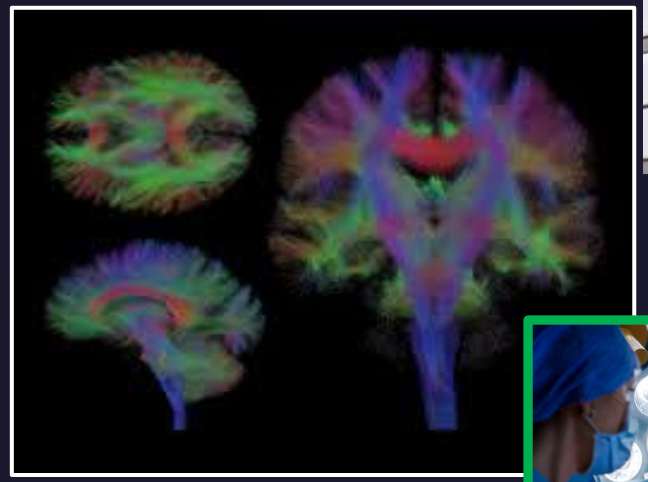
Tecnologie nuove e future in Neurochirurgia

Nicola Montemurro, MD, PhD, MBA, MSc, FACS

UO Neurochirurgia
Azienda Ospedaliero Universitaria Pisana, Pisa

1924



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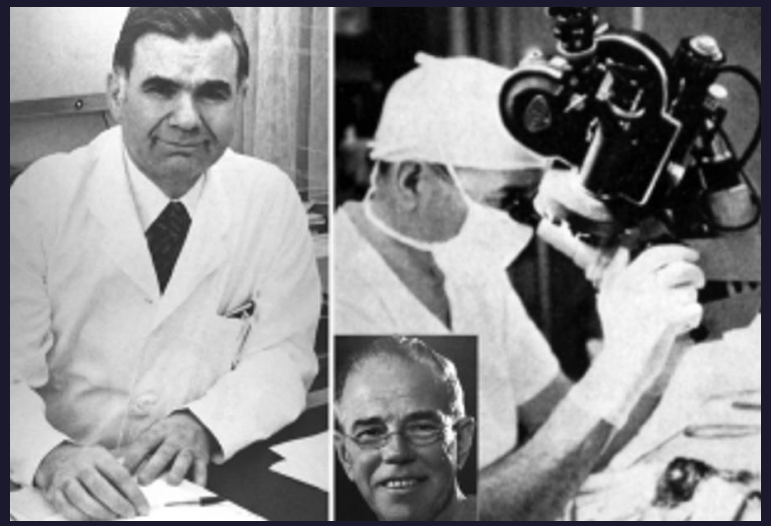
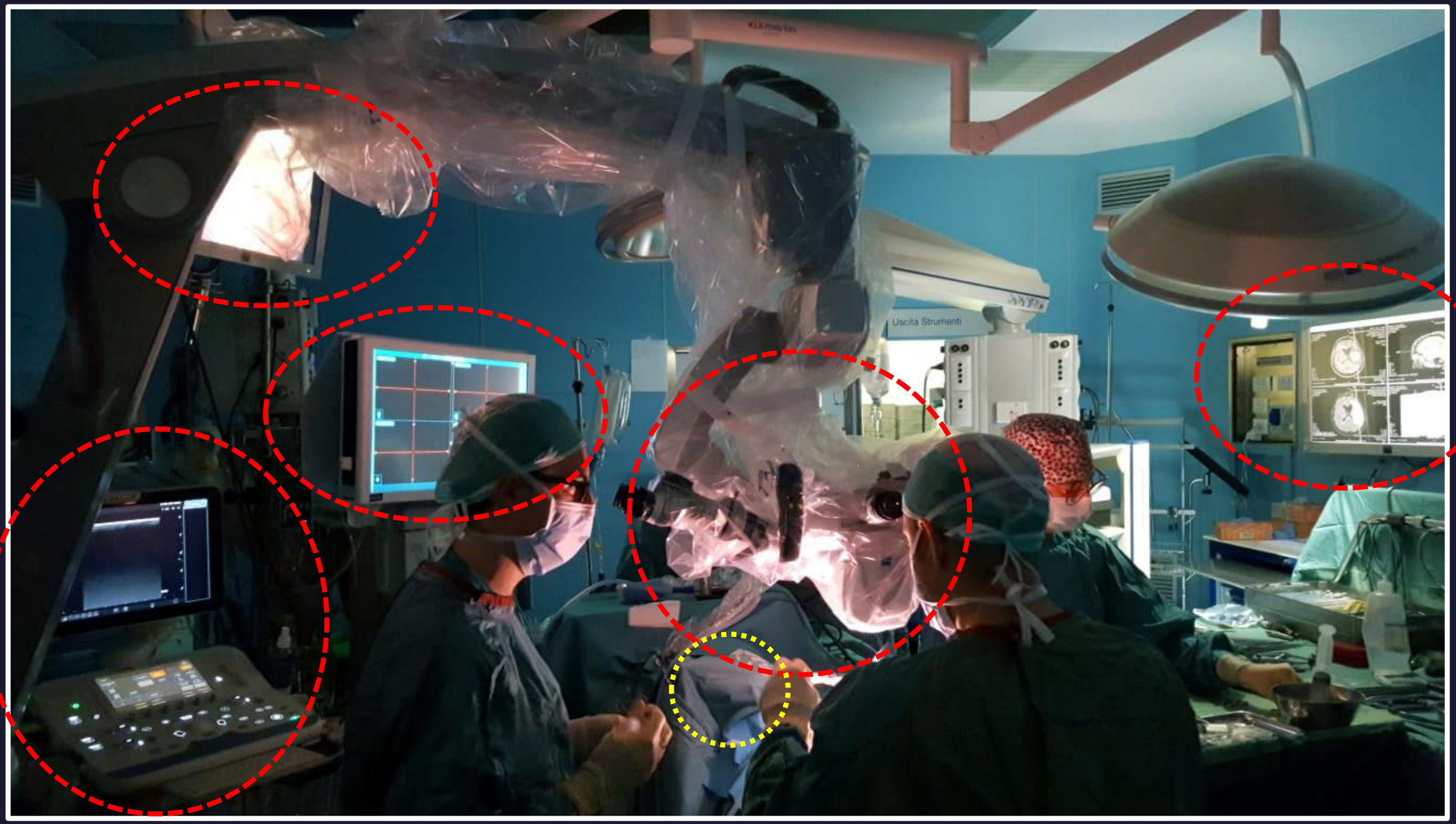
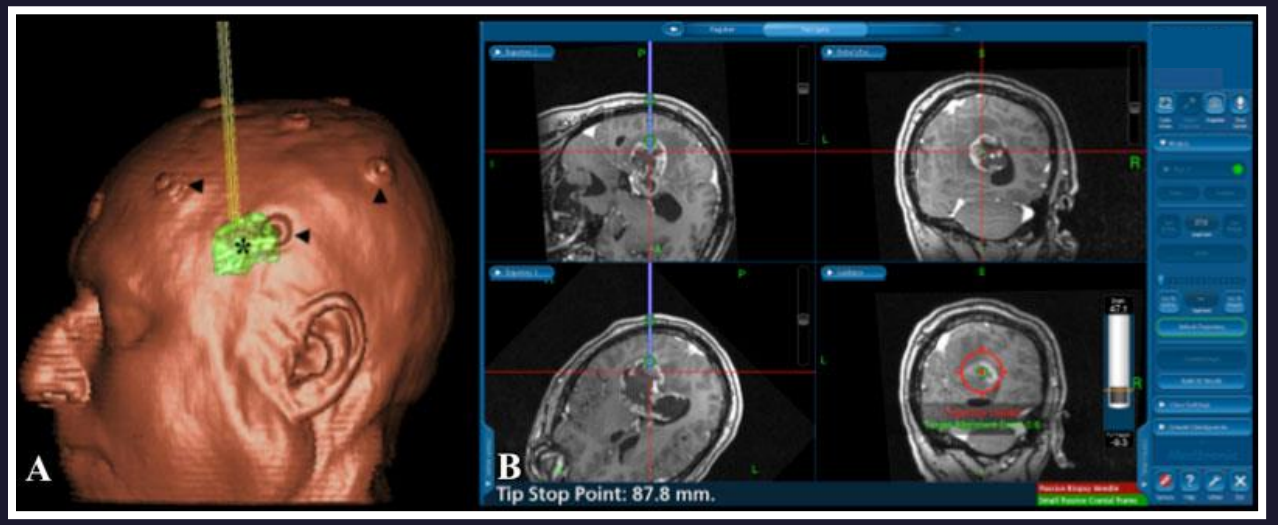
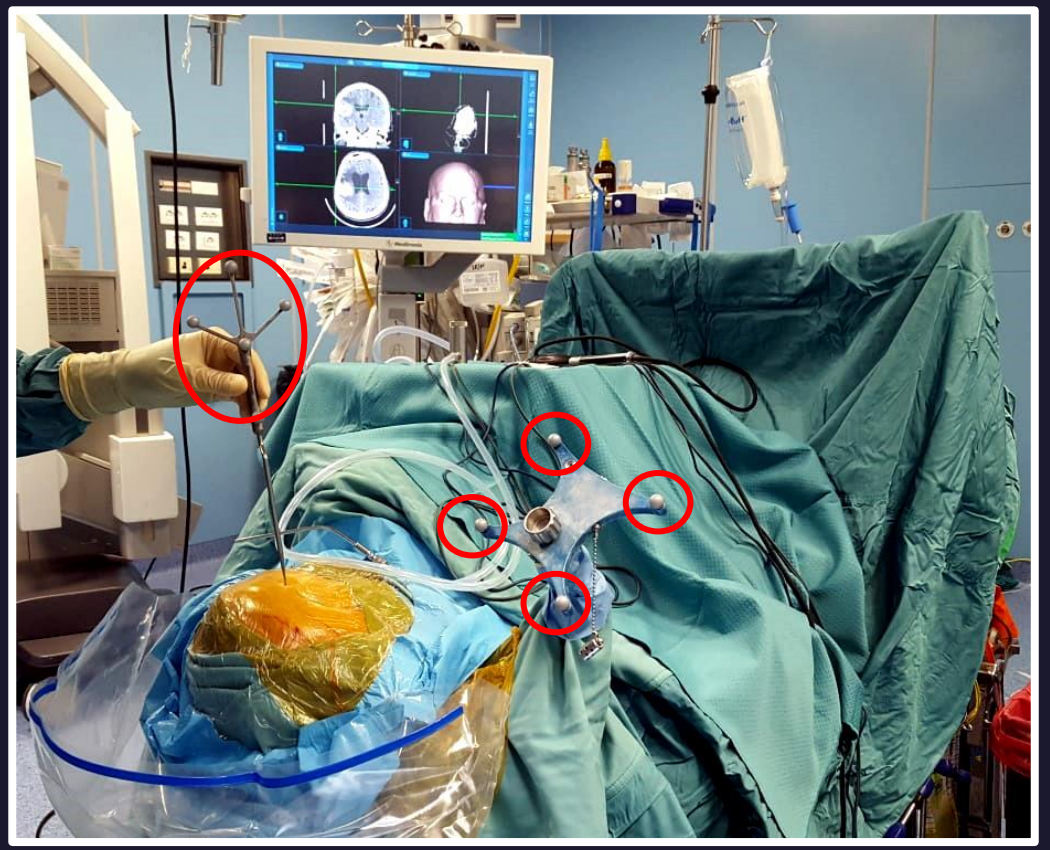


Malekpour M & Cohen-Gadol AA. Making the "inoperable" tumors "operable": Harvey Cushing's contributions to the surgery of posterior fossa tumors. Neurosurg Focus. 2014
Black P. Spinal vascular malformations: an historical perspective. Neurosurg Focus. 2006


Uscita Strumenti

Neuronavigazione intraoperatoria



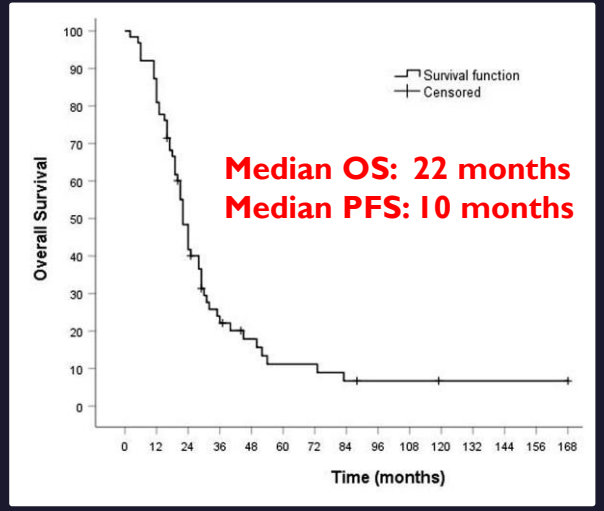


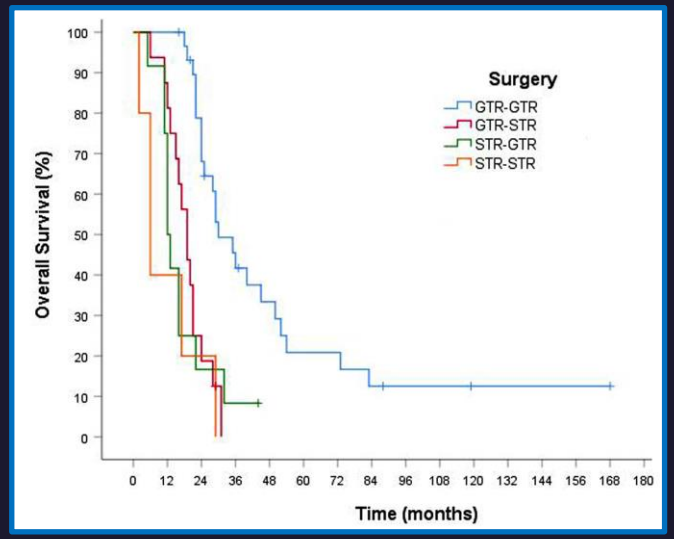
PubMed.gov

Clin Neurol Neurosurg. 2021 Aug;207:106735. doi: 10.1016/j.clineuro.2021.106
Epub 2021 Jun 8.

Surgical outcome and molecular pattern characterization of recurrent glioblastoma multiforme: A single-center retrospective series

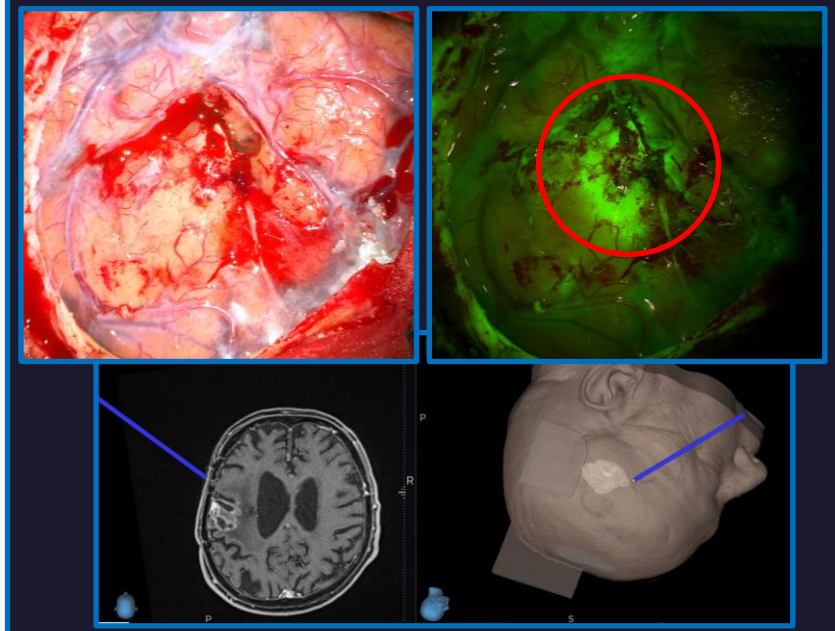
Nicola Montemurro [1], Giuseppe Nicolò Fanelli [2], Cristian Scatena [2], Valerio Ortenzi [3], Francesco Pasqualetti [4], Chiara Maria Mazzanti [5], Riccardo Morganti [6], Fabiola Paiar [4], Antonio Giuseppe Naccarato [2], Paolo Perrini [7]

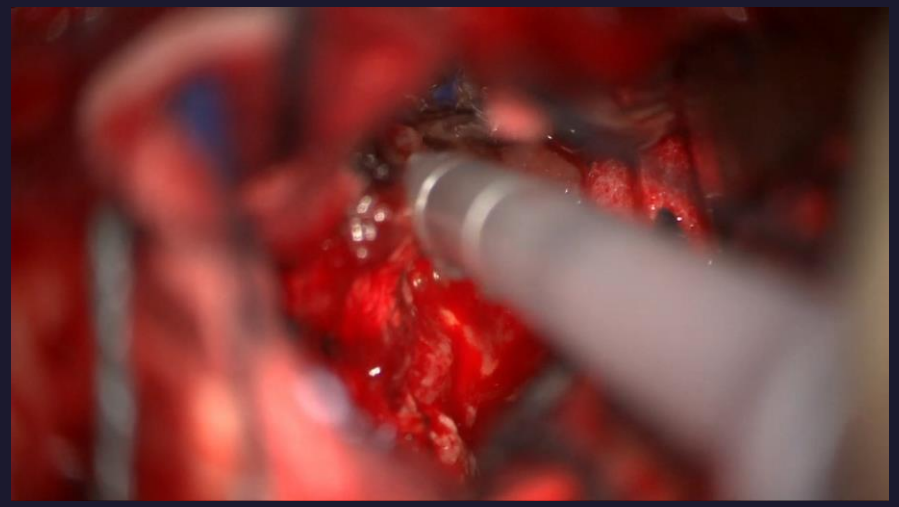


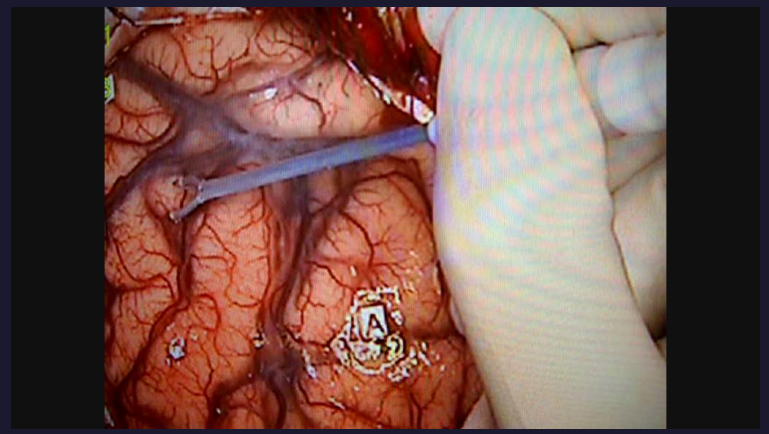


Prognostic factor		Multivariate analysis (Stepwise method)			
	Median OS (months)	RC	HR	CI 95%	p value
OS risk factor					
Sex					
Female	29,5	−1.132	0.322	0.147–0.705	0.005
Male	21				
Age					
PFS	10	−0.042	0.959	0.934–0.986	0.003
Surgery					
Third surgery	32				0.596
Second surgery	21				
Tumor volume at 1° surgery					0.358
Tumor volume at 2° surgery					
Tumor site					
Frontal lobe	22				
Parietal or occipital lobe	20				
Temporal lobe	22				
Multicentric GBM at 1° surgery	14				0.714
Multicentric GBM at 2° surgery	16				0.122
Molecular pattern at 1° surgery					
p53 mutation	21				
MGMT promoter methylation	26.5				0.765
1p/19q co-deletion	24				
Molecular pattern at 2° surgery					
p53 mutation	21.5				0.274
MGMT promoter methylation	28				0.792
1p/19q co-deletion	24.5				
EOR at 1° surgery					
GTR	24				0.218
STR	12				
EOR at 2° surgery					
GTR	24.5				0.528
STR	17				
EOR combination 1–2° surgery					
GTR-GTR	29	−1.634	0.195	0.091–0.419	< 0.0001
GTR-STR	19				0.218
STR-GTR	13				0.528
STR-STR	6				0.377
Adjuvant chemotherapy at recurrence	28	−0.899	0.407	0.206–0.809	0.010

EOR, extension of resection; GTR, gross total resection; HR, Hazard ratio; RC, regression coefficient







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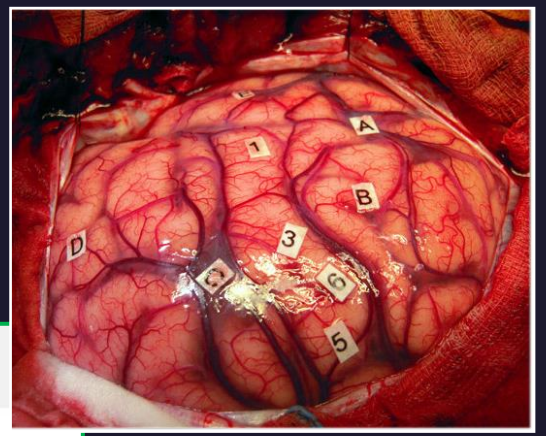
> Brain Topogr. 2016 Jul;29(4):561-71. doi: 10.1007/s10548-016-0490-6. Epub 2016 Apr 11.

Right Cortical and Axonal Structures Eliciting Ocular Deviation During Electrical Stimulation Mapping in Awake Patients

Nicola Montemurro [1], Guillaume Herbet [2 3 4], Hugues Duffau [5 6]



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Editorial > Front Oncol. 2022 Dec 23:12:1094818. doi: 10.3389/fonc.2022.1094818. eCollection 2022.

Editorial: Awake surgery for brain tumors and brain connectomics

Nicola Montemurro [1], Gianluca Trevisi [2]

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> Neurosurgery. 2017 Aug 1;81(2):307-314. doi: 10.1093/neuros/nyx022.

The Cost of Brain Surgery: Awake vs Asleep Craniotomy for Perirolandic Region Tumors

Chikezie I Eseonu [1], Jordina Rincon-Torroella [1], Karim ReFaey [1], Alfredo Quiñones-Hinojosa [1]

Awake craniotomy Vs general anesthesia

- **Costi più bassi: $34.804 Vs $46.798**
- **Miglior outcome post-operatorio, punteggio Karnofsky: 91.8 Vs 81.3**
- **Durata media del ricovero più breve: 4.12 Vs 7.61**

PubMed.gov

Clin Neurol Neurosurg. 2020 Aug;195:105942. doi: 10.1016/j.clineuro.2020.105942. Epub 2020 May 21.

Survival outcomes in patients with recurrent glioblastoma treated with Laser Interstitial Thermal Therapy (LITT): A systematic review

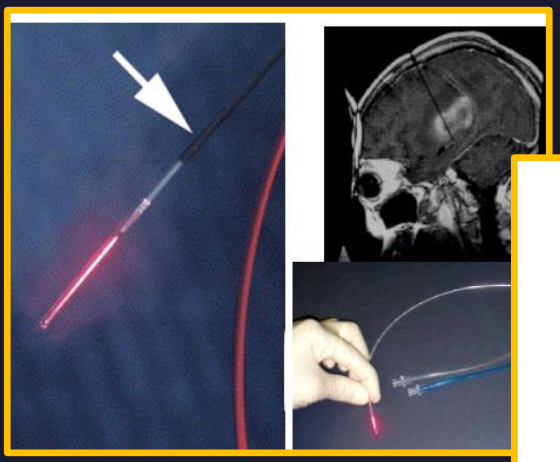
Nicola Montemurro [1], Yury Anania [2], Federico Cagnazzo [3], Paolo Perrini [4]

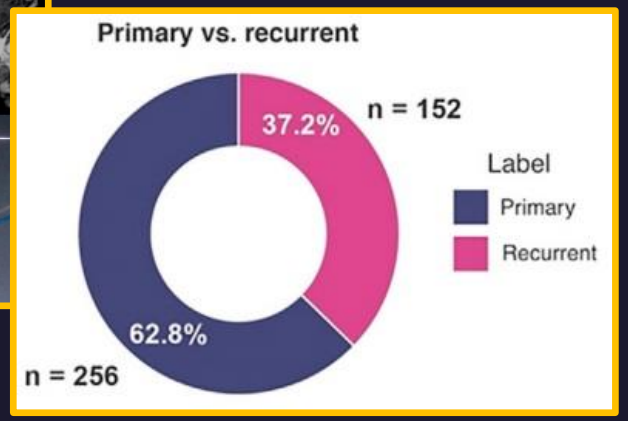
"LITT is a safe and effective treatment for recurrent GBM and may offer an effective alternative to repeat surgery in properly selected patients"

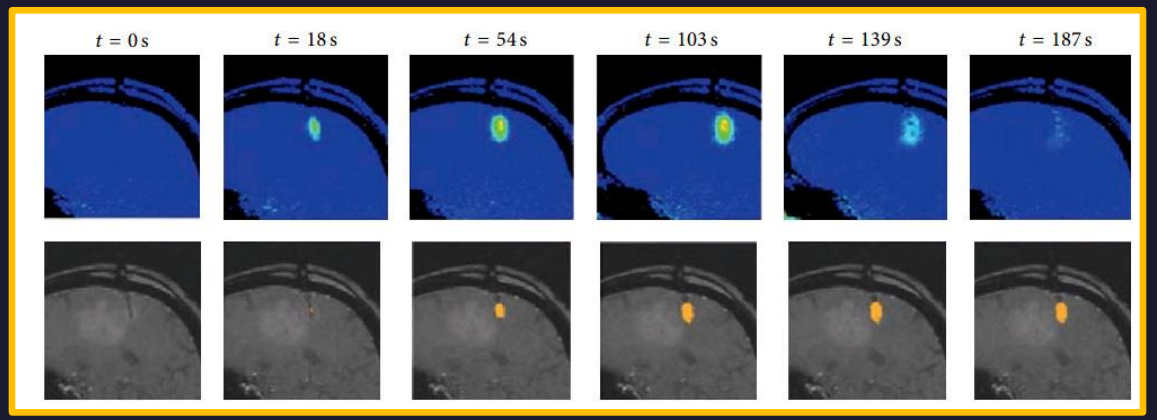
Clinical outcome after treatment with LITT.

Authors	Year	Complications (No.)	Mortality (%)	Mean hospital stay (day)	Pre-op KPS (range)	Post-op KPS (range)	OS from diagnosis (months) (range)	OS after LITT (months) (range)	PFS (months) (range)
Leonardi & Lumenta[13]	2002	0	0	–	–	–	17	9	4
Schwarzmaier et al.[21]	2005	0	0	6 (2–10)	80(70–90)	70	18(16–20)	14(13–15)	–
Schwarzmaier et al.[18]	2006	transient hemiparesis (1)	0	12.0 ± 4.2	70	70	9.4 ± 1.3	6.9 ± 1.7	–
Carpentier et al.[9]	2012	seizures (1)	0	1	70 (50–90)	70(50–90)	26	11	10
Sloan et al.[4]	2013	wound infection (1), motor deficit (1), hemorrhage (1)	0	3	80 (70–90)	80 (60–100)	10.5(2–25.6)	10.5	8
Hawasli et al.[10]	2013	transient hemiparesis (1)	0	1.7 (1–3)	50	50	–	–	8.4
Mohammadi & Schroeder[17]	2014	motor deficit (2)	0	–	–	–	–	–	2.8
Mohammadi et al.[16]	2014	0	0	3	80 (50–90)	–	8	–	6
Sun et al.[22]	2015	–	–	1	–	–	–	–	–
Wright et al.[24]	2016	wound infection (1)	0	–	–	–	–	9,3	3.1
Thomas et al.[23]	2016	seizures (1)	0	–	80	–	–	8	5
Beaumont et al.[8]	2018	0	0	1	80	80	20.4 (8–34.9)	6.8(2.4–12.5)	3.5(2.2–4.9)
Maraka et al.[15]	2018	0	0	–	–	–	–	–	–
Ali et al.[7]	2018	0	0	1	–	–	7.4 (2.8–11.9)	6.1(3–11.9)	4(2.8–5.1)
Sharma et al.[20]	2018	0	0	–	80 (50–100)	–	–	11	4.4
Shah et al.[19]	2019	wound infection (1)	0	1	90	90	7.3 (5.6–13.5)	–	5.6
Kamath et al.[11]	2019	seizures (2)	0	3.2 ± 4.6	–	–	22.3	11.8	7.3

KPS, Karnofsky Performance Score; OS, overall survival; PFS, progression-free survival.

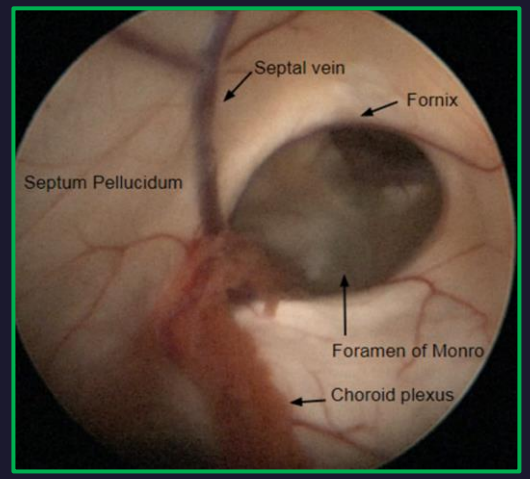


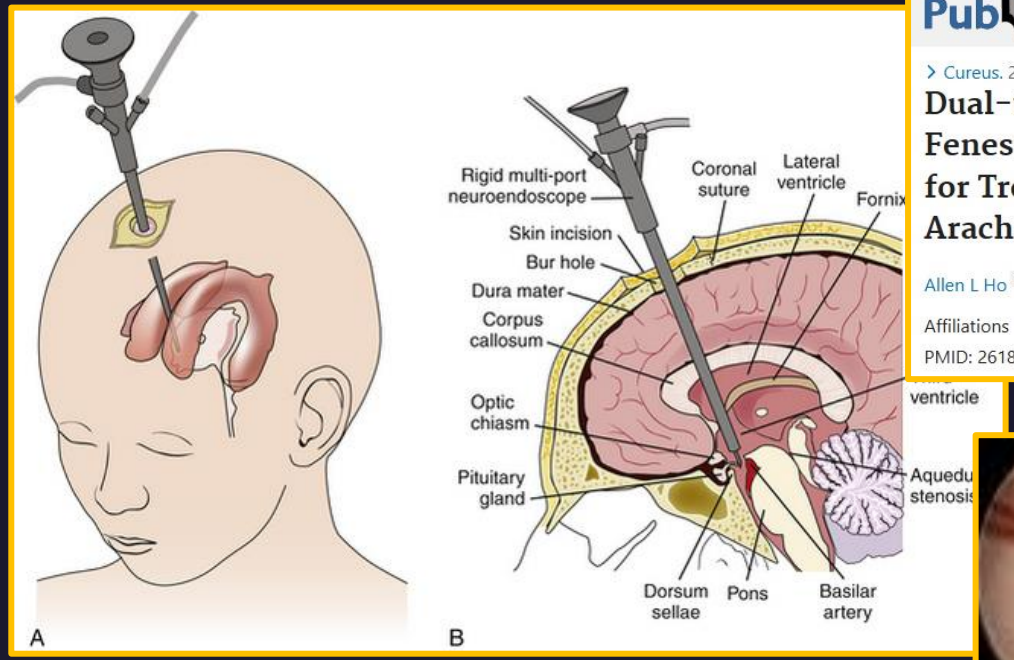




LITT

O'Halloran PJ et al. LITTing up Gliomas-Is the Future Bright? World Neurosurg X. 2022
Norred SE Johnson JA. Magnetic resonance-guided laser induced thermal therapy for glioblastoma multiforme: a review. Biomed Res Int. 2014





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> Cureus. 2015 Mar 5;7(3):e253. doi: 10.7759/cureus.253. eCollection 2015 Mar.

Dual-trajectory Approach for Simultaneous Cyst Fenestration and Endoscopic Third Ventriculostomy for Treatment of a Complex Third Ventricular Arachnoid Cyst

Allen L Ho [1], Arjun V Pendharkar [2], Eric S Sussman [3], Vinod K Ravikumar [2], Gordon H Li [2]

Affiliations + expand

PMID: 26180677 PMCID: PMC4494513 DOI: 10.7759/cureus.253

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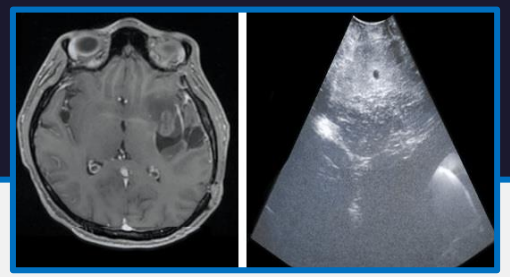
Review > Neurol Res. 2024 Jan;46(1):81-88. doi: 10.1080/01616412.2023.2257461.

Clinical and surgical outcome of endoscopic third ventriculostomy (ETV) and ventriculoperitoneal shunt (VPS) in patients with Long-Standing Overt Ventriculomegaly in Adults (LOVA): a systematic review

Nicola Montemurro [1]

Ecografo



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> Cureus. 2024 Jun 12;16(6):e62278. doi: 10.7759/cureus.62278. eCollection 2024 Jun.

Intraoperative Ultrasound: An Old but Ever New Technology for a More Personalized Approach to Brain Tumor Surgery

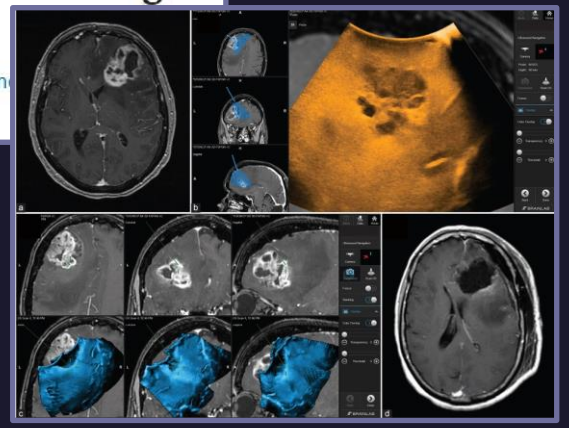
Gervith Reyes Soto [1], Carlos Murillo Ponce [2], Carlos Catillo-Rangel [3], Bernardo Cacho Diaz [2], Renat Nurmukhametov [4], Gennady Chmutin [5], Jeff Natalaja Mukengeshay [6], Cherubain Mpoyi Tshiunza [6], Manuel de Jesus Encarnacion Ramirez [5], Nicola Montemurro [7]

PubMed.gov

Case Reports > Surg Neurol Int. 2022 Aug 12;13:356. doi: 10.25259/SNI_469_2022. eCollection 2022.

Navigated 3D ultrasound-guided resection of high-grade gliomas: A case series and review

Ahmed Habib [1], Nicolina Jovanovich [1], Meagan Hoppe [1], N U Farrukh Ham
Lincoln Edwards [1], Pascal Zinn [1]



PubMed.gov

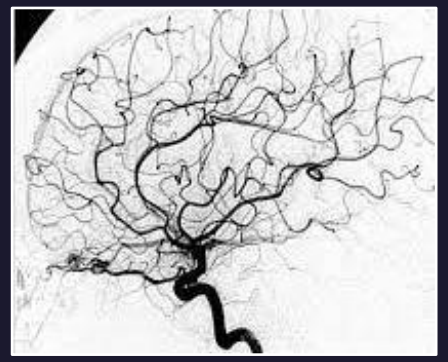
Review > J Clin Med. 2021 Dec 31;11(1):223. doi: 10.3390/jcm11010223.

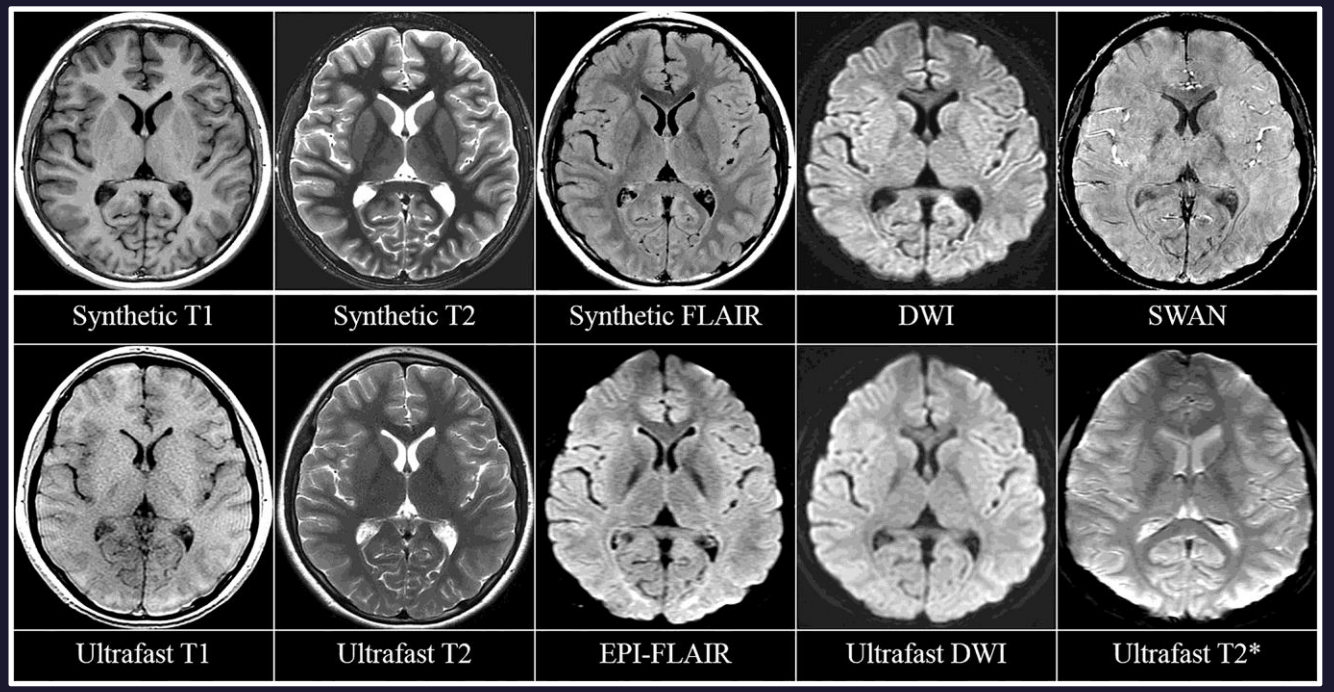
The Exoscope in Neurosurgery: An Overview of the Current Literature of Intraoperative Use in Brain and Spine Surgery

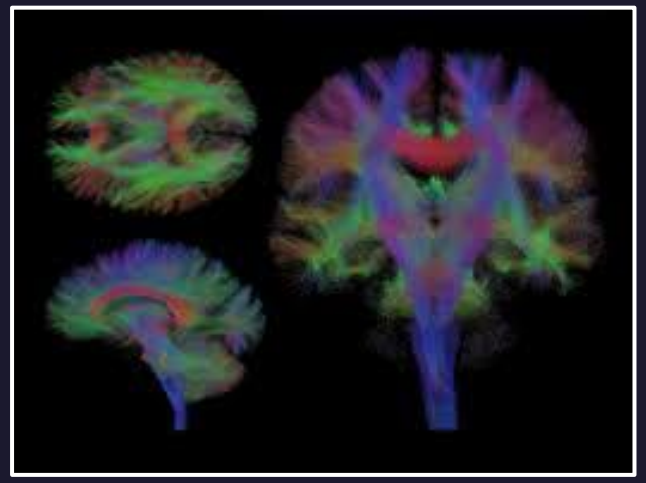
Nicola Montemurro [1], Alba Scerrati [2],

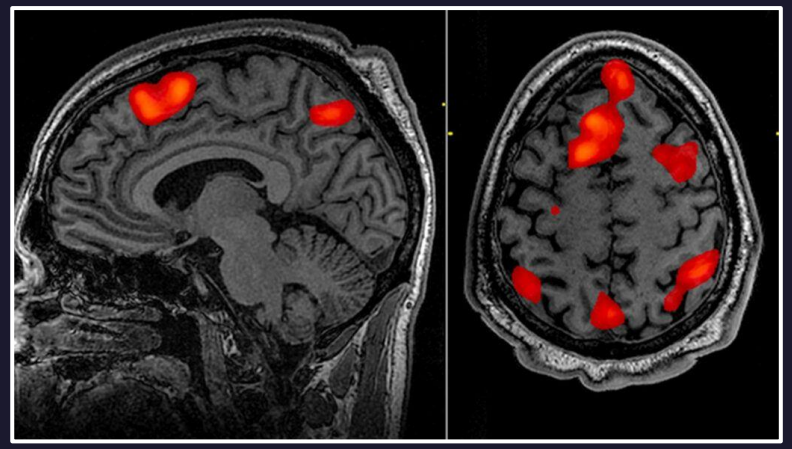
Esoscopio

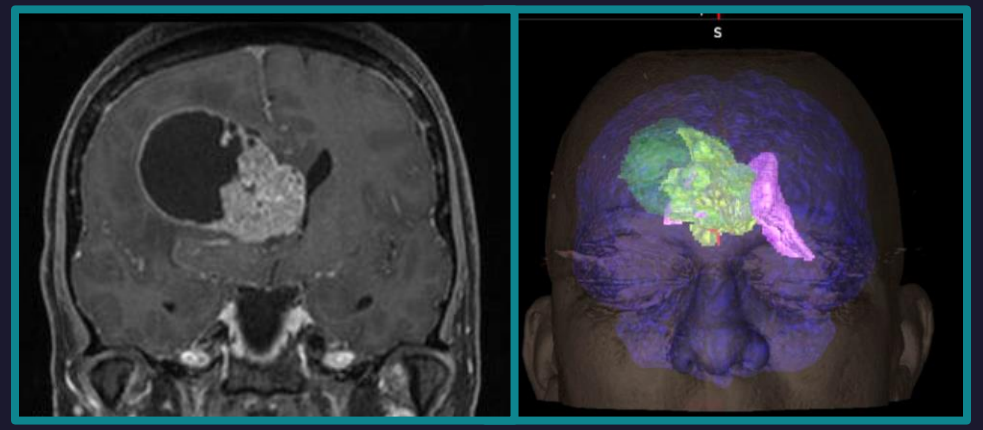
Neuroimaging in Neurochirurgia









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Medicina (Kaunas). 2022 Apr 2;58(4):508. doi: 10.3390/medicina58040508.

Digital Transformation Will Change Medical Education and Rehabilitation in Spine Surgery

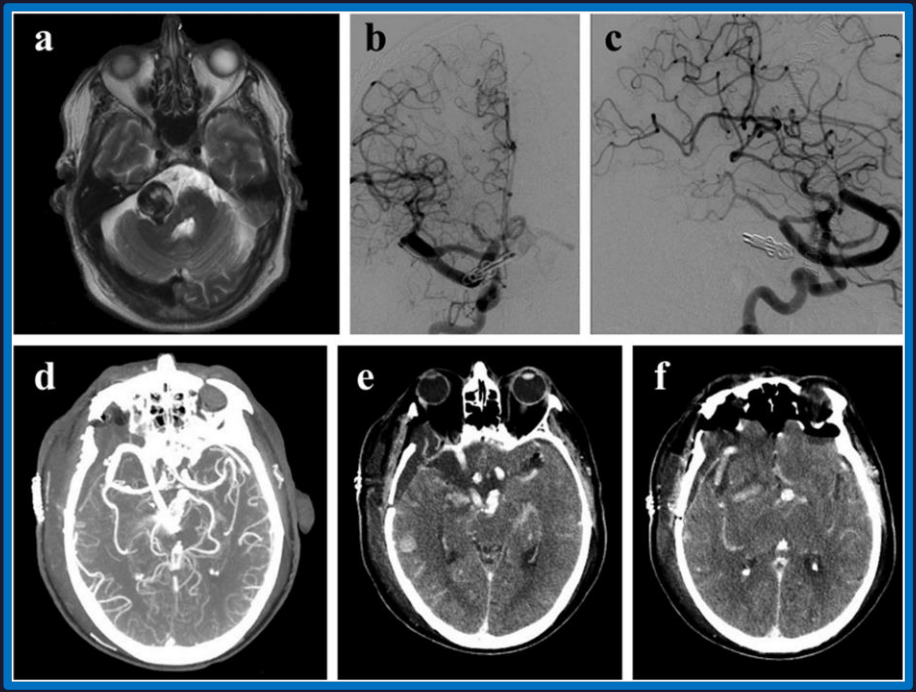
Tadatsugu Morimoto [1], Hirohito Hirata [1], Masaya Ueno [1], Norio Fukumori [2], Tatsuya Sakai [1], Maki Sugimoto [3], Takaomi Kobayashi [1], Masatsugu Tsukamoto [1], Tomohito Yoshihara [1], Yu Toda [1], Yasutomo Oda [2], Koji Otani [4], Masaaki Mawatari [1]

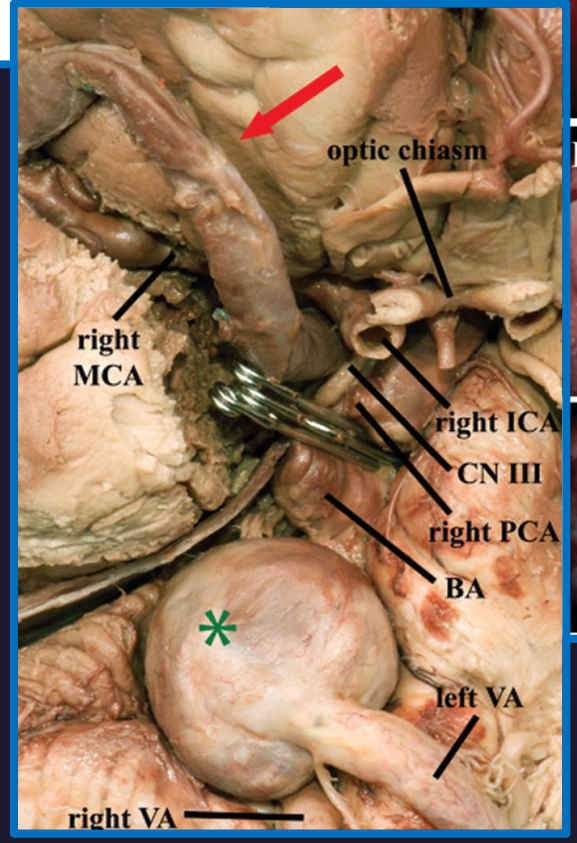
PubMed.gov

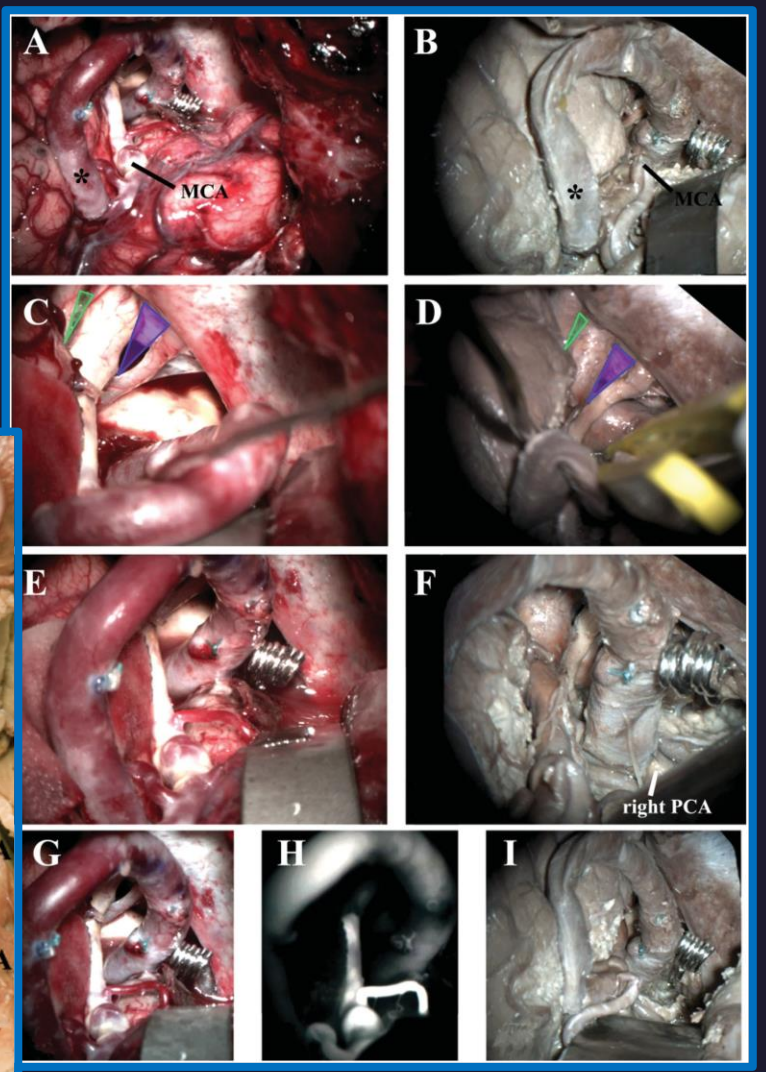
Br J Neurosurg. 2022 May 17;1-4. doi: 10.1080/02688697.2022.2077306. Online ahead of print.

Unsuccessful bypass and trapping of a giant dolichoectatic thrombotic basilar trunk aneurysm. What went wrong?

Nicola Montemurro [1], Paolo Perrini [1], Michael T Lawton [2]

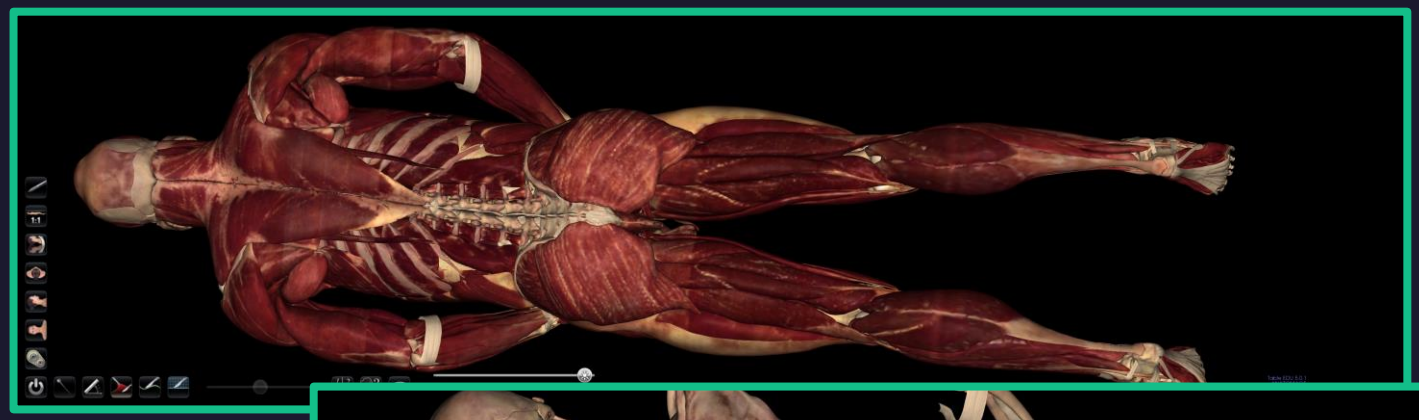


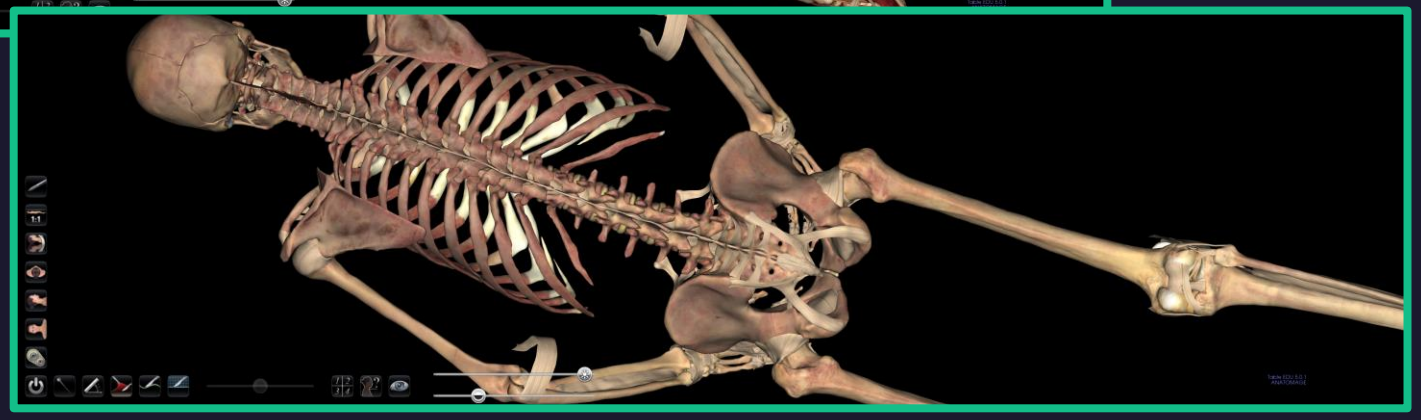




3D Anatomy & Virtual Dissection Platform

Anatomage table





3D video

PubMed.gov

> Oper Neurosurg (Hagerstown). 2016 Mar 1;12(1):93-94. doi: 10.1227/NEU.0000000000001022.

Clipping of Ruptured Residual Anterior Communicating Artery Aneurysm After Endovascular Coiling: 3-Dimensional Operative Video

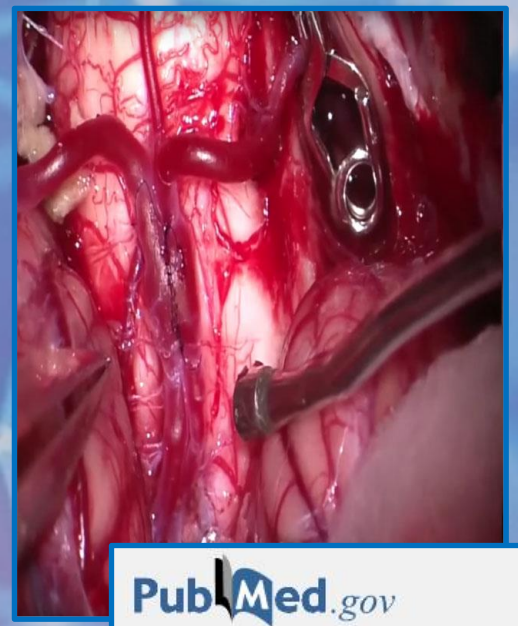
Nicola Montemurro [1], Arnau Benet [1], Michael T Lawton [1 2]

PubMed.gov

> Neurosurg Focus. 2022 Aug;53(2):E4. doi: 10.3171/2022.5.FOCUS2261.

360° 3D virtual reality operative video for the training of residents in neurosurgery

Daniel M Bruening [1], Peter Truckenmueller [1], Christian Stein [2 3], Josch Fuellhase [1], Peter Vajkoczy [1], Thomas Picht [1 2 4], Gueliz Acker [1 5]



PubMed.gov

> Oper Neurosurg (Hagerstown). 2017 Jun 1;13(3):400. doi: 10.1093/ons/opw022.

Management of a Ruptured Posterior Inferior Cerebellar Artery (PICA) Aneurysm With PICA-PICA In Situ Bypass and Trapping: 3-Dimensional Operative Video

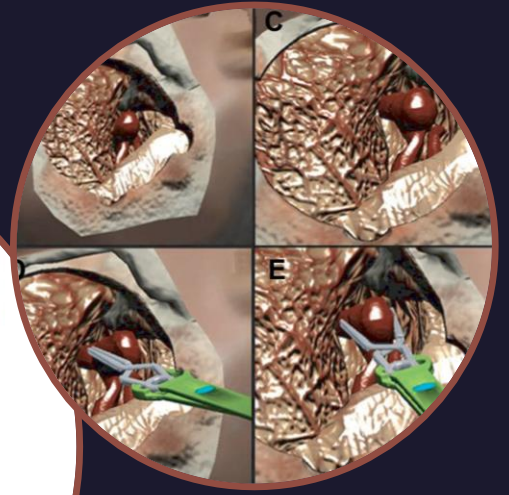
Arnau Benet [1], Nicola Montemurro [1], Michael T Lawton [1 2]

PubMed.gov

Neurosurgery. 2015 Mar;11 Suppl 2(0 2):52-8. doi: 10.1227/NEU.0000000000000583.

Virtual reality cerebral aneurysm clipping simulation with real-time haptic feedback

Ali Alaraj [1], Cristian J Luciano, Daniel P Bailey, Abdussalam Elsenousi, Ben Z Roitberg, Antonio Bernardo, P Pat Banerjee, Fady T Charbel



Virtual reality and augmented reality

PubMed.gov

Review > Int J Environ Res Public Health. 2022 Feb 2;19(3):1719. doi: 10.3390/ijerph19031719.

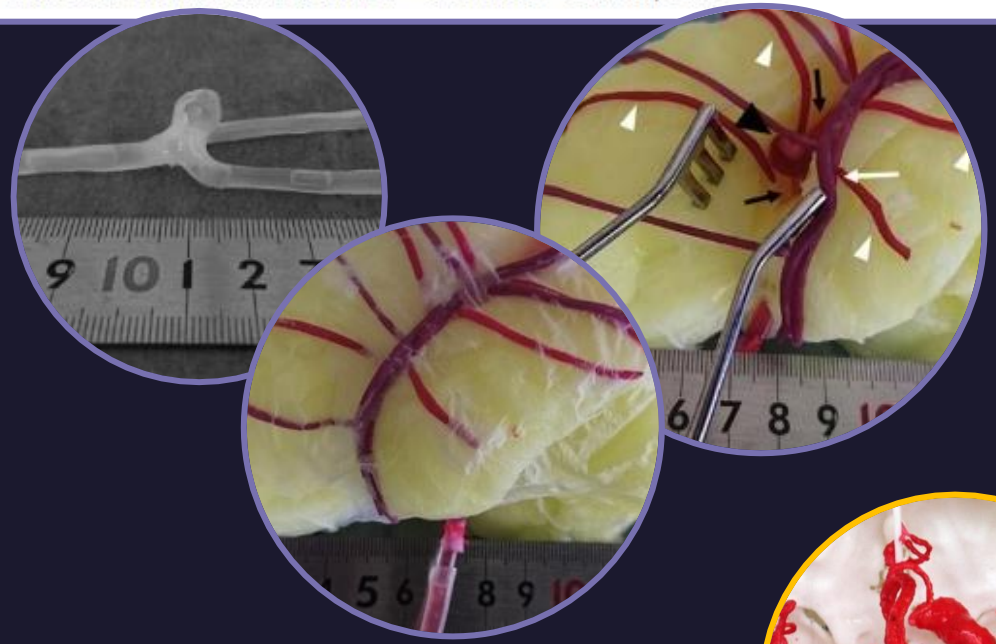
Virtual Reality in Neurosurgery: Beyond Neurosurgical Planning

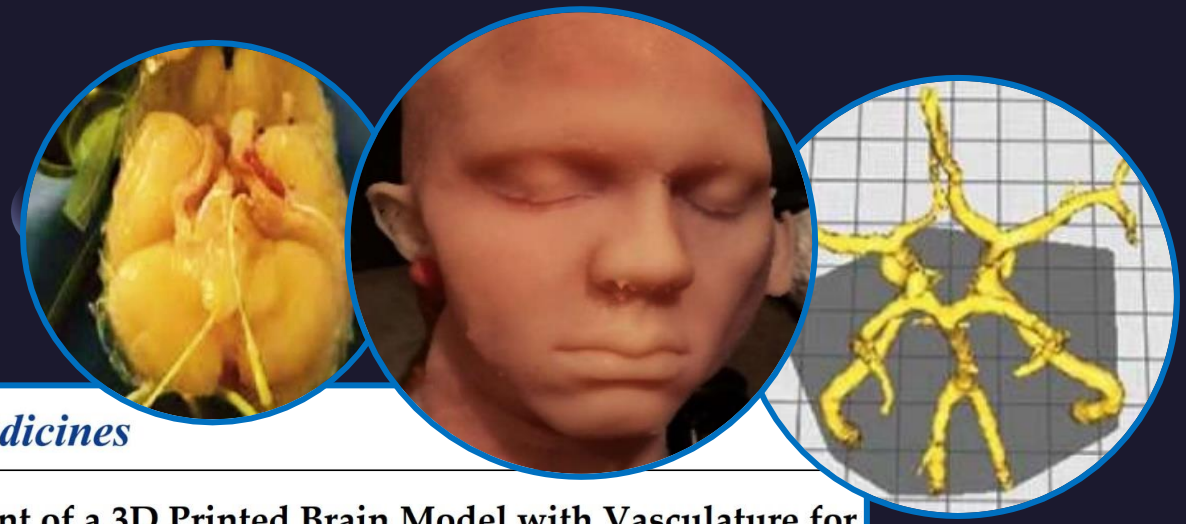
Rakesh Mishra [1], M D Krishna Narayanan [2], Giuseppe E Umana [3], Nicola Montemurro [4], Bipin Chaurasia [5], Harsh Deora [6]

Interdisciplinary Neurosurgery: Advanced Techniques and Case Management

Training model for cerebral aneurysm clipping

Hiroshi Tenjin, M.D., Ph.D. [a,*], Yoshio Okano, B.S. [b]





biomedicines

Article

Development of a 3D Printed Brain Model with Vasculature for Neurosurgical Procedure Visualisation and Training

Manuel Encarnacion Ramirez [1], Issael Ramirez Pena [2], Rossi E. Barrientos Castillo [1], Albert Sufianov [3], Evgeniy Goncharov [4], Jose A. Soriano Sanchez [5], Manuel Colome-Hidalgo [6], Renat Nurmukhametov [1], José Rafael Cerda Céspedes [7] and Nicola Montemurro [8,*]

PubMed.gov

> Oper Neurosurg (Hagerstown). 2021 Nov 15;21(6):558-569. doi: 10.1093/ons/opab357.

Novel System of Simulation Models for Aneurysm Clipping Training: Description of Models and Assessment of Face, Content, and Construct Validity

Evgenii Belykh [1 2], Andrei Giovani [3], Irakliy Abramov [1], Brandon Ngo [1], Liudmila Bardonova [1], Xiaochun Zhao [1], Thanapong Loymak [1], Michael A Mooney [1], John P Sheehy [1], Sarah McBryan [1], Rokuya Tanikawa [4], Michael T Lawton [1], Mark C Preul [1]

Interdisciplinary Neurosurgery

Technical Notes & Surgical Techniques

A workflow to generate physical 3D models of cerebral aneurysms applying open source freeware for CAD modeling and 3D printing

Alba Scerrati[a,*], Federica Trovalusci[b], Alessio Albanese[c], Gennaro Salvatore Ponticelli[d], Vincenzo Tagliaferri[b], Carmelo Lucio Sturiale[c], Michele Alessandro Cavallo[a], Enrico Marchese[c]

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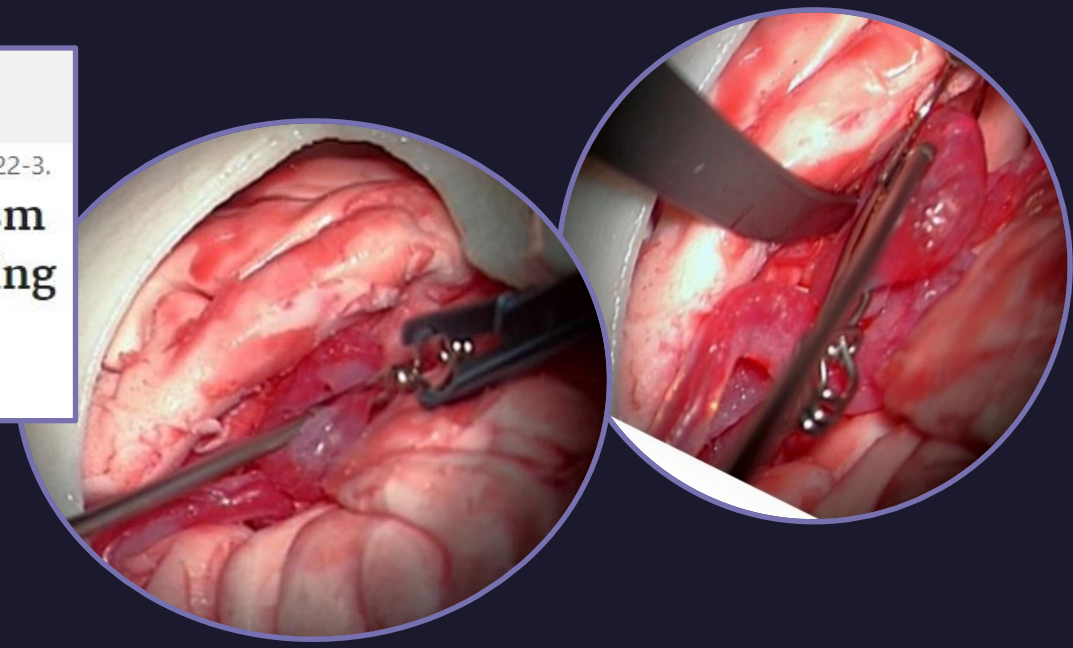
Acta Neurochir (Wien). 2020 Oct;162(10):2313-2321. doi: 10.1007/s00701-020-04522-3.

Neurosurgical simulator for training aneurysm microsurgery-a user suitability study involving neurosurgeons and residents

Fredrick Johnson Joseph [1], Stefan Weber [1], Andreas Raabe [2], David Bervini [3]



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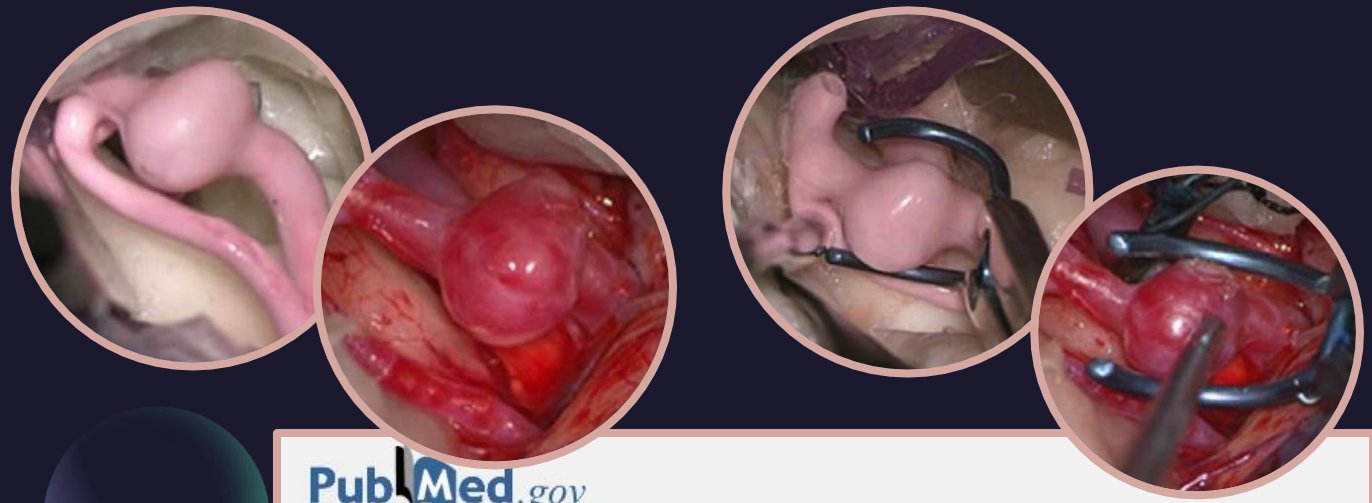
J Korean Neurosurg Soc. 2022 Jul;65(4):489-498. doi: 10.3340/jkns.2021.0235.

3D-Printed Disease Models for Neurosurgical Planning, Simulation, and Training

Chul-Kee Park [1]



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Training in Cerebral Aneurysm Clipping Using Self-Made 3-Dimensional Models

Toshihiro Mashiko [1], Naoki Kaneko [2], Takehiko Konno [2], Keisuke Otani [3], Rie Nagayama [2], Eiju Watanabe [2]

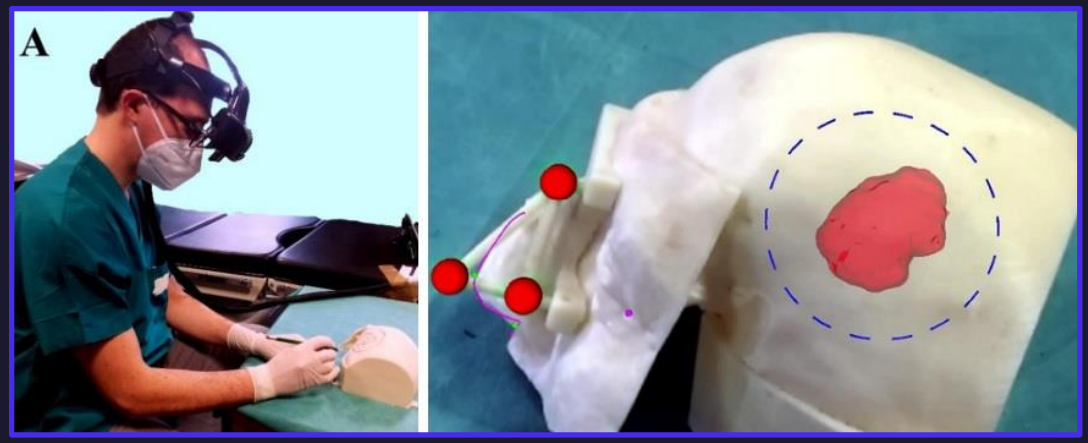
Augmented reality in neurosurgery

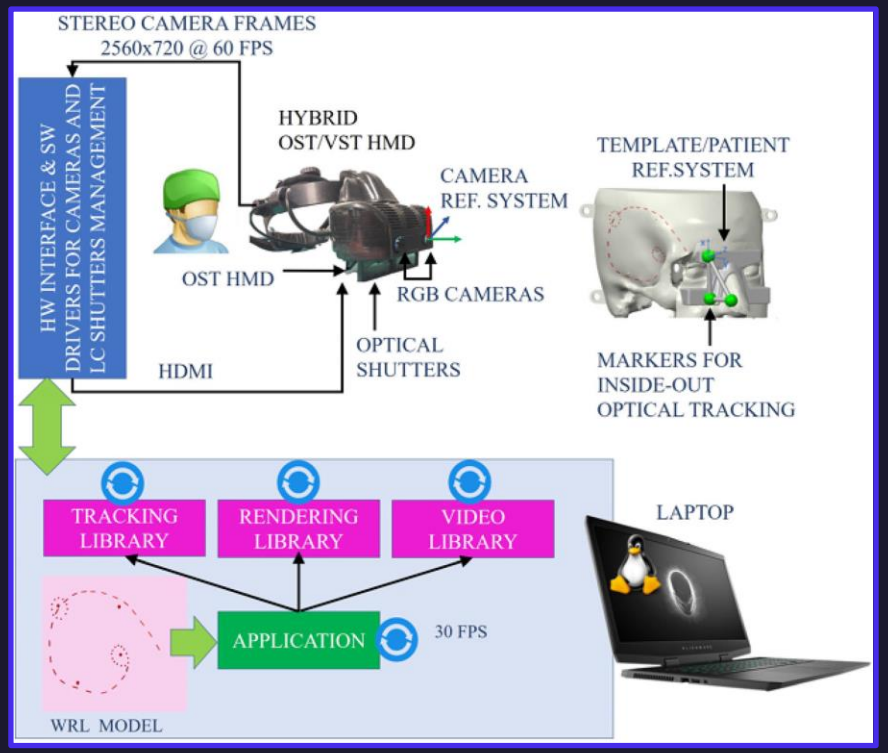
PubMed.gov

Ann Biomed Eng. 2021 Sep;49(9):2590-2605. doi: 10.1007/s10439-021-02834-8. Epub 2021 Jul 23.

Evaluation of a Wearable AR Platform for Guiding Complex Craniotomies in Neurosurgery

Sara Condino [1 2], Nicola Montemurro [3 4], Nadia Cattari [5 4], Renzo D'Amato [6 5], Ulrich Thomale [7], Vincenzo Ferrari [6 5], Fabrizio Cutolo [8 9]





VOSTARS

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Editorial > Int J Environ Res Public Health. 2022 May 23;19(10):6347.
doi: 10.3390/ijerph19106347.

Brain Tumor and Augmented Reality: New Technologies for the Future

Nicola Montemurro [1], Sara Condino [2 3], Marina Carbone [3], Nadia Cattari [3 4], Renzo D'Amato [2 3], Fabrizio Cutolo [2 3], Vincenzo Ferrari [2 3]

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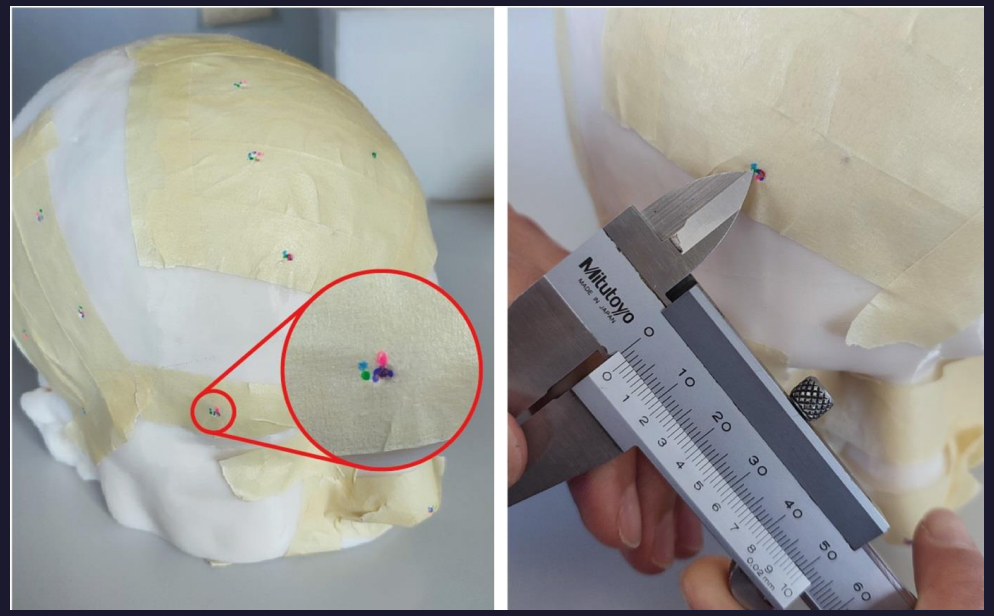
Front Digit Health. 2025 Jan 14:6:1500677. doi: 10.3389/fdgth.2024.1500677. eCollection 2024.

Targeting accuracy of neuronavigation: a comparative evaluation of an innovative wearable AR platform vs. traditional EM navigation

Marina Carbone [#1,2], Nicola Montemurro [#2,3], Nadia Cattari [1,2], Martina Autelitano [2,3], Fabrizio Cutolo [1,2], Vincenzo Ferrari [1,2], Emanuele Cigna [2,4], Sara Condino [1,2]

TABLE 3 Results of phantom-study: comparison of Vostars and StealthStation across various landmarks and users.

Landmark	Vostars						StealthStation					
	User 1	User 2	User 3	User 4	Median	IQR	User 1	User 2	User 3	User 4	Median	IQR
FR 1	1.4	1.4	1.7	1.6	1.5	0.2	2.1	3.0	2.5	2.4	2.5	0.3
FR 2	1.4	1.8	2.7	1.9	1.9	0.4	3.1	3.1	3.1	3.0	3.1	0.0
FR 3	0.5	0.5	0.5	0.5	0.5	0.0	2.1	3.3	1.8	2.3	2.2	0.5
FR 4	0.5	0.5	0.5	0.5	0.5	0.0	2.0	2.0	3.1	2.5	2.3	0.7
FR 5	0.5	0.5	1.5	0.7	1.6	0.6	2.0	2.4	2.4	2.3	3.9	0.1
TR 1	0.5	2.5	1.5	1.6	1.6	0.6	3.9	4.2	3.9	3.8	3.8	0.8
TR 2	0.5	1.6	2.7	1.6	2.2	1.2	2.9	3.6	4.7	4.0	4.4	0.0
TR 3	1.9	1.7	4.5	2.5	2.2	0.8	4.4	4.4	4.4	4.2	3.0	0.1
TR 4	1.2	2.0	3.6	2.3	1.1	0.3	2.9	3.0	3.0	2.8	2.2	0.3
NR 1	0.5	1.1	1.5	1.0	0.8	0.7	1.4	2.2	2.3	2.1	1.6	0.2
NR 2	0.5	0.5	1.6	1.0	1.0	1.4	1.7	1.7	1.4	1.5	2.0	0.3
OR 1	0.5	0.5	3.3	1.4	1.5	0.7	1.7	2.1	2.1	1.9	3.6	0.3
OR 2	0.5	1.7	2.1	1.3	0.6	0.4	3.2	3.5	4.1	3.6	2.4	0.2



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IEEE J Transl Eng Health Med. 2023 Nov 13:12:258-267. doi: 10.1109/JTEHM.2023.3332088. eCollection 2024.

Registration Sanity Check for AR-guided Surgical Interventions: Experience From Head and Face Surgery

Sara Condino [1], Fabrizio Cutolo [1], Marina Carbone [1], Laura Cercenelli [2], Giovanni Badiali [1], Nicola Montemurro [3], Vincenzo Ferrari [1]

Ricerca finalizzata 2021, "Clinical testing of augmented reality navigation for brain tumor surgery"
Project Code GR-2021-12373198

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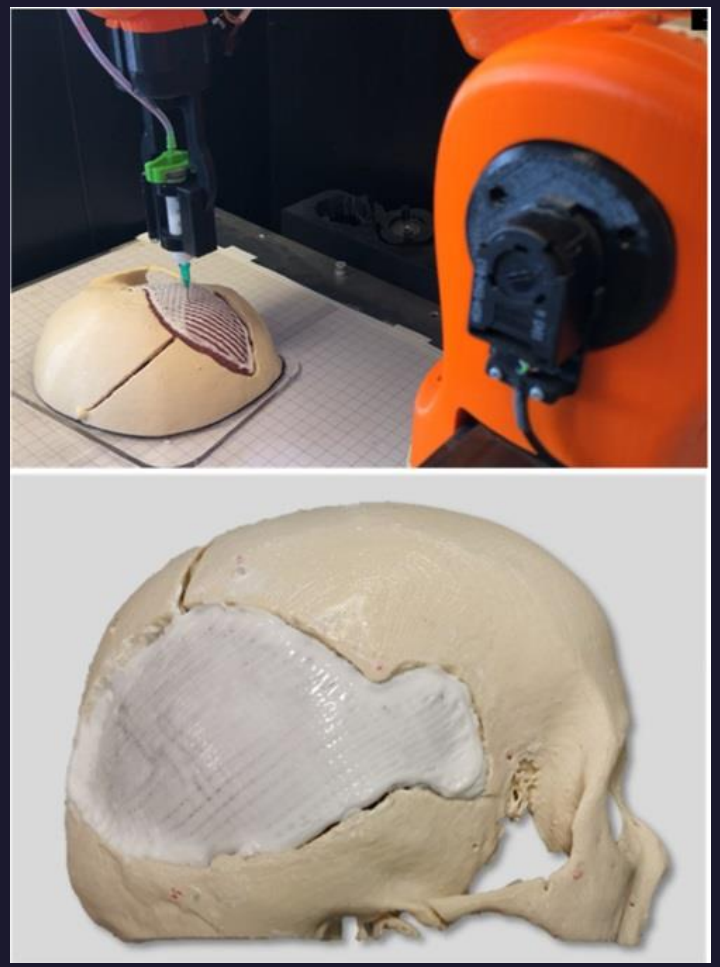
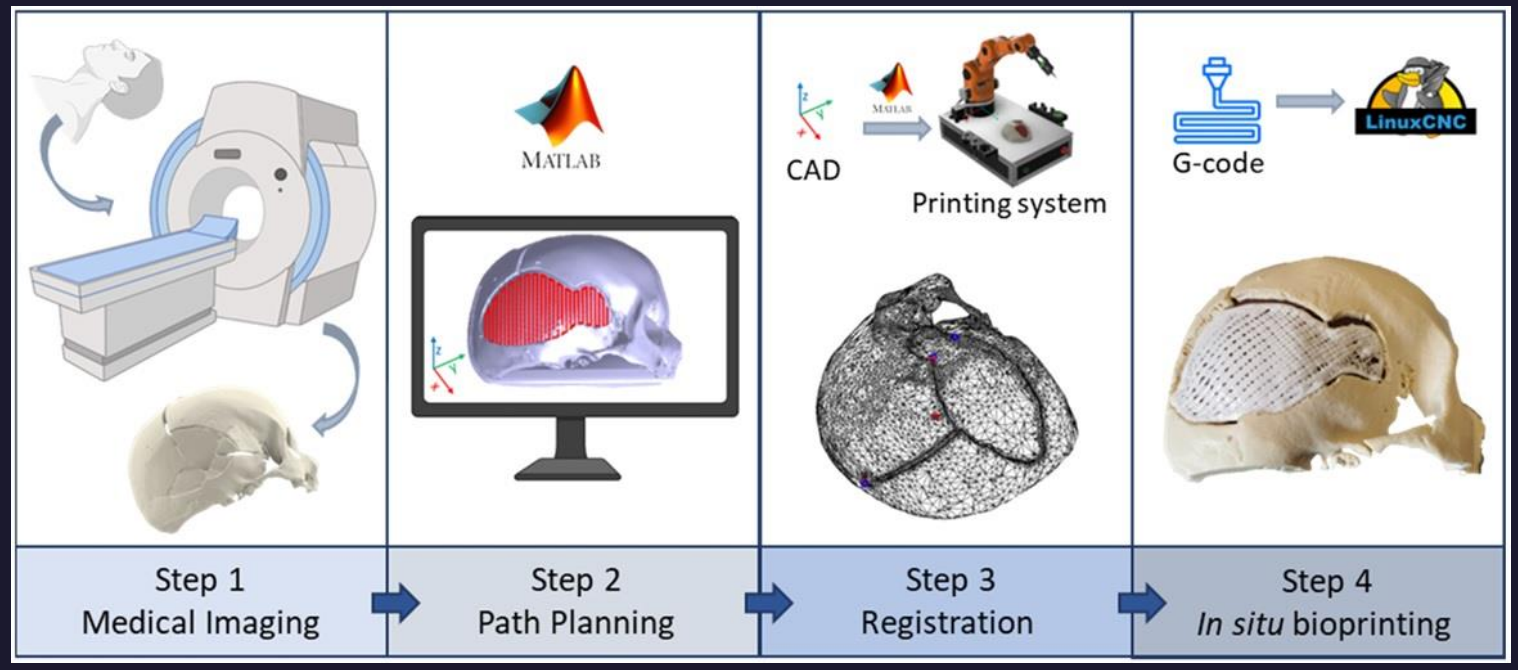
Analysis of the Robotic-Based In Situ Bioprinting Workflow for the Regeneration of Damaged Tissues through a Case Study

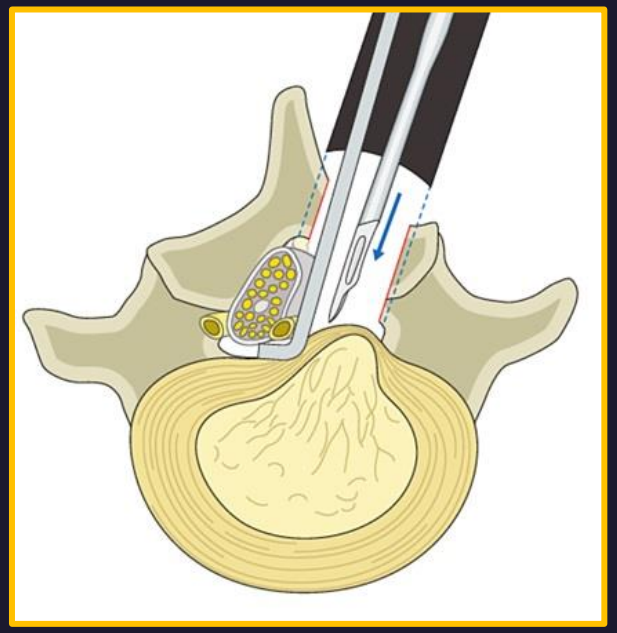
Gabriele Maria Fortunato [1 2], Sofia Sigismondi [1 2], Matteo Nicoletta [1 2], Sara Condino [1 3], Nicola Montemurro [4], Giovanni Vozzi [1 2], Vincenzo Ferrari [1 3], Carmelo De Maria [1 2]



Il processo di bioprinting in situ per fratture della volta cranica



Spine



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> J Neurol Surg A Cent Eur Neurosurg. 2024 Mar;85(2):182-191. doi: 10.1055/a-2029-2694.

Is Minimally Invasive Spinal Surgery Superior to Endoscopic Spine Surgery in Postoperative Radiologic Outcomes of Lumbar Spine Degenerative Disease? A Systematic Review

Kashyap Patel [1] [2], Mandara Muralidhar Harikar [3], Tejas Venkataram [2] [3], Vishal Chavda [4] [5], Nicola Montemurro [6], Marjan Assefi
Babak Kateb [11] [12], Kai-Uwe Lewandr

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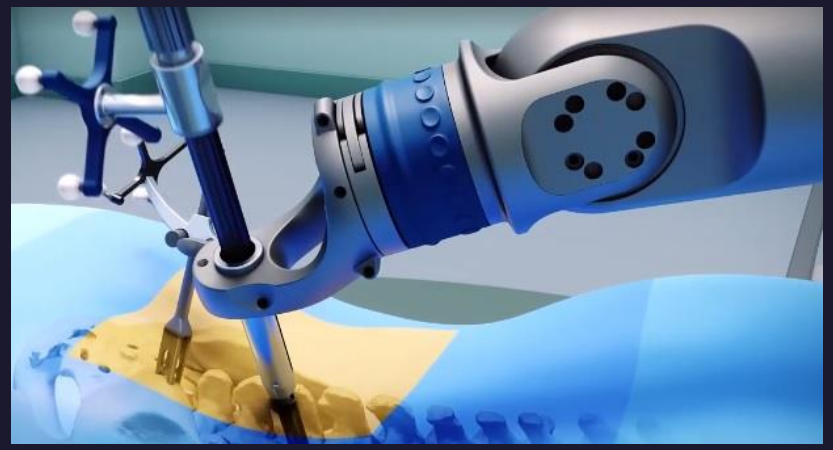
> Int J Spine Surg. 2025 Mar 6;19(1):49-56. doi: 10.14444/8698.

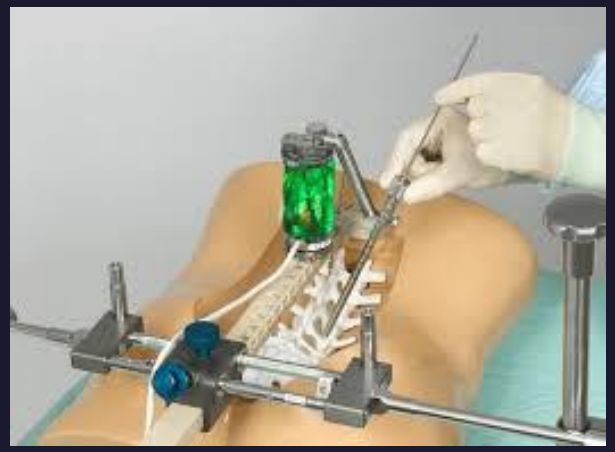
Is Transforaminal Endoscopic Discectomy the Best Option for Recurrent Lumbar Disc Herniation? A Systematic Review

Gerald Musa [1], Medetbek D Abakirov [2], Naya Arzoumi [3], Samat T Mamyrbaev [4], Rossi E Barrientos Castillo [1], Gennady E Chmutin [1], Jeff Ntalaja [5], Tshiunza Mpoyi Chérubin [5], Edinson David Berrio Perea [6], Gervit Reyes-Soto [7], Carlos Castillo-Rangel [8], Manuel De Jesus Encarnacion Ramirez [9], Nicola Montemurro [10]

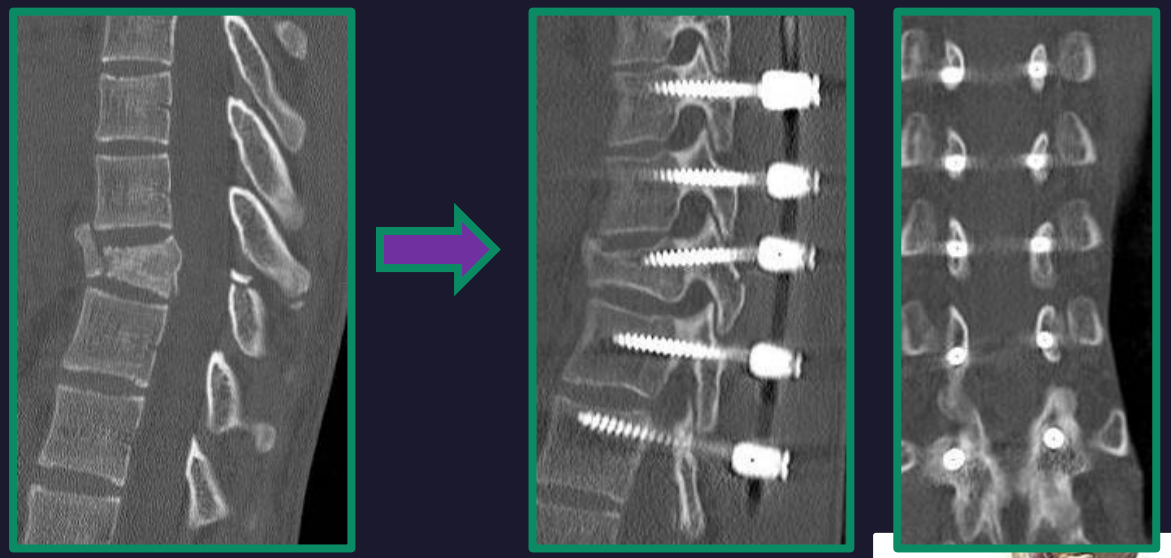
Spinal Navigation: Digitalizing Spine Surgery

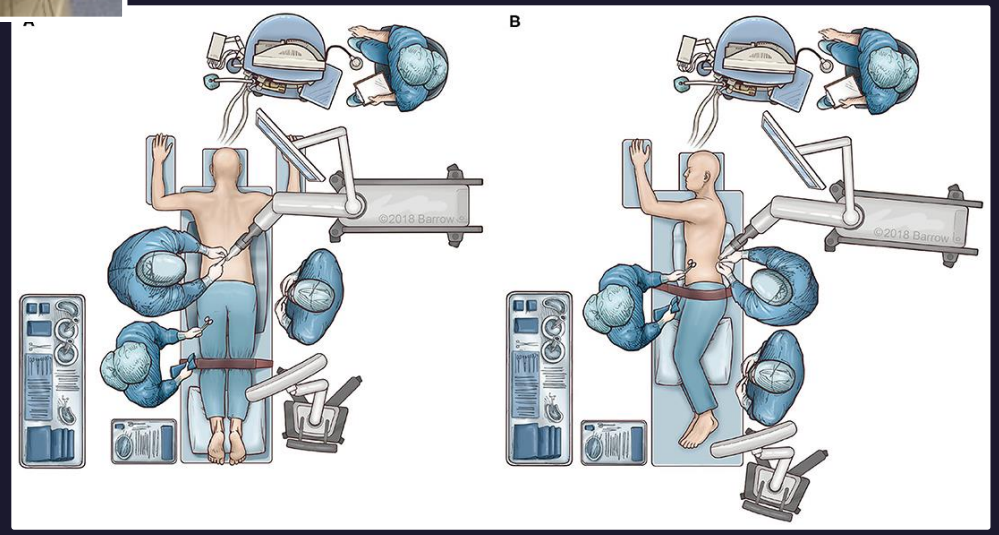
Robot in spine surgery

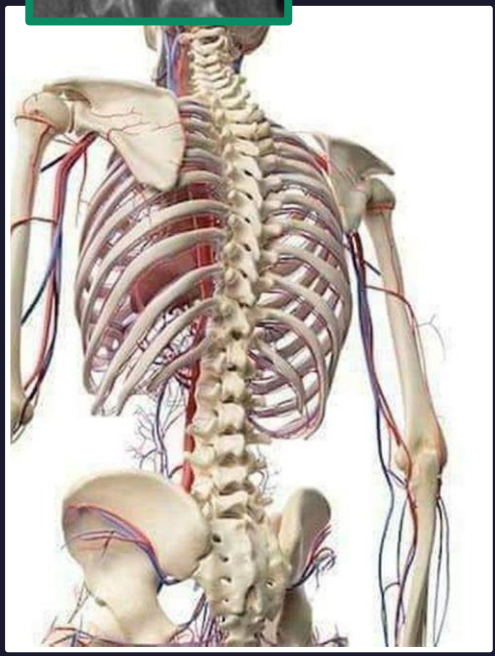




Robot in spine surgery







Looking at the future...

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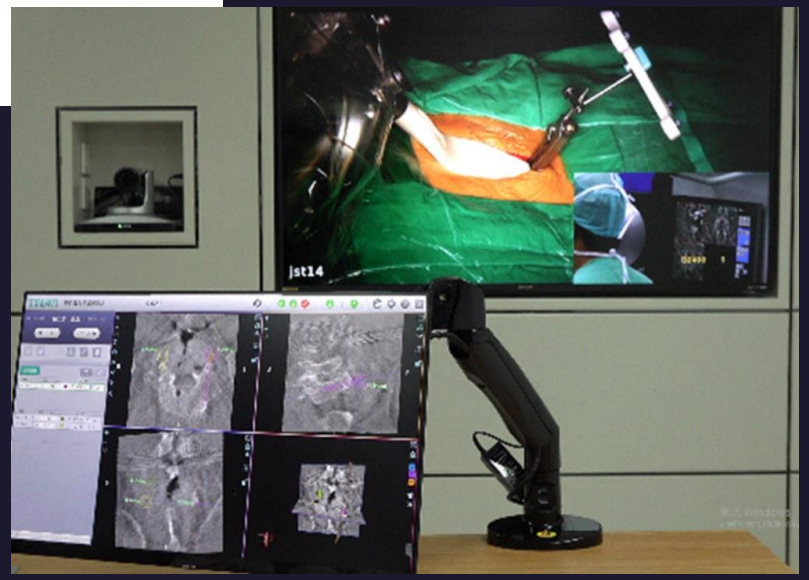
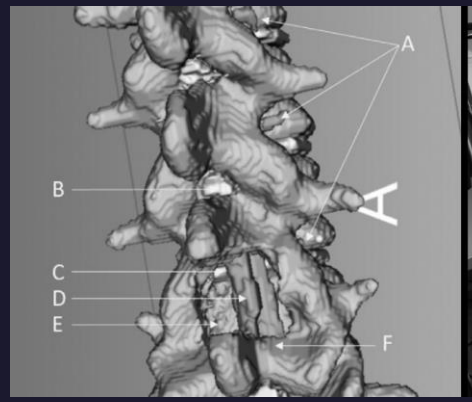
Telerobotic Spinal Surgery Based on 5G Network: The First 12 Cases

Wei Tian [1 2], Mingxing Fan [1], Cheng Zeng [1], Yajun Liu [1], Da He [1], Qi Zhang [1]





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> N Am Spine Soc J. 2021 Apr 14;6:100063. doi: 10.1016/j.xnsj.2021.100063. eCollection 2021 Jun.

Virtual reality as a learning tool in spinal anatomy and surgical techniques

T Chen [1 2], Y Zhang [3], C Ding [3], K Ting [3], S Yoon [2], H Sahak [3], A Hope [3], S McLachlin [3], E Crawford [2], M Hardisty [3], J Larouche [2], J Finkelstein [2]

Virtual reality

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Review > Int J Environ Res Public Health. 2022 Feb 2;19(3):1719. doi: 10.3390/ijerph19031719.

Virtual Reality in Neurosurgery: Beyond Neurosurgical Planning

Rakesh Mishra [1], M D Krishna Narayanan [2], Giuseppe E Umana [3], Nicola Montemurro [4], Bipin Chaurasia [5], Harsh Deora [6]

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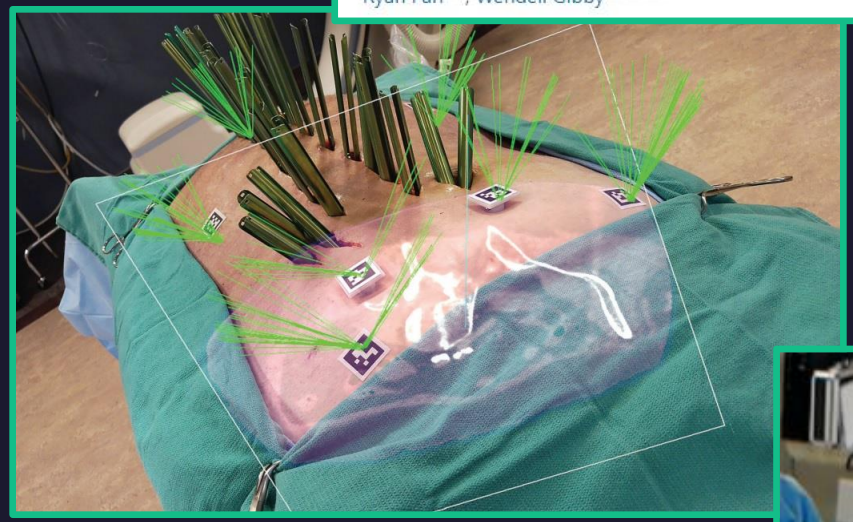
Augmented Reality Spine Surgery Navigation: Increasing Pedicle Screw Insertion Accuracy for Both Open and Minimally Invasive Spine Surgeries

Brent Felix [1], Seyed Babak Kalatar [2], Bradley Moatz [3], Christoph Hofstetter [4], Michael Karsy [5], Ryan Parr [6], Wendell Gibby [6 7 8]



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Minimally Invasive Spinal Treatment (MIST)-A New Concept in the Treatment of Spinal Diseases: A Narrative Review

Ken Ishii [1 2 3], Goichi Watanabe [4], Takashi Tomita [5], Takuya Nikaido [6], Tomohiro Hikata [7], Akira Shinohara [8], Masato Nakano [9], Takanori Saito [10], Kazuo Nakanishi [11], Tadatsugu Morimoto [12], Norihiro Isogai [1 2], Haruki Funao [1 2 3], Masato Tanaka [13], Yoshihisa Kotani [14], Takeshi Arizono [15], Masahiro Hoshino [16], Koji Sato [17]

3D printing

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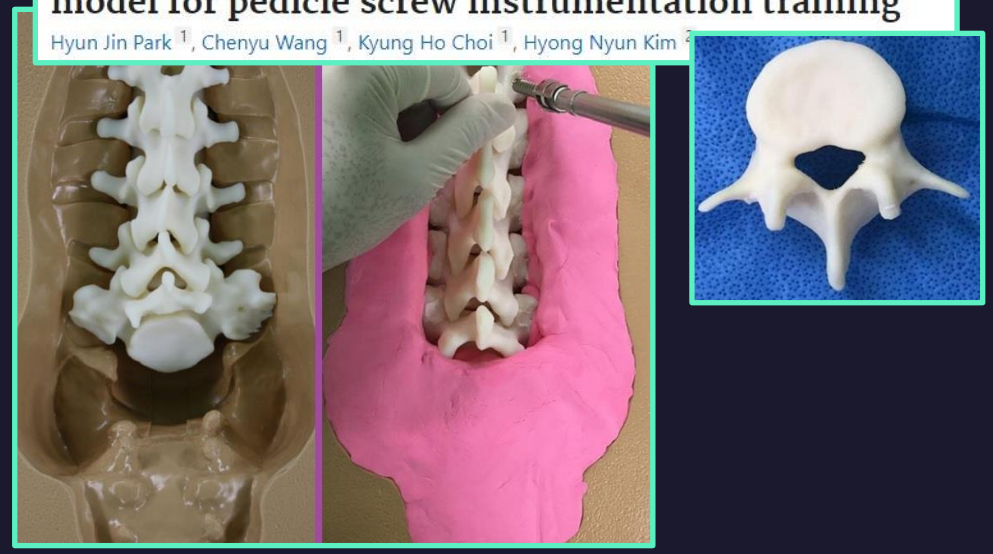
J Orthop Surg Res. 2018 Apr 16;13(1):86. doi: 10.1186/s13018-018-0788-z.

Use of a life-size three-dimensional-printed spine model for pedicle screw instrumentation training

Hyun Jin Park [1], Chenyu Wang [1], Kyung Ho Choi [1], Hyong Nyun Kim [1]



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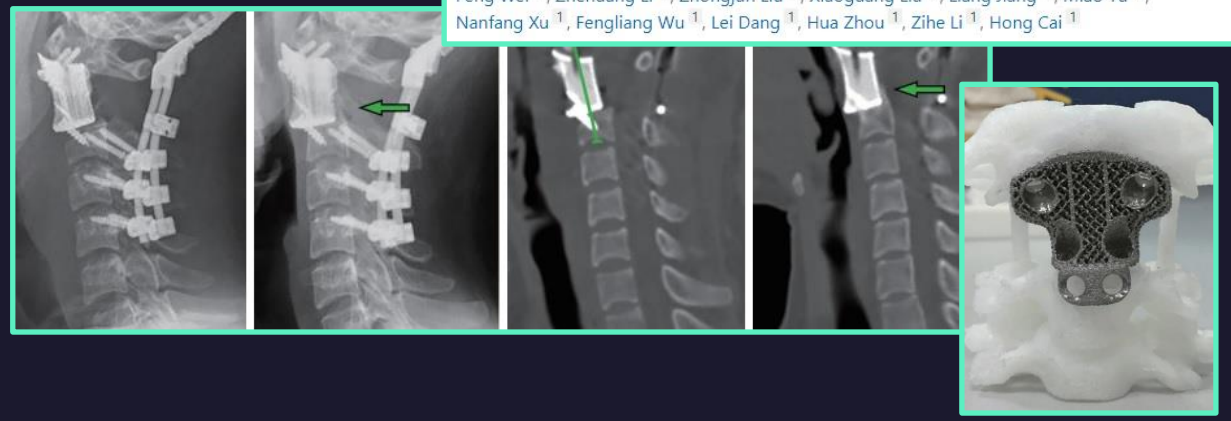
Upper cervical spine reconstruction using customized 3D-printed vertebral body in 9 patients with primary tumors involving C2

Feng Wei [1], Zhehuang Li [1], Zhongjun Liu [1], Xiaoguang Liu [1], Liang Jiang [1], Miao Yu [1], Nanfang Xu [1], Fengliang Wu [1], Lei Dang [1], Hua Zhou [1], Zihe Li [1], Hong Cai [1]



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Case Reports

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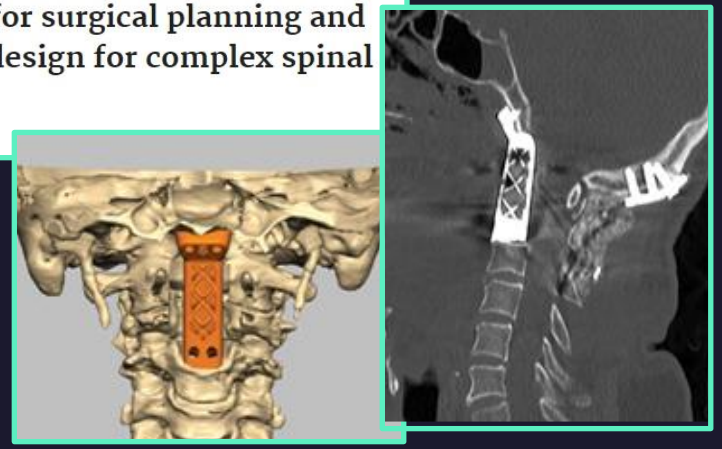
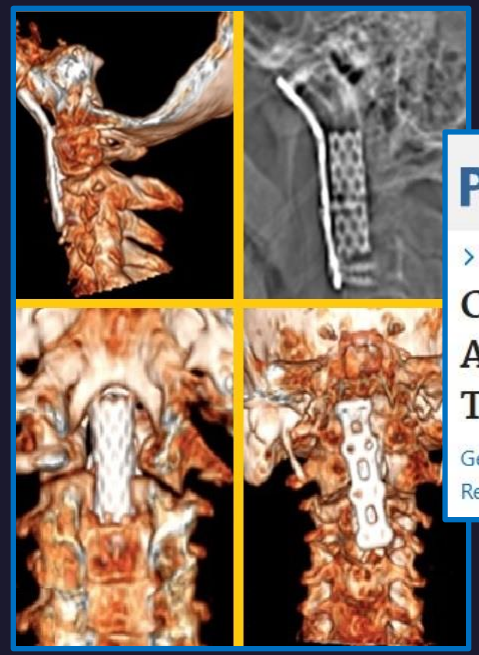
The utility of 3D printing for surgical planning and patient-specific implant design for complex spinal pathologies: case report

Ralph J. Mobbs et al.





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Brain Sci. 2024 Mar 5;14(3):254. doi: 10.3390/brainsci14030254.

Clivus-Cervical Stabilization through Transoral Approach in Patients with Craniocervical Tumor: Three Cases and Surgical Technical Note

Gervith Reyes-Soto [1], Alfonso Corona De la Torre [1], Kaori Guadalupe Honda Partida [1], Renat Nurmukhametov [2], Manuel De Jesus Encarnacion Ramirez [2], Nicola Montemurro [3]

Spinal Cord Stimulation (SCS)

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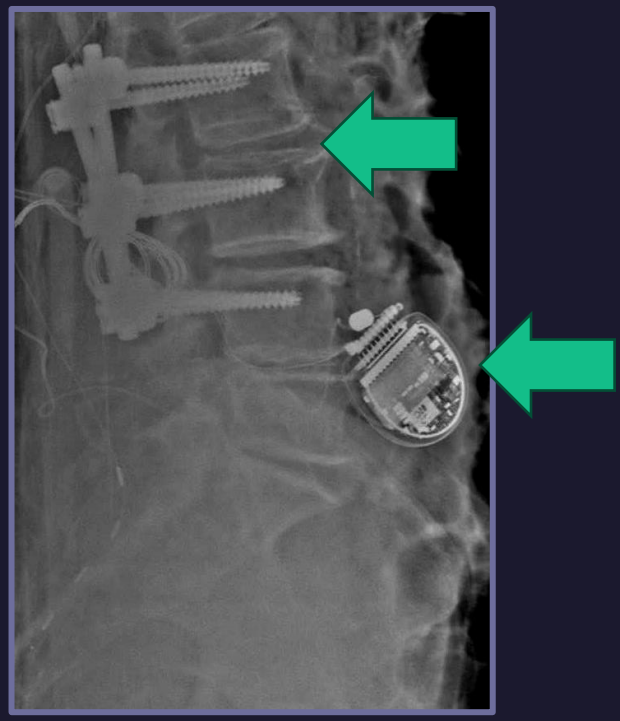
› Surg Neurol Int. 2024 Sep 27:15:348. doi: 10.25259/SNI_468_2024. eCollection 2024.

Value-based healthcare in management of chronic back pain: A multidisciplinary- and lean-based approach

Nicola Montemurro [1], Nunzio Zotti [2], Jacopo Guercini [3], Giuliano De Carolis [4], Chiara Leoni [4], Roberto Marotta [5], Renata Tomei [6], Angelo Baggiani [2], Adriana Paolicchi [4], Simone Lazzini [7], Francesca Di Serafino [2]



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