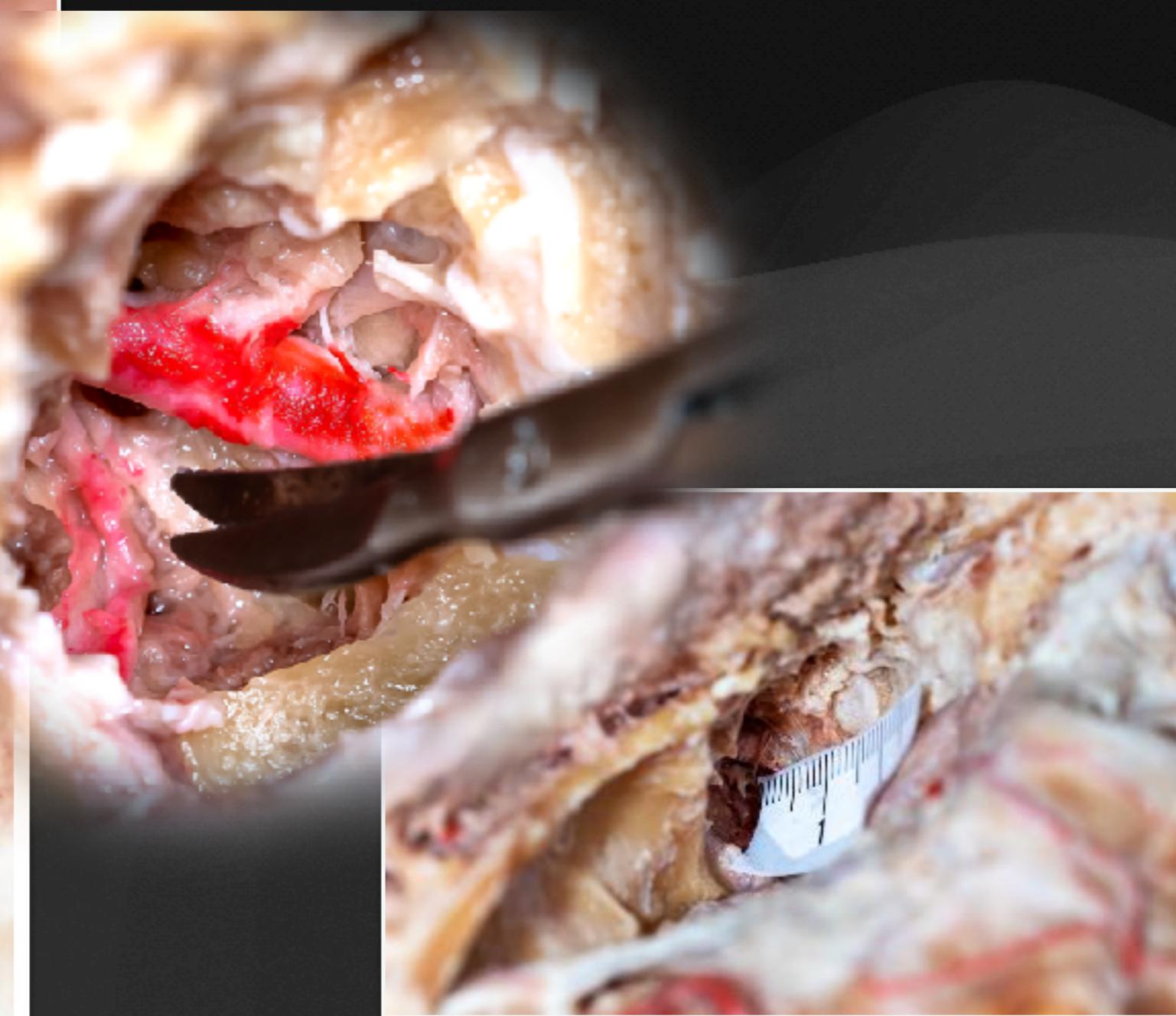
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**WFNS Neurosurgical Anatomy
Committee
Hands-on course**



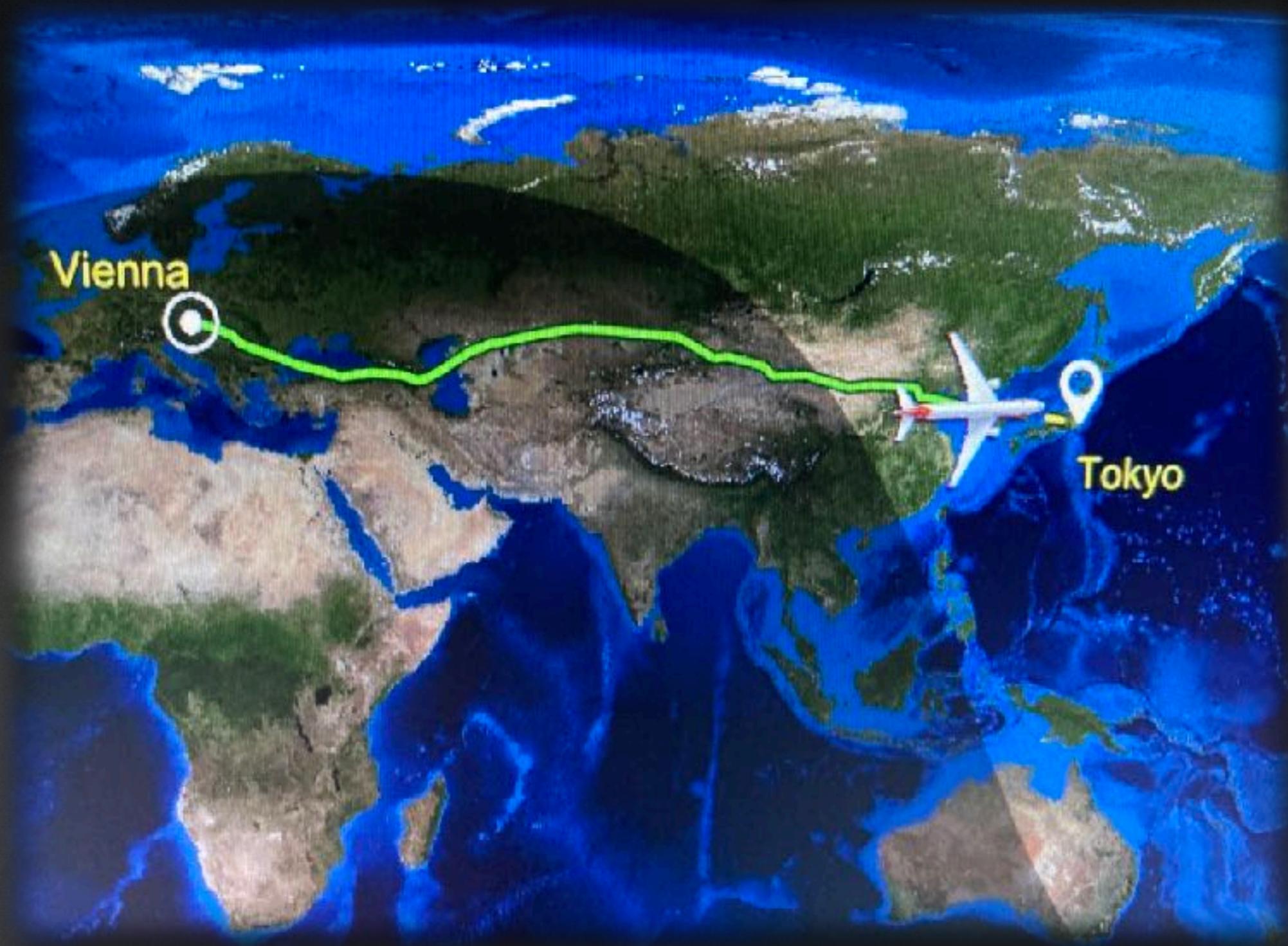
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IMAX (int.max.a.bypass)



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- many years of a single brand microscope experience
- operation theatre section reconstruction
- illumination of deeper seated fields in maximum magnification suboptimal
- image resolution
- zoom + focus speed in specific microsurgical tasks questionable
- other issues: interference in p-fossa surgery, 5-ALA imaging, bulky storage, customer service



FAR EAST NEUROSURGICAL INSTITUTE

SAPPORO, JAPAN

Live Surgery Schedule	
Day 1(11.July, Monday)	
■ OR2	: Moya Moya Disease
■ OR3	: IC-Acho aneurysm, left
Day 2(12.July, Tuesday)	
■ OR2	: Recurrent aneurysm after A3-A3 bypass
■ OR3	: IC-PC aneurysm, right
■ OR4	: CEA, left
Day 3(13.July, Wednesday)	
■ OR2	: IC Cavernous Giant aneurysm, right
■ OR3	: IC-PC aneurysm, left
■ OR4	: MCA aneurysm, left
Day 4(14th, Thursday)	
■ OR2	: Moya Moya Disease with STA-MCA bypass
■ OR3	: IC-PC aneurysm, right
■ OR4	: MCA aneurysm, left



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... acquiring a new microscope after testing 3 candidates

decision making criteria			
	Z	L	M
overall picture quality			
depth of field			
field illumination in deeply seated pathologies			
zoom speed and precision			
navigation, 5-ALA and ICG videoAG integration			
microscope arm maneuverability			
user interface - software			
compactness, manipulation, storage, form factor			
draping system			
grading: 1= worst, 5 = best			



philosophy

technique

hardware



technology of visualization

training

instruments

virtuosity

LIGHT & PICTURE QUALITY

- **overall progress in NS = treating deeper, more difficult-to-reach pathologies = light requirements**
- **Yasargil: ‘neurosurgery of perforators’**
- **trend of mini-invasive approaches = high demands on visibility / illumination in a deep, narrow surgical corridor**
- **most vascular pathologies around Circle of Willis, basal cisterns**

DEPTH OF FIELD

- **bigger = better**
- **reduces the need for frequent focus/zoom readjustment**
- **helps avoid “collateral damage” - ie you pay less attention to structures out of focus**
- **some pathologies stretch from spfc to deep (AVM feeders VS drainage)**
- **in atrophied brains the surgical field sink deep below craniotomy = suturing material extends from superficial to deep layers**

ZOOM SPEED

- **“can’t see the forest for the trees” and ...**
- **... “can’t see the trees for the forest”**
- **fast zoom (+footswitch) = essence of time saving & precision in bypass surgery**
- **knot tying VS biting the stitches**
- **allows for “speed ramping” during the entire operation**
- **helpful in bipolar cutting technique**

MAXIMUM MAGNIFICATION

- **enables the best, sharp arachnoid dissection**
- **visualizes translucent vessel walls in bypass surgery**
- **precise sutures - avoiding through stitch**
- **maximum visual control over perforators**

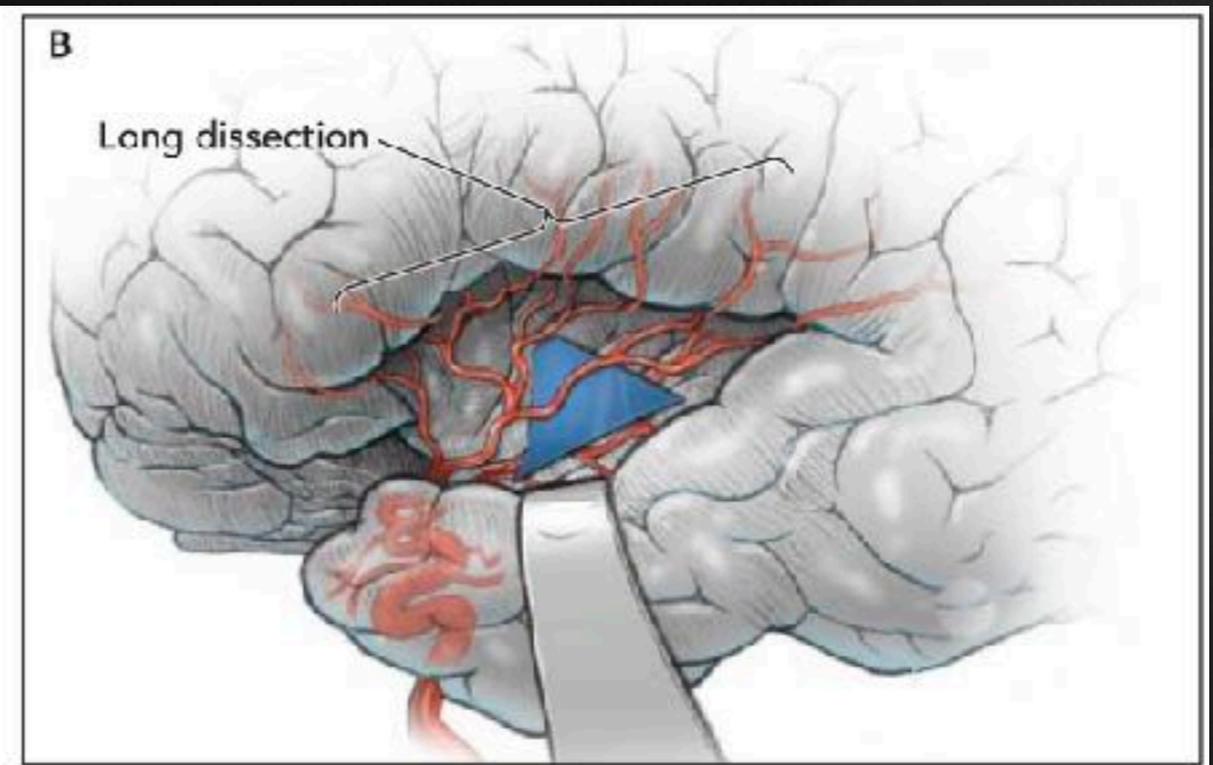
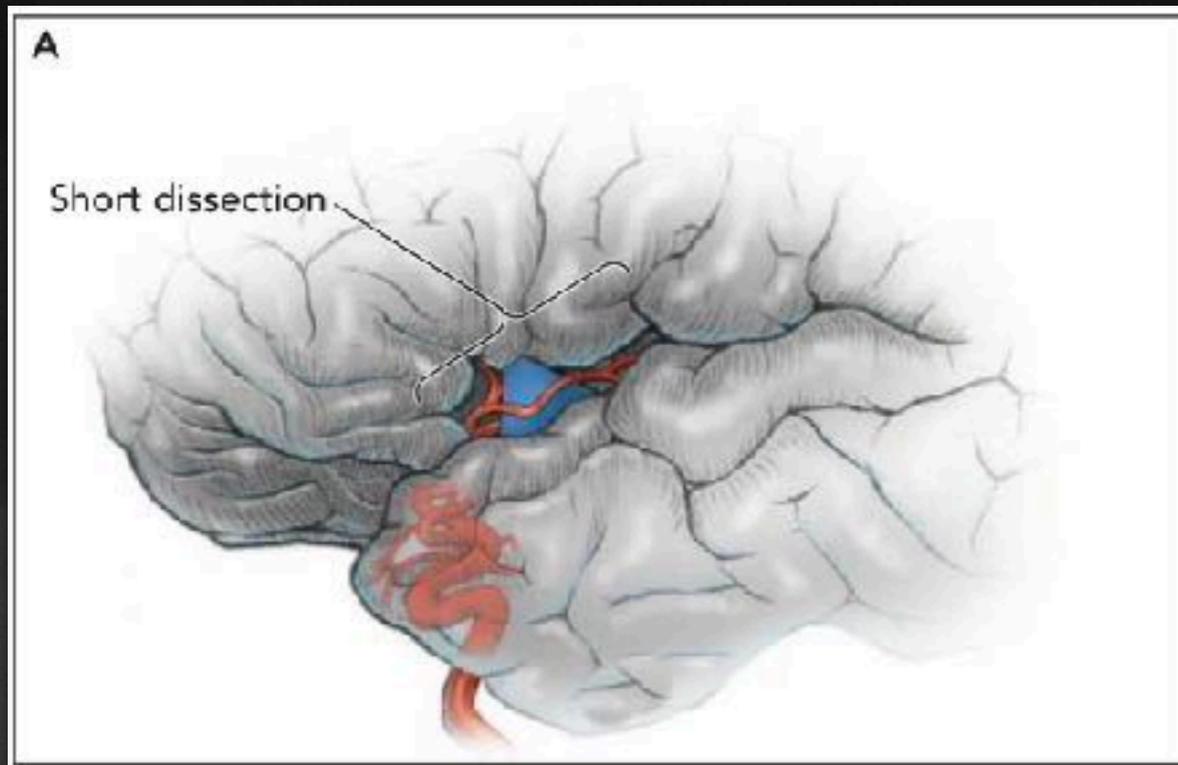
Japanese approach & technique

- **maximum security, avoid uncertainty, insurance bypass**
- **best visualization possible**
- **METICULOUS hemostasis - bipolar cutting**
- **SHARP ARACHNOIDAL DISSECTION**
- **wide approach allows for easy clipping / best bleeding control**

Japanese approach & technique

~~MINI-INVASIVENESS~~

WIDE VISUAL APPROACH

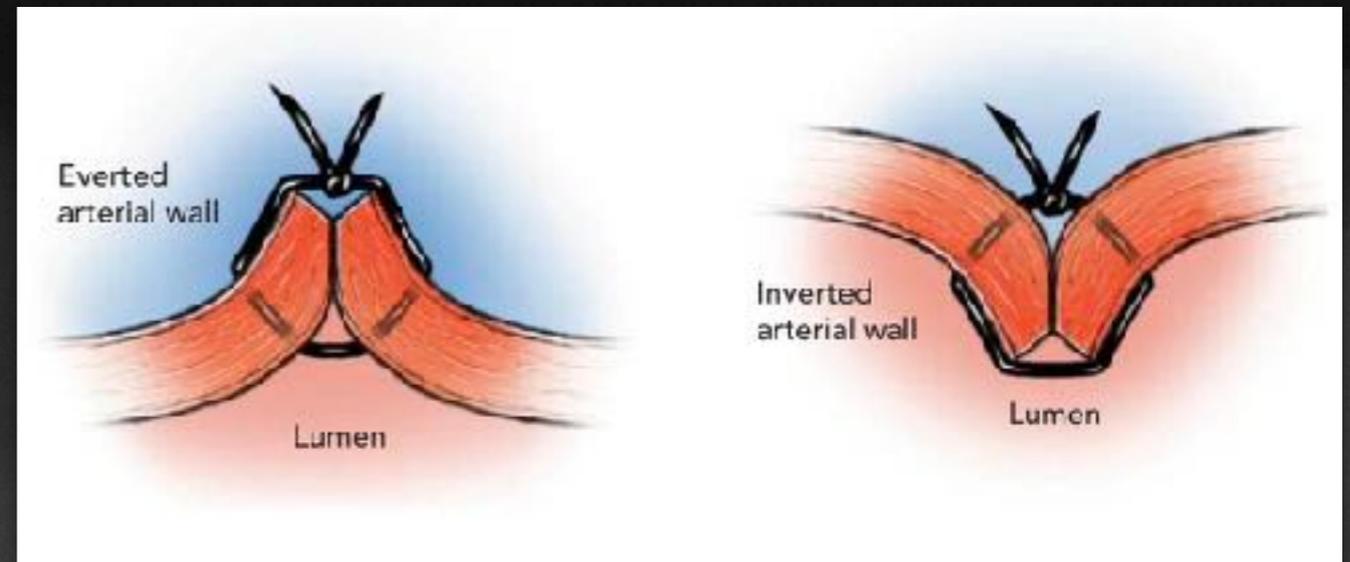


examples:

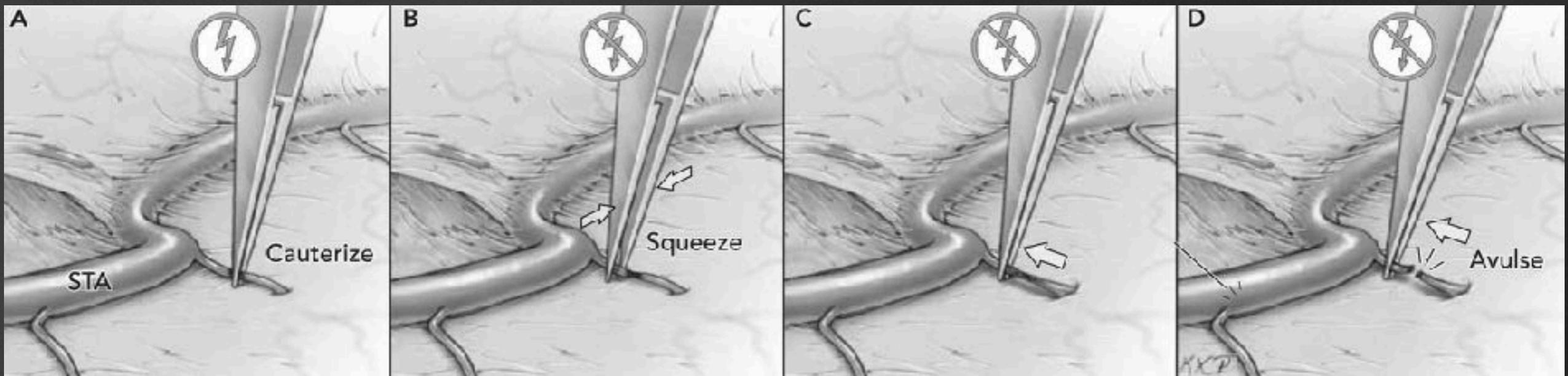
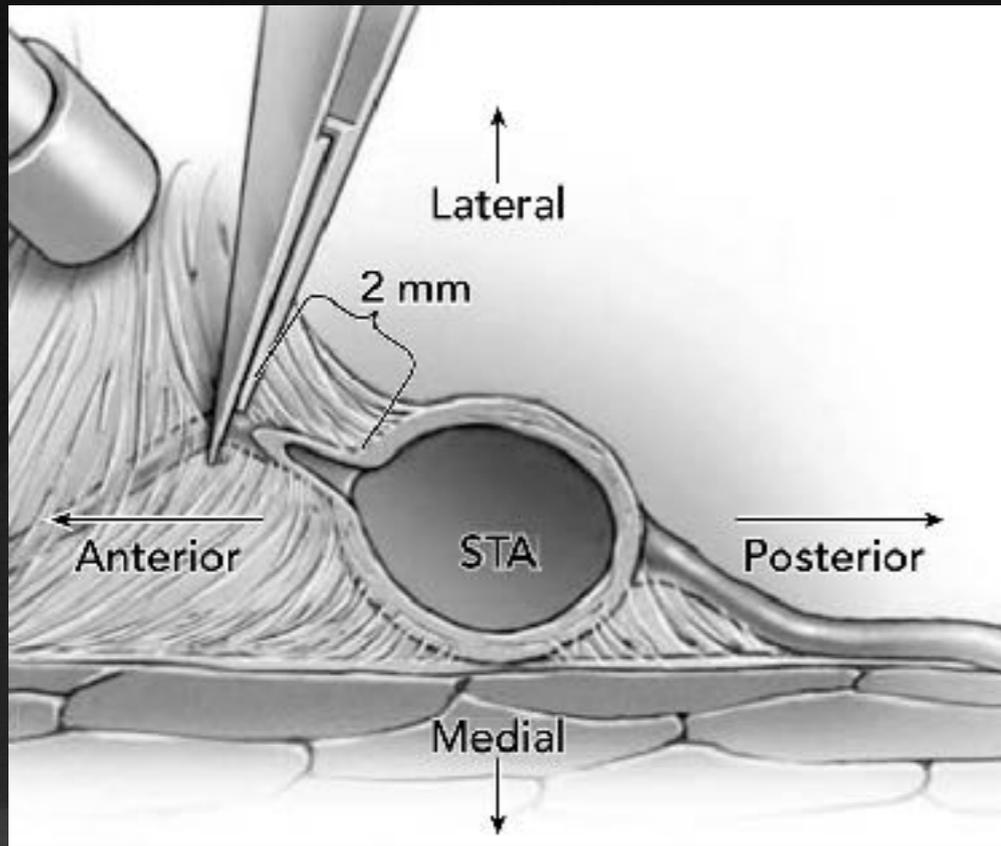
- ACom ANs clipped through anterior interhemispheric approach
- PCom ANs - ATA mobilization

Japanese approach & technique

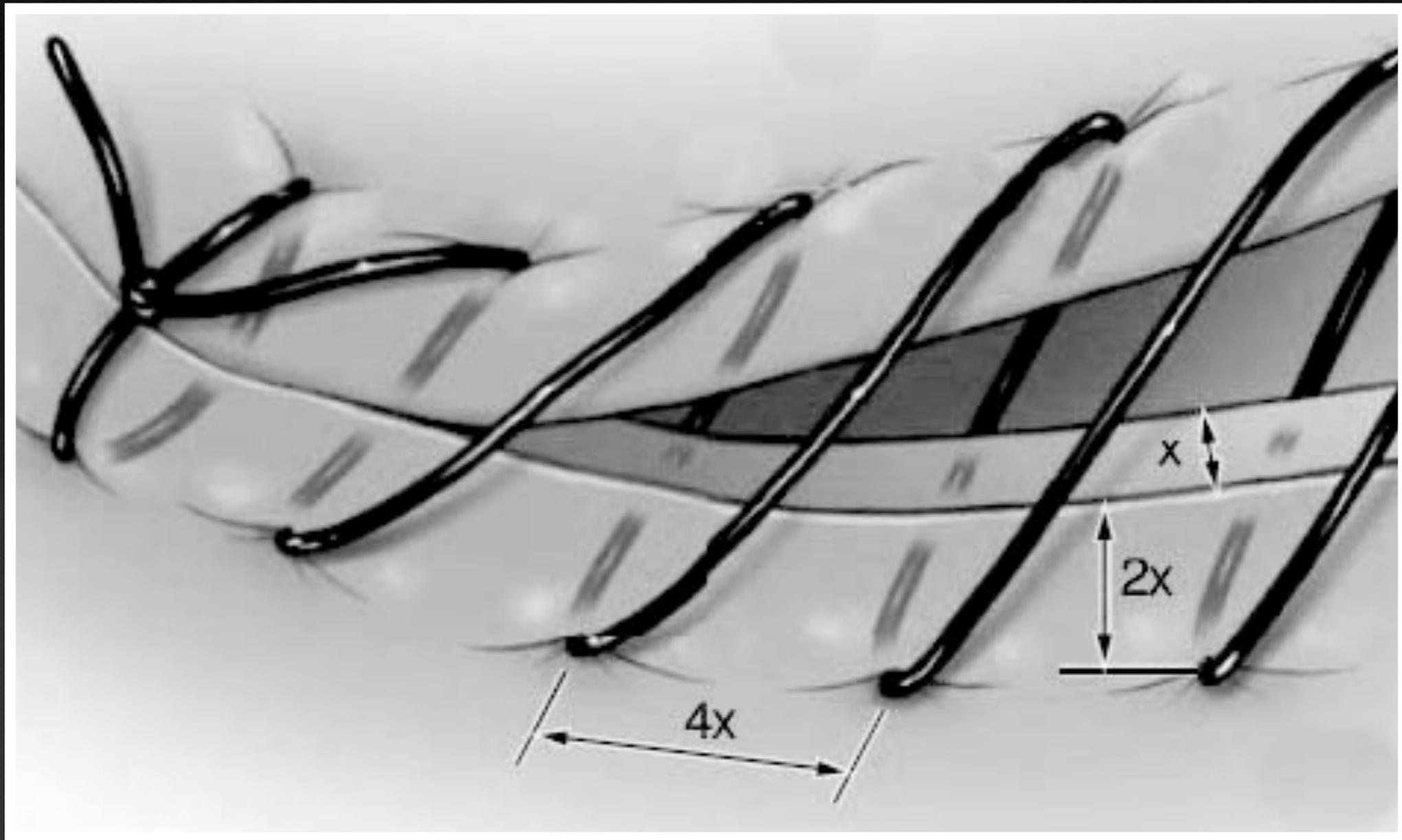
- lift-up technique
- 2-4 stitching rule
- intima - intima eversion
- ATA mobilisation → uncus retraction → retrocarotid space visualisation
- sfenoparietal sinus mobilisation
- vein preservation



LIFT-UP & BIPOLAR CUTTING



2-4 stitching rule



Japanese approach & technique

- anastomosis leaking → adding stitches with unclipped vessels
- NO cortical perforators allowed to coagulate - manipulate recipient vessel w/clips
- needle tip grasping in difficult stitches
- cervical ICA dissection in atherosclerotic ANs for prox control
- suction decompression





- **poor vision = increased stress**
- **bigger stress = tremor**

MICROSURGERY TRAINING

ALL SURGERIES ARE 'VASCULAR' !

- **PRACTICE WITH THE BEST MICROSCOPE FROM THE START!!!**
- **artificial material**
- **animal models - live or cadavers**
- **human arteries / veins in trauma cases - radial, ulnar, digital**
- **peripheral nerve surgery**
- **human cadavers**
- **practice on non-vascular pathologies**

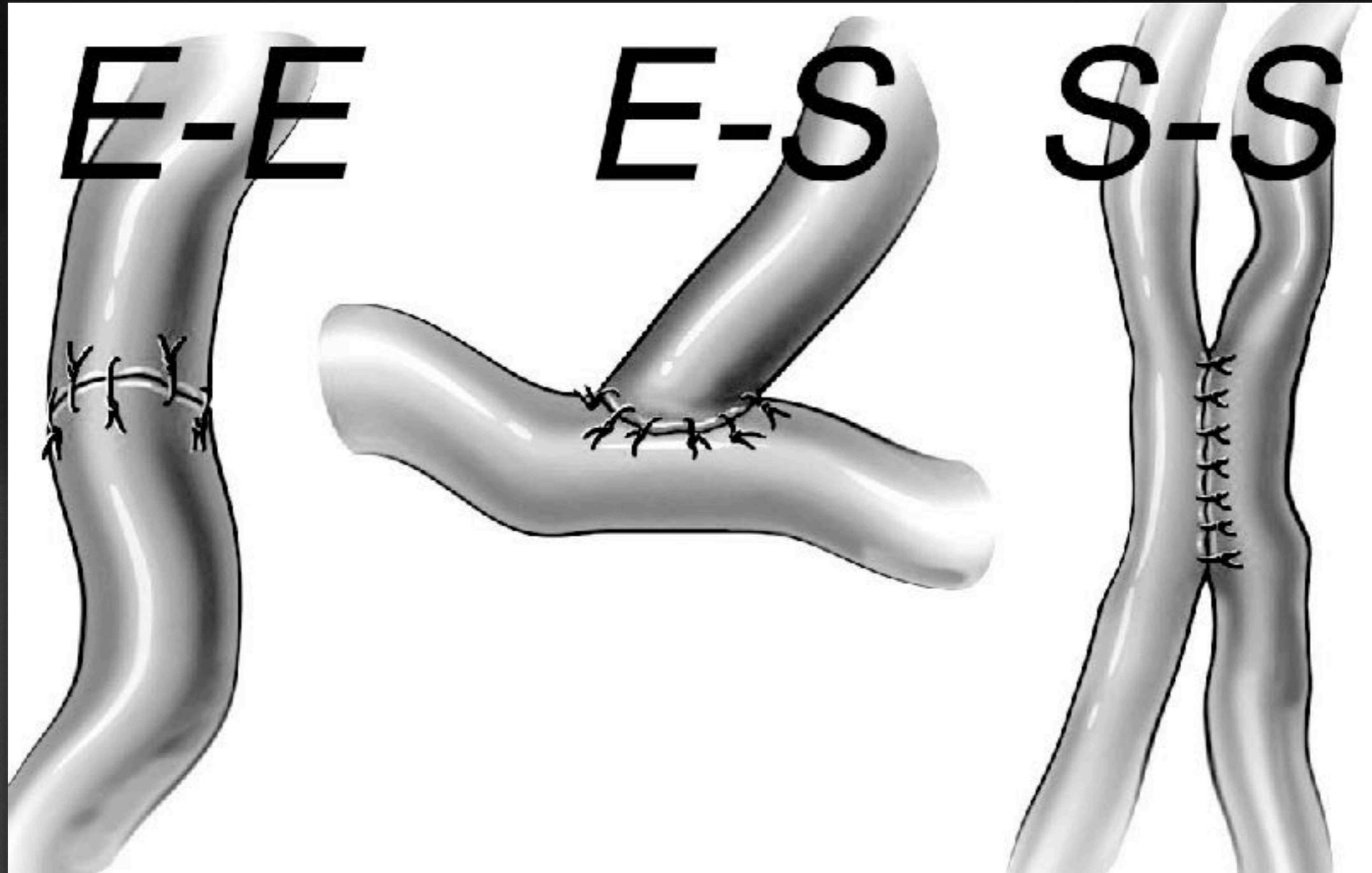
TECHNIQUE, DEXTERITY

- **brace**
- **speed**
- **short instruments**
- **change the height of the armrest**
- **body centre of gravity**
- **breathing**
- **ambidexterity**
- **take advantage of microscope size and maneuverability !**
- **FOOTSWITCH !!!**

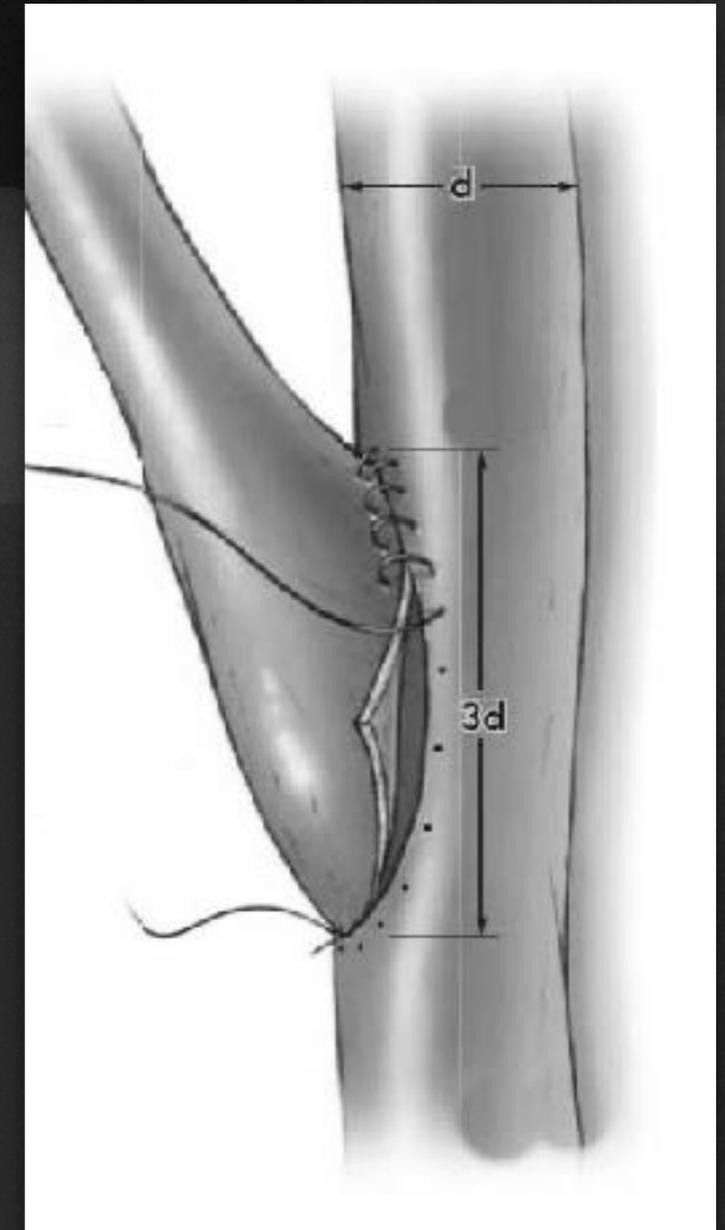
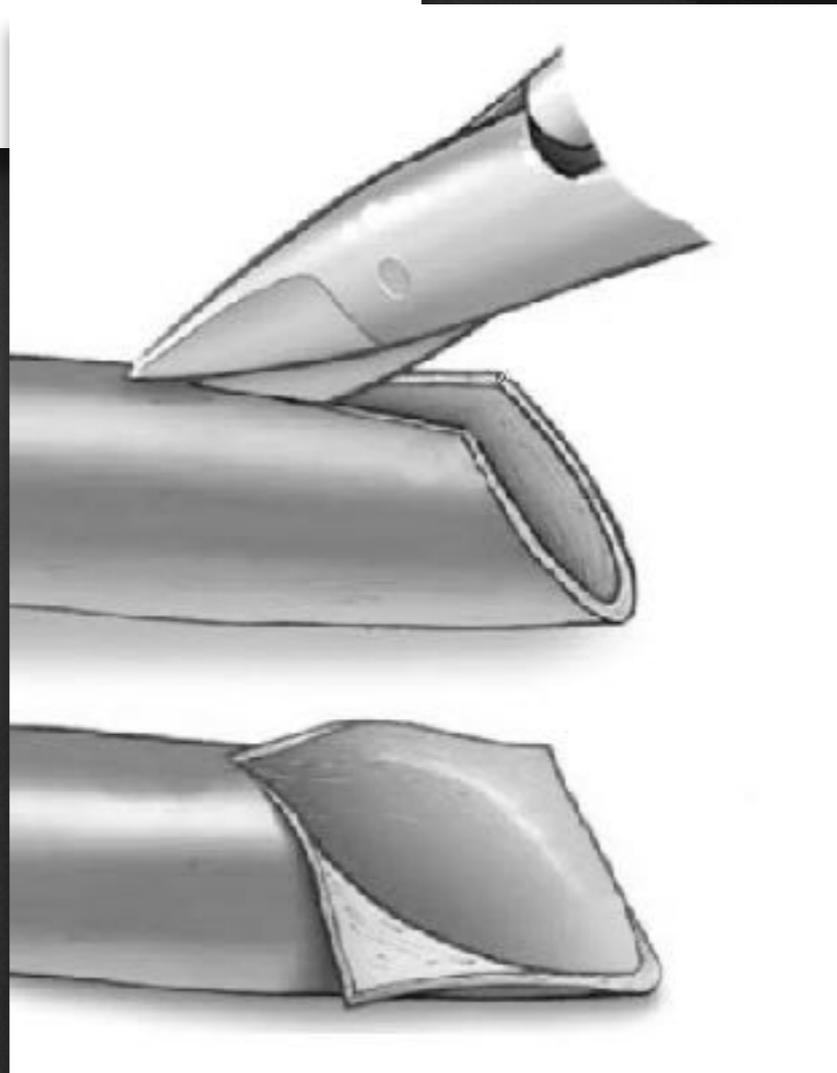
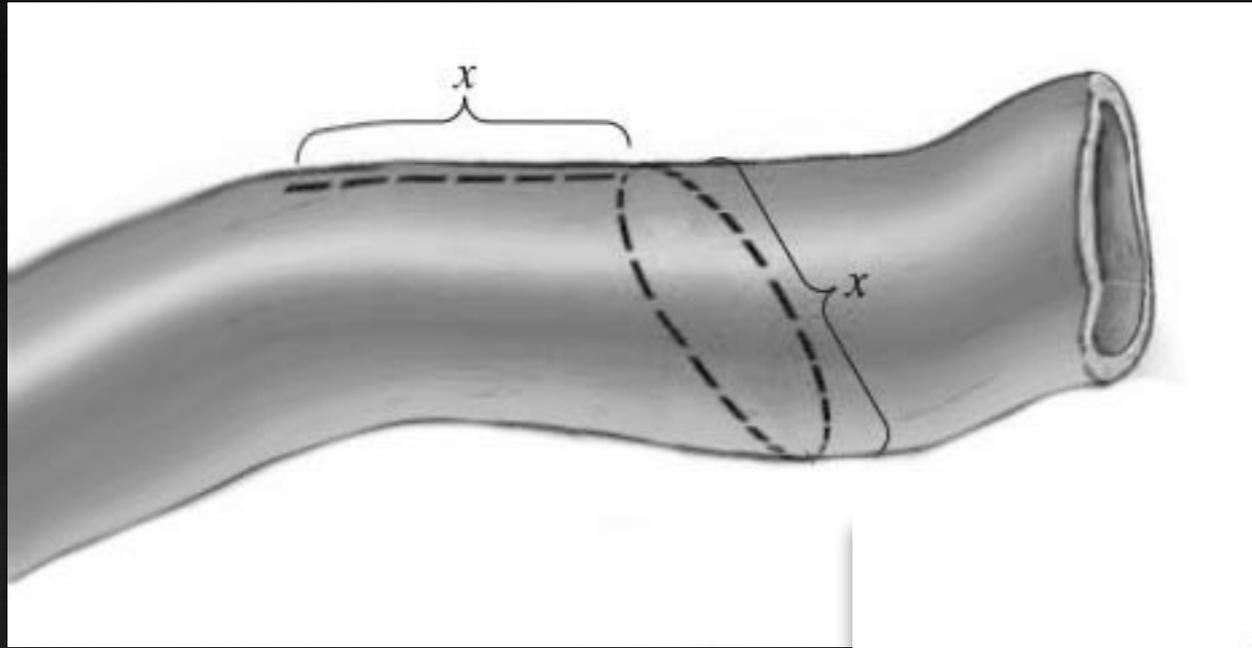
ANASTOMOSIS

- **start slow = get fast later**
- **speed-ramping**
- **1 stitch / 1 min**
- **1 anastomosis = 20 stitches**

TYPES OF ANASTOMOSES

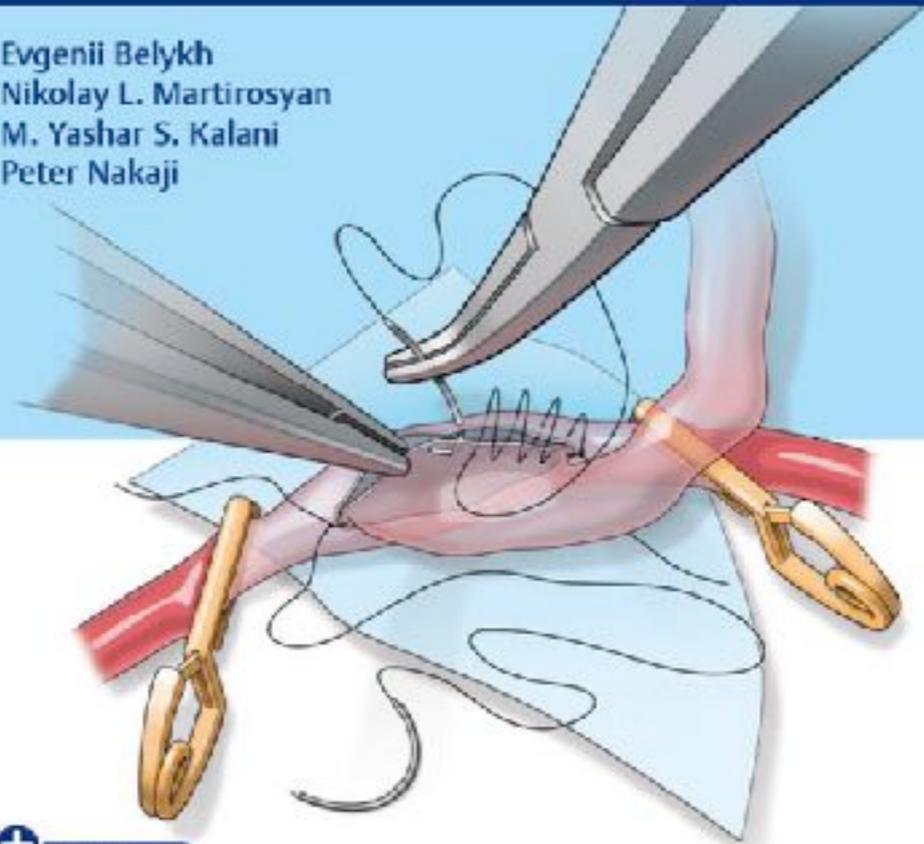


FISHMOUTH



Microsurgical Basics and Bypass Techniques

Evgenii Belykh
Nikolay L. Martirosyan
M. Yashar S. Kalani
Peter Nakaji



Online at
MedOne
Videos

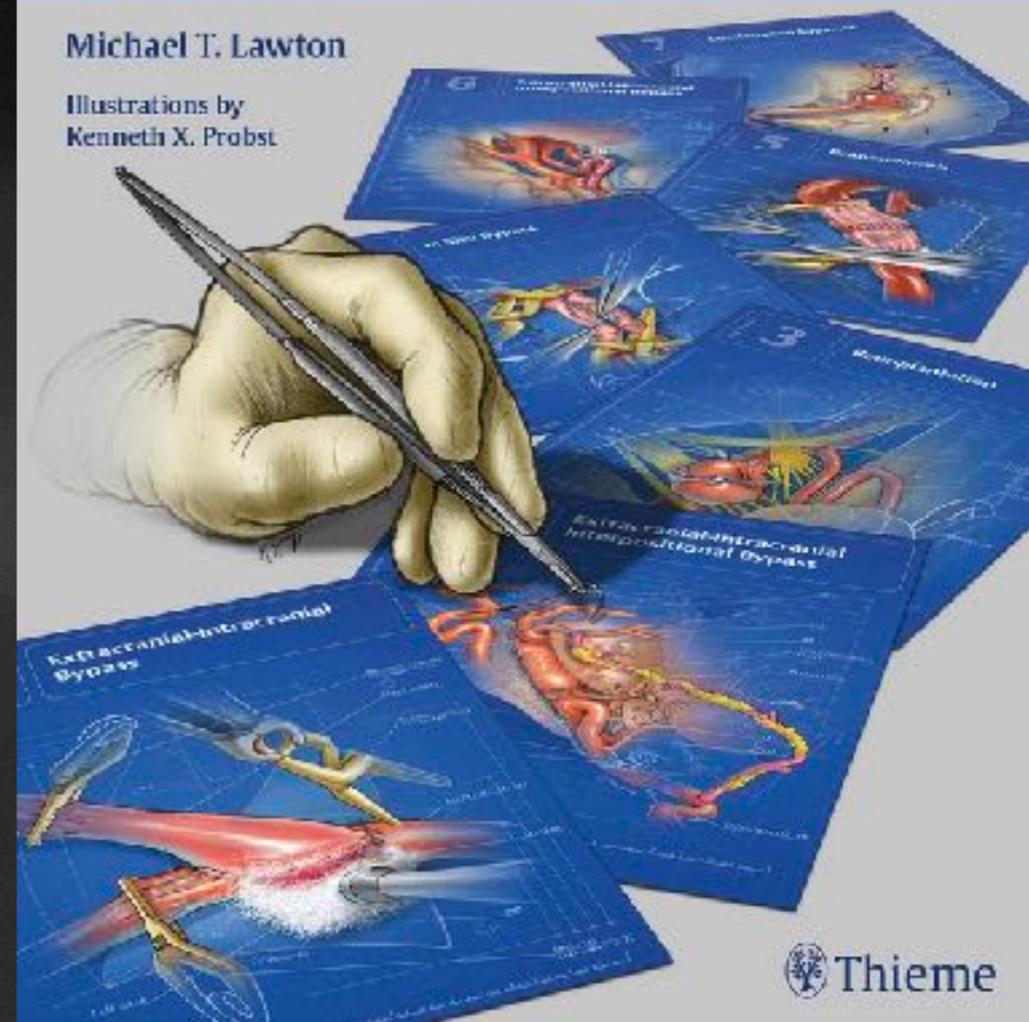
 Thieme

Seven Bypasses

Tenets and Techniques for Revascularization

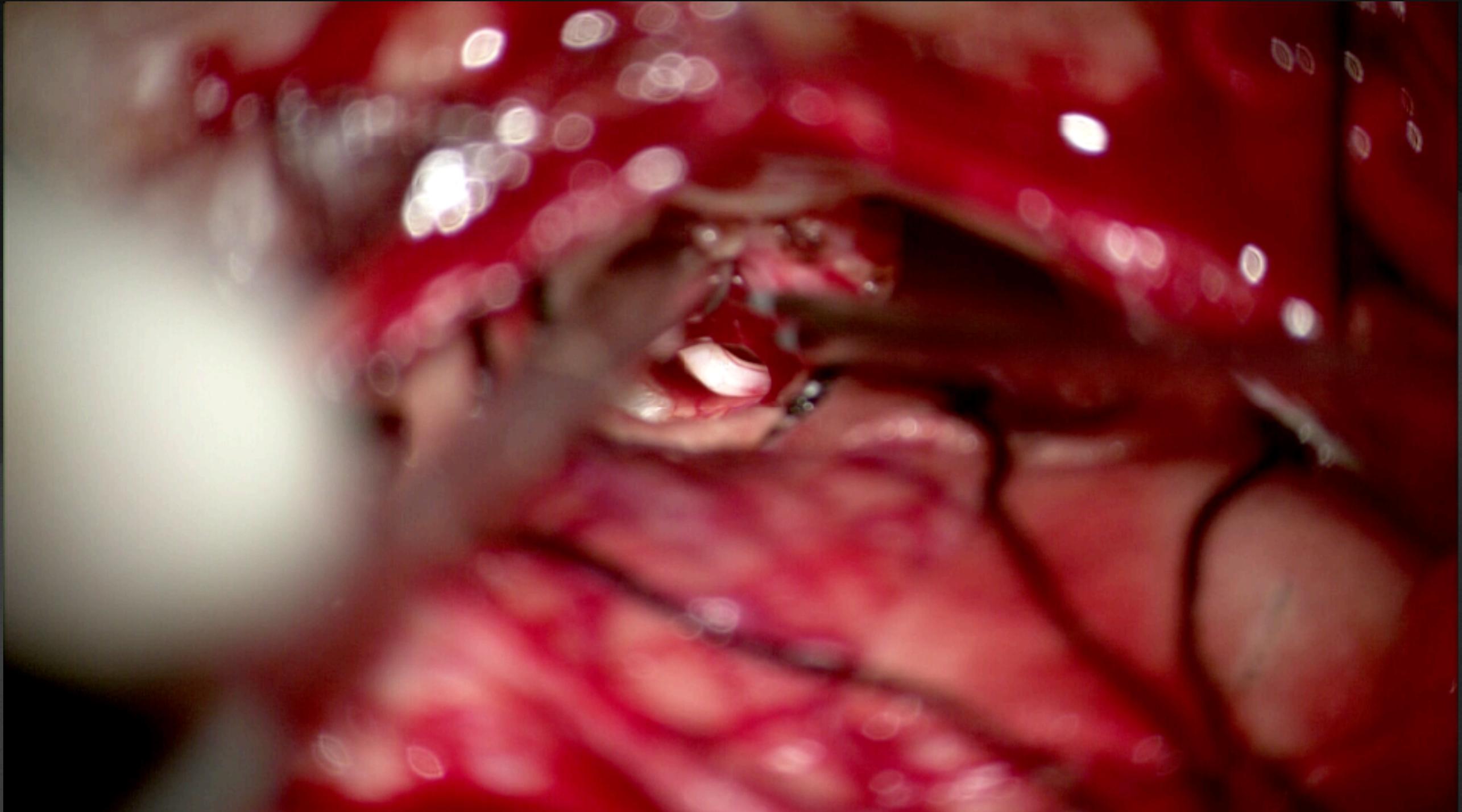
Michael T. Lawton

Illustrations by
Kenneth X. Probst



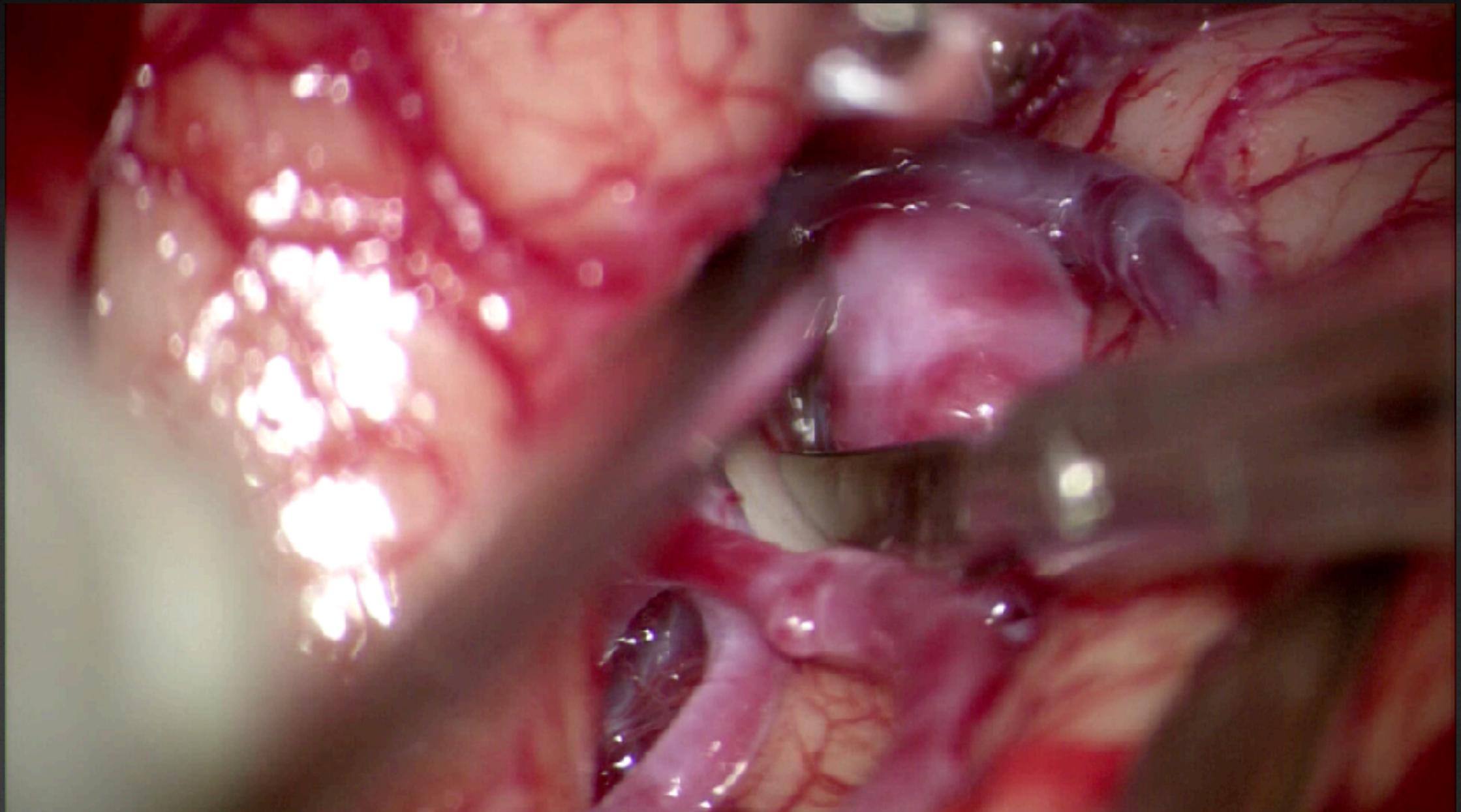
 Thieme

vestibular schwannoma



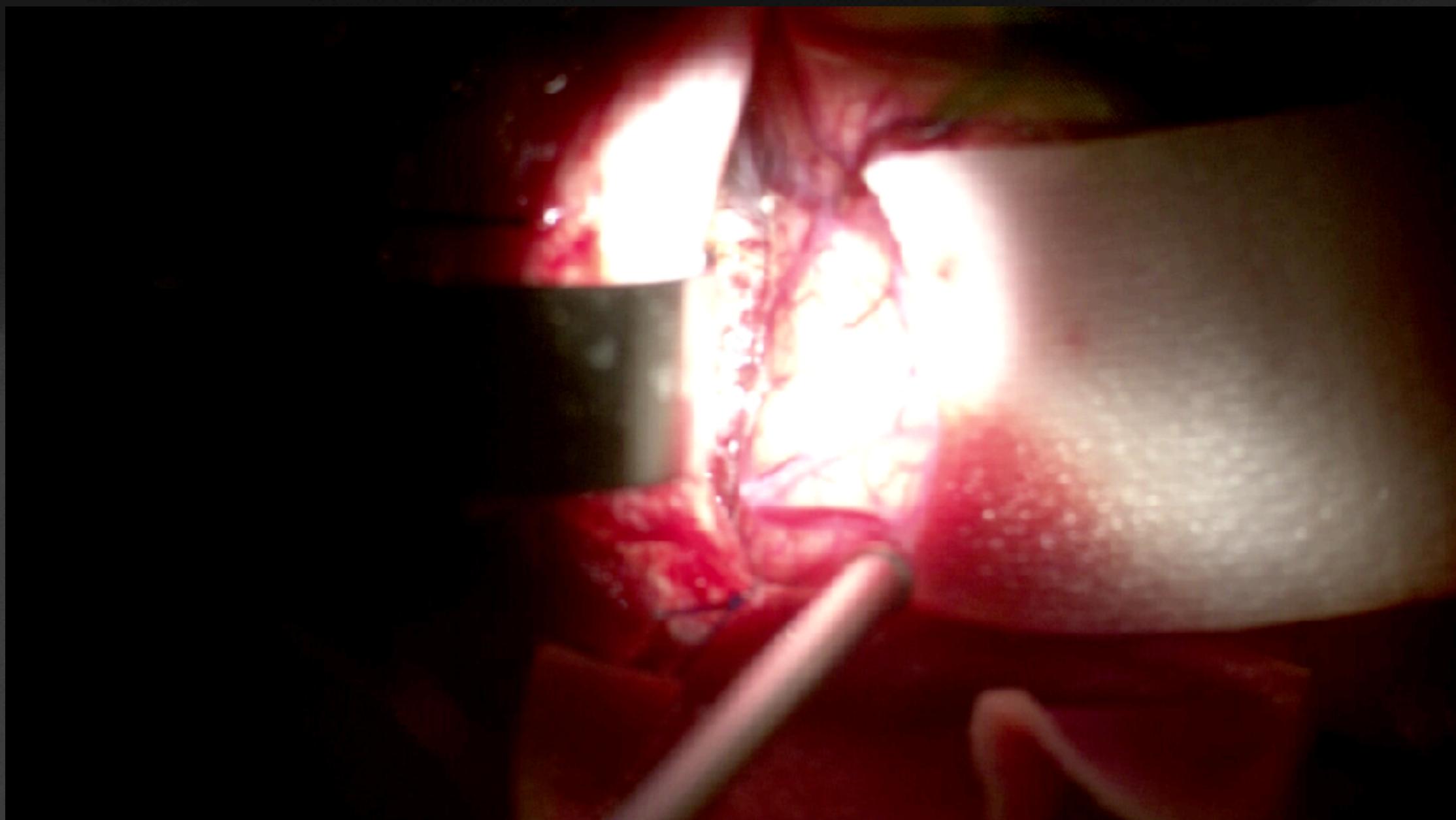
MCA AN

upper blade Kamiyama technique



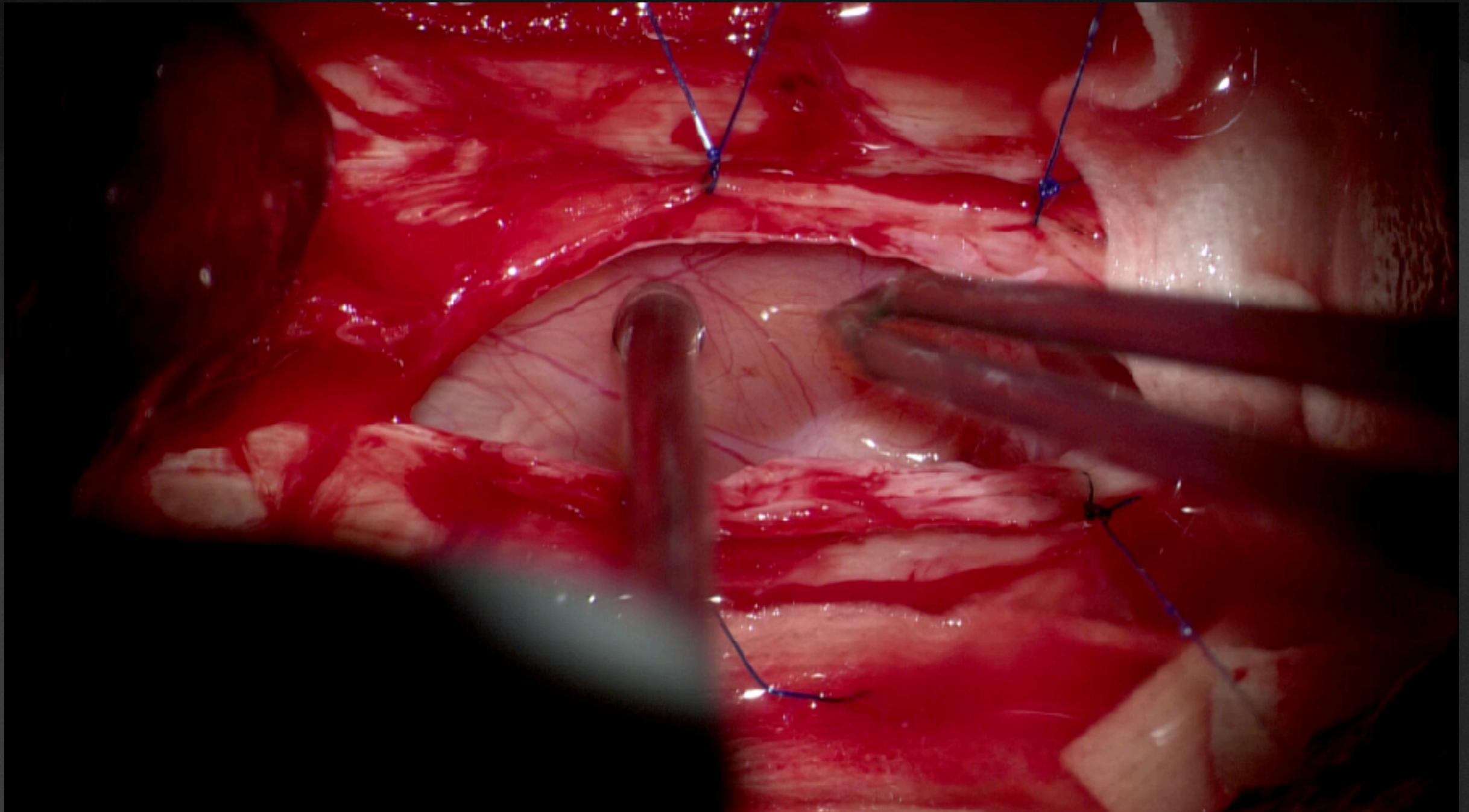
OLFACTORY MENINGEOMA

interhemispheric approach



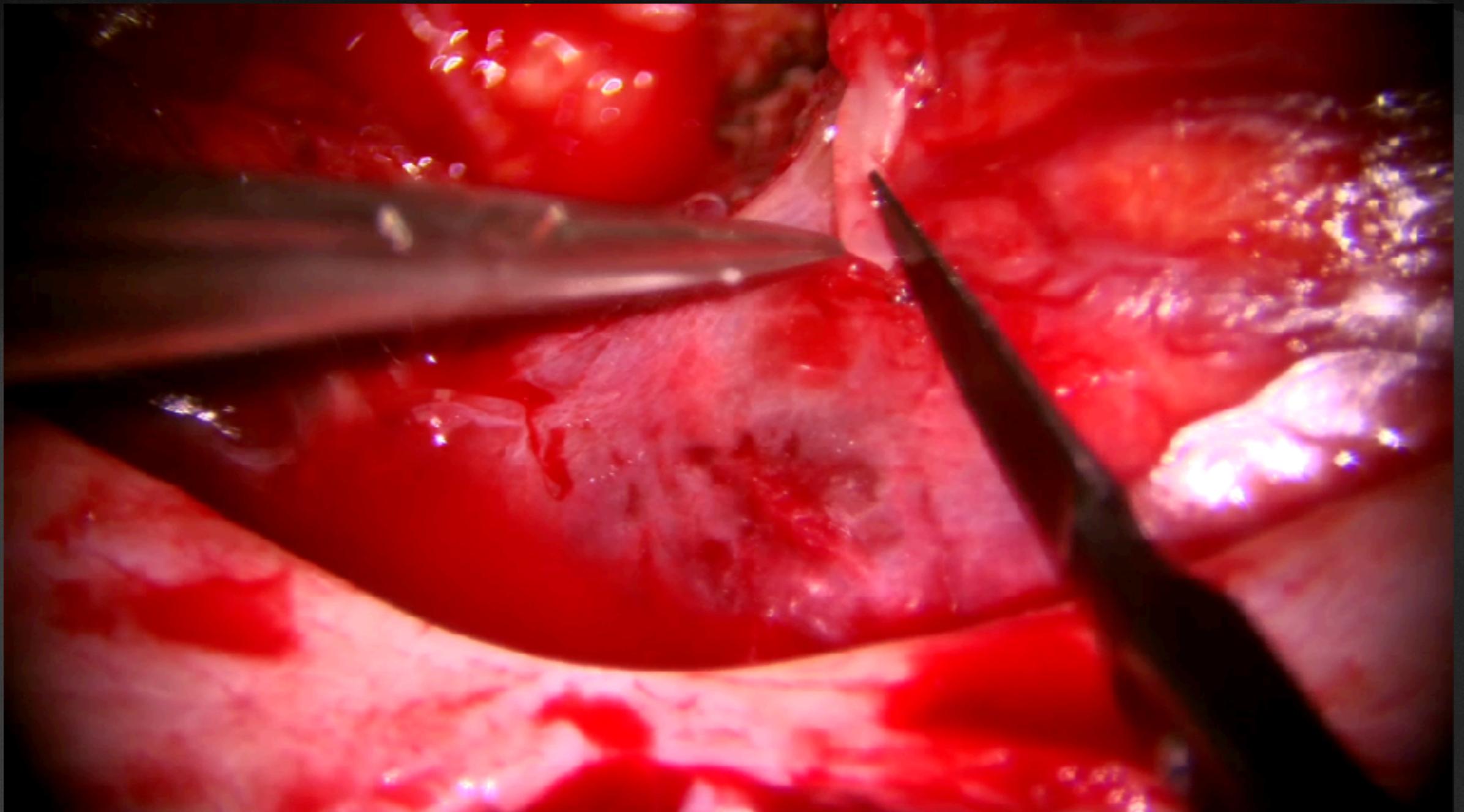
SPINAL SCHWANNOMA

VEIN DISSECTION



ICA blister rupture

EC-IC + ICA suture + wrapping



Lawton in 'Seven Bypasses':

“ It is one thing to demand perfection, but another thing to deliver it with this technically difficult operation, such as

when sewing intraluminally in a side-to-side anastomosis of the S1 SCA-P2 PCA in-situ bypass in the pretemporal corridor.

Visualizing translucent walls at this depth at the ends of long instruments in low light can be a struggle....”

...it's a long journey

...we need a GOOD light to shine on the path and on:

- discovering new terrain**
- rediscovering the old terrain**
- discovering and improving our skills**

MICROVASCULAR NEUROSURGICAL WORKSHOP

ČESKÉ BUDĚJOVICE, 28 NOV - 1 DEC, 2023

- **microanastomosis hands-on**
- **animal models**
- **live surgeries**
- **lectures by esteemed speakers**



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