Scientific Research Publishing

Open Journal of Modern Neurosurgery, 2022, 12, 233-247
https://www.scirp.org/journal/ojmn
ISSN Online: 2163-0585
ISSN Print: 2163-0569

# Complications of Learning Curve in Supratentorial Intraventricular Region. The Concept of Fast Daily Fresh Cadaver Practice. (Technical Note for Training Method)

**Csókay András[1*], Péter Forró[1], Josvai Attila[1], Gergely Csókay[2], Jäckel Márta[1]**

[1]Hungarian Deffence Forces Medical Center, Budapest, Hungary
[2]Department of Maxillofacial Surgery, Semmelweis University, Budapest, Hungary
Email: *csokaya@gmail.com

**How to cite this paper:** András, C., Forró, P., Attila, J., Csókay, G. and Márta, J. (2022) Complications of Learning Curve in Supratentorial Intraventricular Region. The Concept of Fast Daily Fresh Cadaver Practice. (Technical Note for Training Method). *Open Journal of Modern Neurosurgery*, **12**, 233-247.
https://doi.org/10.4236/ojmn.2022.124025

**Received:** July 28, 2022
**Accepted:** October 25, 2022
**Published:** October 28, 2022

Copyright © 2022 by author(s) and Scientific Research Publishing Inc.
This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).
http://creativecommons.org/licenses/by/4.0/

Open Access

## Abstract

Background: The difficulty of learning curve in different microsurgical regions is one of the most challenging factors that affect neurosurgeon's life. Two of the delicate areas are the suprasellar intraventricular and pontocerebellar region. High level of microsurgery or endoscopic surgery requires virtuosity, which can not be learnt only by assisting. Even among the well skilled neurosurgeons who work in big centers we can often hear "in spite of centralization there are not enough operations available to keep the high level of our skills". The situation of surgeons working at mid centers is more difficult especially on duties. Methods: Huge number of scientific articles demonstrate the importance of different types of cadaver practice, but always did not pay enough attention to the daily fast fresh cadaver exercises. Focusing on lifelong every day practice we examined the difficulties of learning curve in intraventricular and pontocerebellar region and try to give some useful advice for practicing on fresh cadavers on a daily basis. We offer a simple endovascular fresh cadaver model for practicing. Results: We have performed more than 800 quick (60 - 90 minutes long) routine practice sessions in these two regions during last 18 years. We found that implantation a modelized pathology and removing it by microscopical or endoscopic way without causing injuries to sensitive structures seems to be the most practical way of fast everyday training. Nerves and vascular bypass sutures are also excellent practical method. Conclusions: We have focused on daily fast fresh cadaver practice as a novel training method like used in professional sport and art. After 18 years experience we can state that, for mastering the microsurgery of pontocerebellar and intraventricular region, which is one of the most challenging regions minimum 100 fresh cadaver practice sessions need before performing the op-

eration. We believe this region should be part of fast fresh cadaver microsurgical practice routine programme on daily bases, minimum one time/week/person.

## Keywords

Cadaver Practice, Fresh Cadaver Practice, Neurosurgical Training, Endovascular Training

## 1. Introduction

"Every surgeon carries within himself a small cemetery, where from time to time he goes to pray—a place of bitterness and regret, where he must look for an explanation for his failures." (René Leriche, *La philosophie de la chirurgie*, 1951)

Anatomical laboratories are not available in thousands of regional centers, the number of autopsy has reduced in the developed world because modern diagnostic facilities prove exact diagnosis which lead to death. The number of daily cadaver dissections has also been reduced; chance of daily training has become virtually non exsistent. In order to manage this problem introducing standard autopsy for educational purposes, it manageable in a lot of developed countries, without the consent of relatives, like in case of organ donations after brain death. During the regular autopsy, any type of fresh cadaver practice that can be performed seems to be a good solution.

It is a promising possibility, which could bring a great development in microsurgical sciences, instead of practicing on "living patients", which is covered by "PC" expression "learning curve". In reality, severe complications are hidden behind this statement. Practicing on fresh cadavers dates back to hundreds of years ago. High number of scientific articles demonstrate the importance of cadaver practice, but none of them mention how many times per week or month [1]-[18]. In professional sport or in artistic performance it is unimagineable to stay on a high professional level without daily training. High level of microsurgery or endoscopic surgery requires virtuosity, which cannot be learnt by assisting. Only even among well skilled neurosurgeons working in big centers we can often hear that "in spite of centralization there are not enough operations available to keep our skills on a high level". The situation of surgeons working at mid centers is more difficult especially on duties. Many of workshops are being organized in different centers all over the world. The workshops are really beneficial facilities to practice and to learn the nuances; however practical skills cannot be acquired without continous practice. We examined the difficulties of learning curve in case of different regions such as the supratentorial intraventricularand pontocerebellar region and try to propose some useful advice for daily fast practice on fresh cadavers. We also advise a model for practicing basic fresh cadaver neuroendovascular procedures.

## 2. Method

Authors summarized agree with experts opinion [9] possible dangers of learning curve in supratentorial intraventricular surgery (**Figure 10** and **Figure 11**) [7] [10] [17].

1) Transcallosal approach

a) Injury to superior sagittal sinus.

b) Inadvertent sacrifice of major bridgeing veins entering superior sagittal sinus.

c) Injury of anterior cerebral arteries in midline.

d) Excessive retraction of bilateral cingulate gyri.

e) Injury of the fornix, or excessive opening of the intraforniceal raphe.

f) Mechanical brain injury, from prolonged or excessive retraction.

2) Translaminaterminal approach

a) Optic apparatus injury, to optic nerve or chiasma.

b) Hypothalamic injury.

c) Pituitary gland injury.

d) Vascular injury ICA or its tributaries.

3) Trans pineal approach

Injury of venous structure (Internal cerebral vein, Rosenthal vein, vermian vein).

4) Transsphenoidal approach

Injury of endonasal structure and above mentioned (2), (3) structures.

Strategies in practice on fresh cadavers: exact exposure in fresh cadaver is very useful in itself for practising but no sufficient. Modelizing pathology and possible injury of the nerves and microvessels and repairing them without retracting the brain, seems to be the most efficient way of every day fast fresh cadaver practice.

The difficulties of learning curve in pontocerebellar region is summarized below [9]:

1) Injury to CNs V-to XI because of excessive retraction or manipulation.

2) Vascularinjury of AICA, labyrinthine artery, PICA, sigmoid sinus, superior petrosalsinus, petrosal vein.

3) Mechanical brain injury, from prolonged or excessive retraction.

To modelize the pathology and possible injury of the nerves and wessels, and repair it without retracting the brain, seemed to be the best for practicing.

Endovascular procedures also can be modellized on fresh cadaver brain which were taken out from the skull as regular autopsy declare. To check the movements of driven catheter on the screen by camera placed above the modelized situation gives similar to the living situation in endovascular OR.

## 3. Results

We found that the following procedure to be the most efficient: Implant (**Figures 1-9**) a modellized pathology from transcallosal, translamina terminalis or transpineal direction, made by autolog organ (liver) and pieces of sponge, and

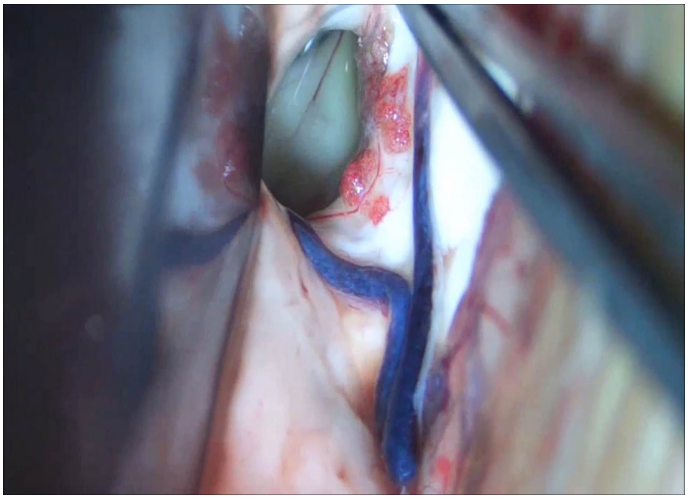

**Figure 1.** Transcallosal approach for modeling.

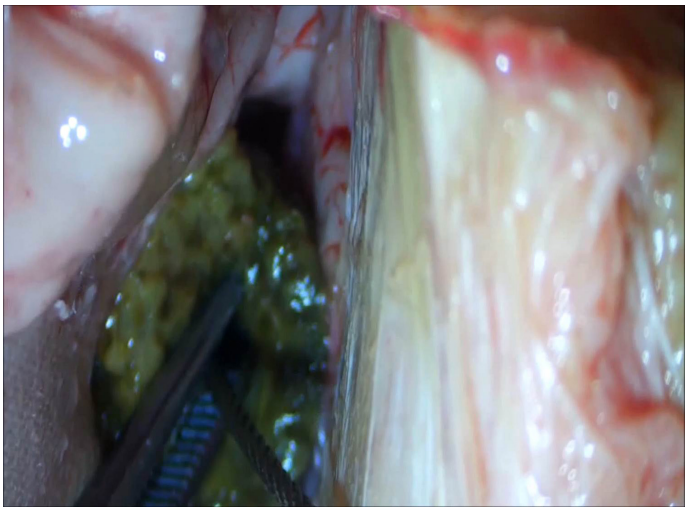

**Figure 2.** Transcallosal implantation of modeled tumor with the help of guide wire, made by piece of autolog liver and sponge.

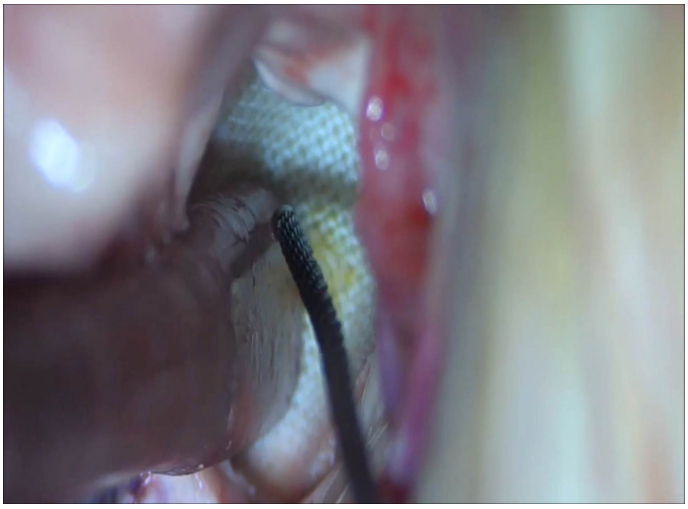

**Figure 3.** Guide wire under removing.

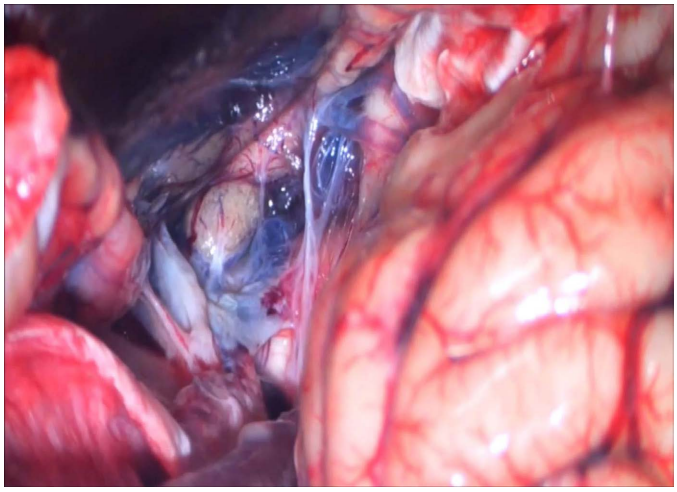

**Figure 4.** Infratentorial supracerebellar transpineal approach for modeling.

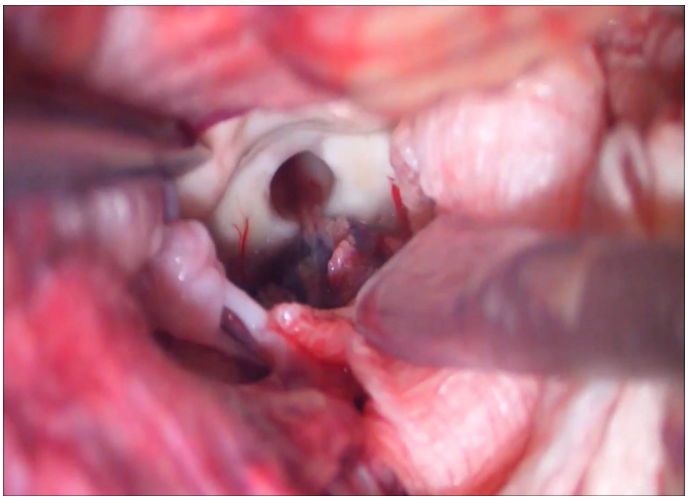

**Figure 5.** Transpineal transventricular approach for modeling.

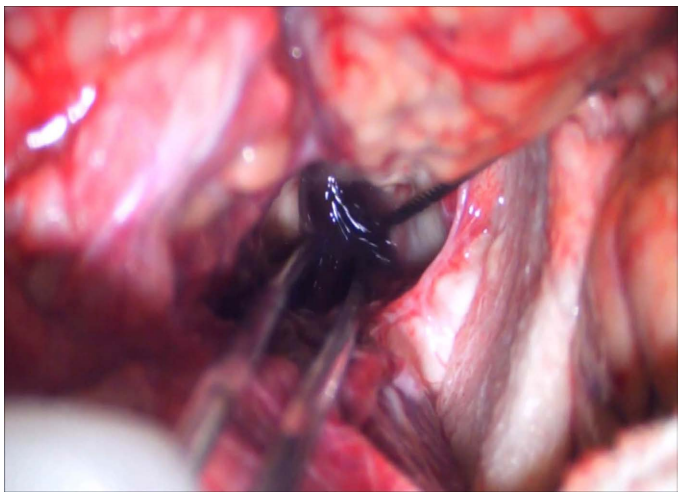

**Figure 6.** Transpineal transventricular approach for implantation with the help of guide wire a piece of autolog liver and cottonoid.

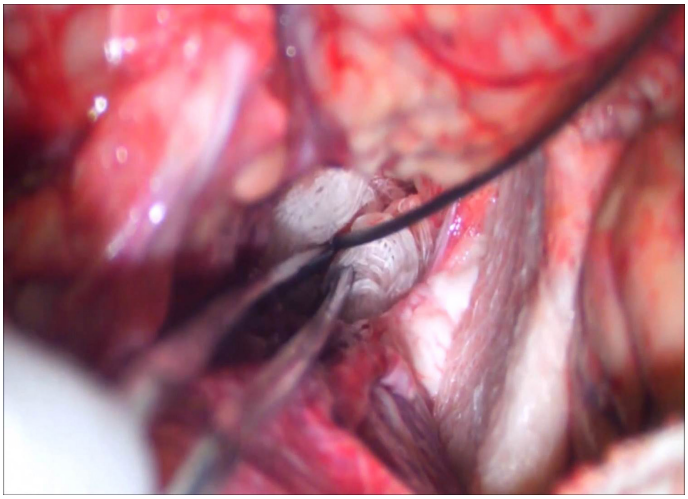

**Figure 7.** The modelized tumor fixed by gauze.

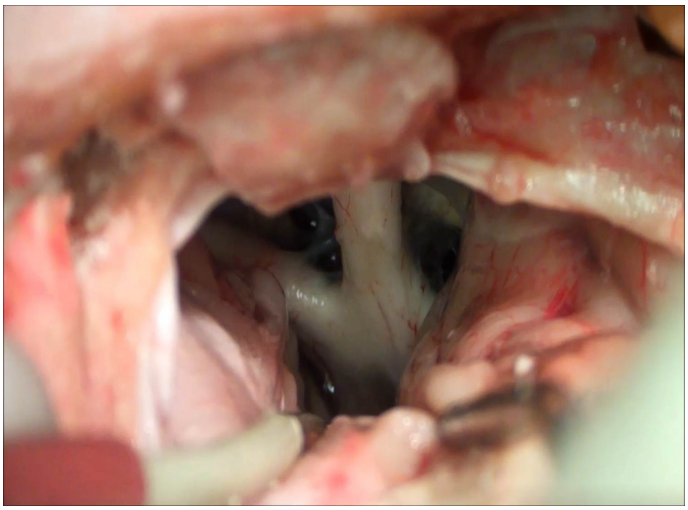

**Figure 8.** Frontolateral approach. Optic chiasma is visible.

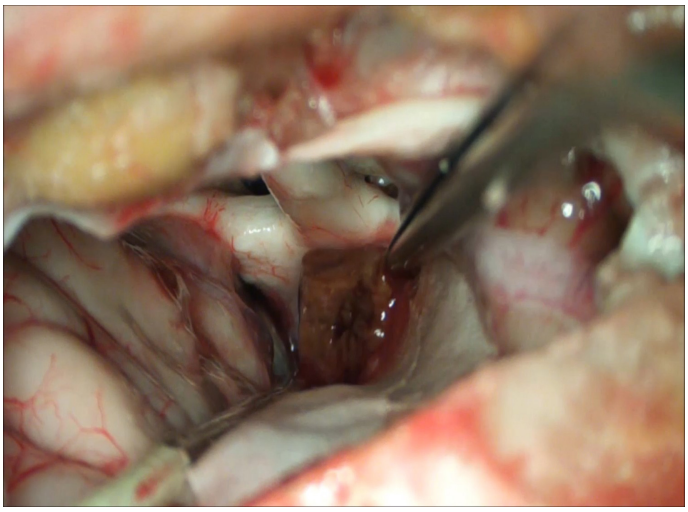

**Figure 9.** Translaminaterminalis approach. Remove the modelized tumor by piecemeal resection.

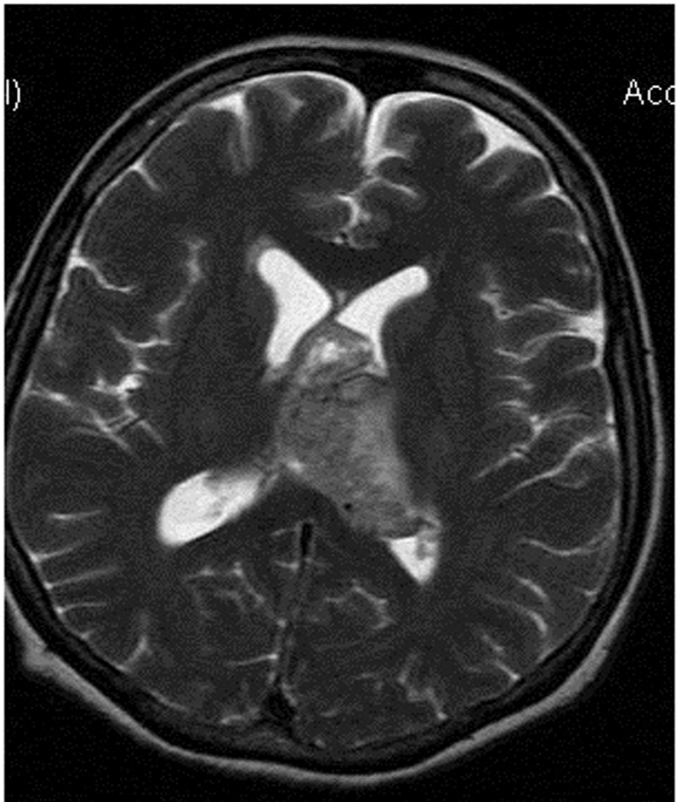

**Figure 10.** Case 1. Acute neurological progression. Intraventricular tumor. Preop MRI.

**Figure 11.** Case 1. Post op CT. Difficulties of learning curve. Fatal outcome after tumor removal. Patient died on 8th postop day. Possible cause of vascular injury (thalamostriate vein, small arteries) or mechanical manipulation led to death.

glue, and removing it by microscopic or endoscopic way by the same or another neurosurgeon, who is not familiar with the case. Removal of modeled pathology in suprasellar or intraventricular region occurs from another direction without causing injuries of sensitive, above mentioned structures. Finally, before ending the practice session, we can cause a direct vascular injury on adeep vein or an artery and to practice microsuturing it [1] [6] [8] [18]. After more than 600 fresh cadaver practice in pc. region, the best method seems to lenghten the trigeminal nerve and VII-VIII nerve complex by grafting a piece of oculomotor or sural nerve by one neurosurgeons and modellize by fluid stick and sponge a pc angle huge tumor which makes the bed for the nerves and wessels in different part (**Figures 12-17**). It gives very good way for practicing. There is also an important step. For the second participant who didn't participate in modeling procedure until now, it is unknown, how the modelized situation was created. He need to remove the modellized pathology without touching the cerebellum and injuring the nerves and wessels.

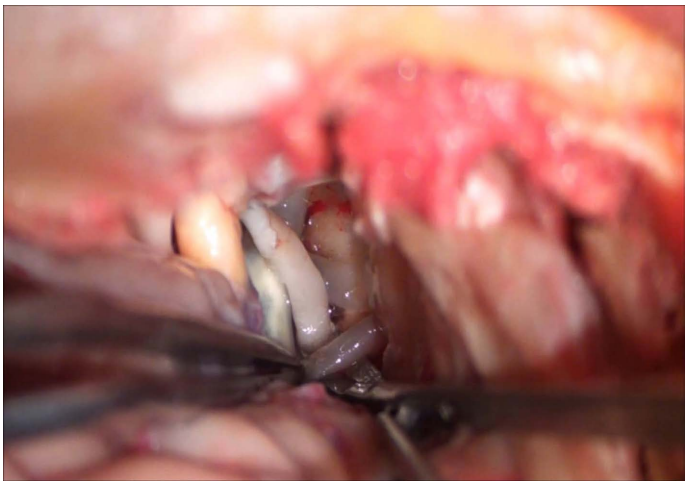

**Figure 12.** Right supercilliar approach. Removal of 2 cm long piece of n.III.

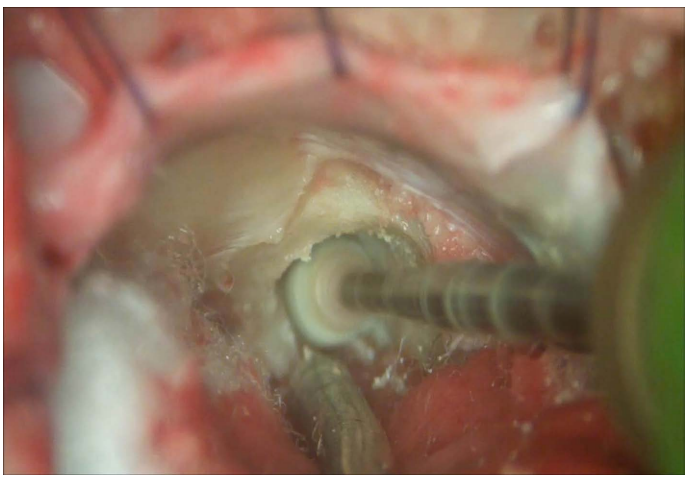

**Figure 13.** Drilling the meatus.

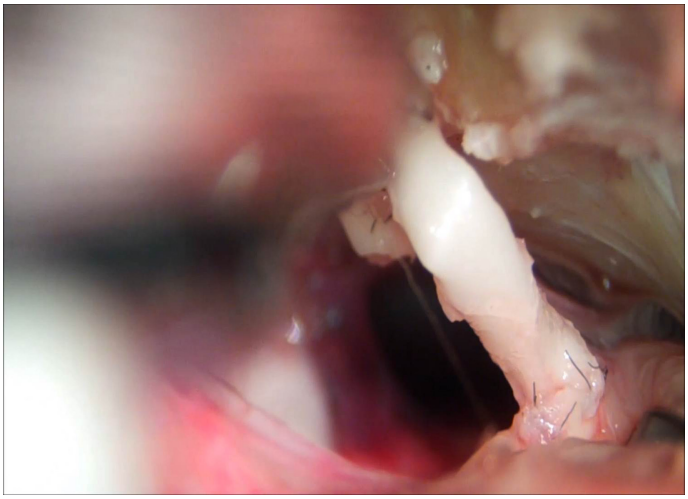

**Figure 14.** N.VII. grafting lenghtened N.VII.

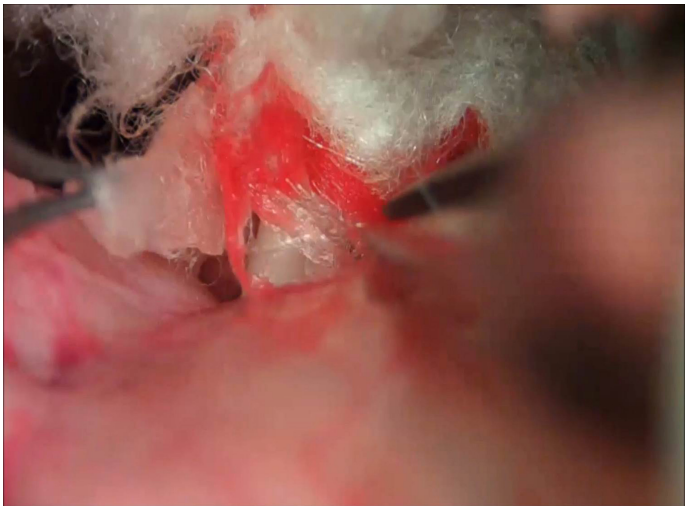

**Figure 15.** PC tumor modelling made by glu and sponge, wrapping the nerve complex VII-VIII.

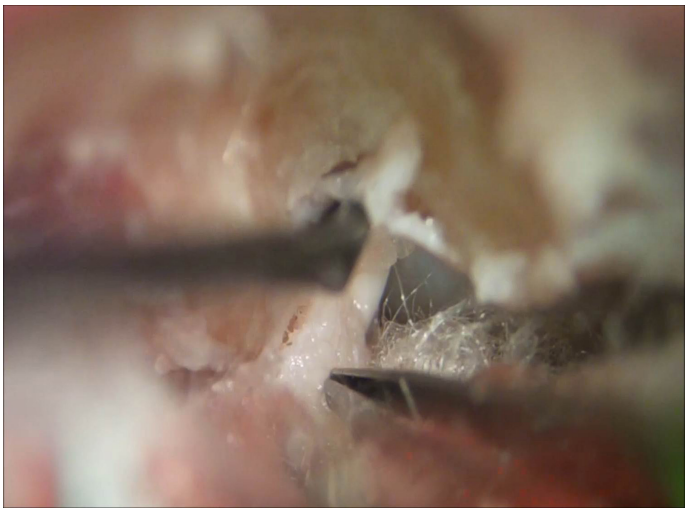

**Figure 16.** Preparation the nerve VII by oneother neurosurgeon.

At the end to make a direct injury on AICA or PICA and suture it.

Considering the endovascular practice we experienced as the most practical advantages to sense the wall of the smal artery and especially the thin wall of the veins (Figures 18-20).

The fast fresh cadaver exercise on daily base not need to last more than 1 hour.

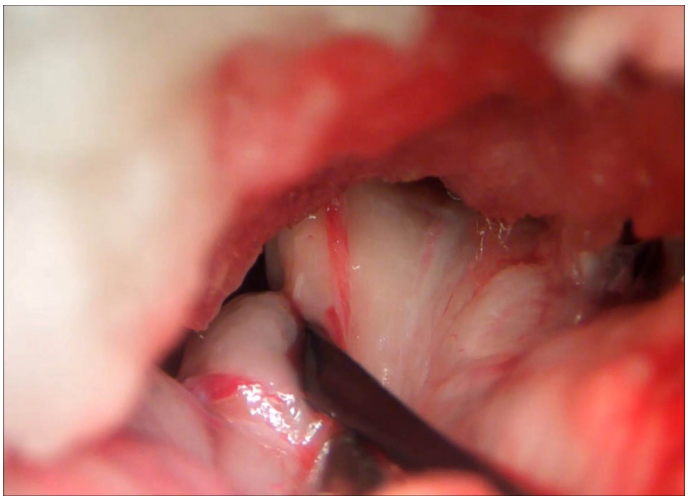

**Figure 17.** Removal of the modelling tumor preserving the nerves.

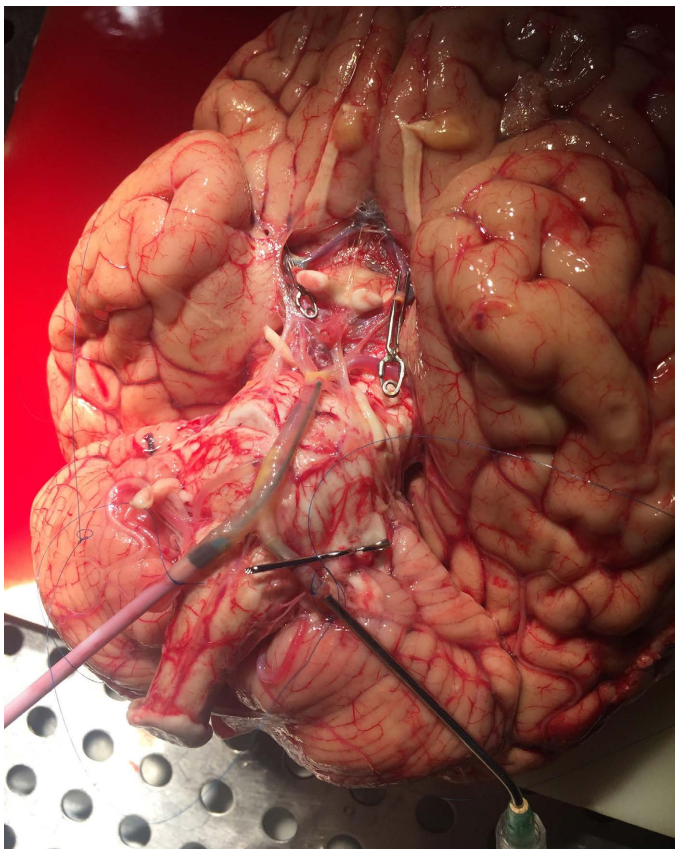

**Figure 18.** Endovascular fresh cadaver model.

**Figure 19.** Endovascular practicing checking by camera connected with a screen.

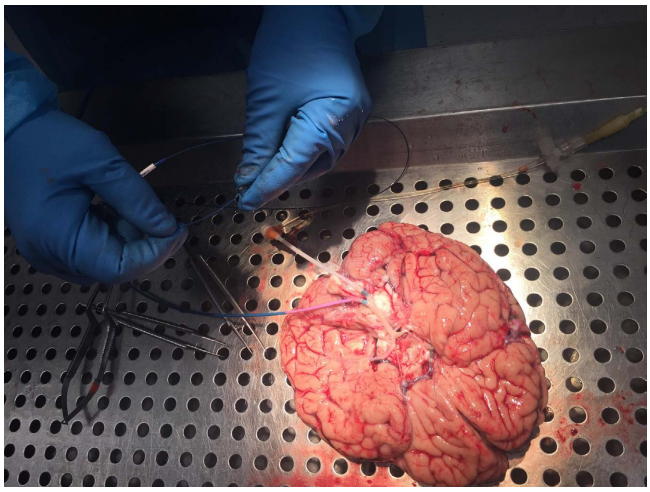

**Figure 20.** Daily neuroenscularis practicing to drive catheter into small branches. To sense the baloon inflation also important practice.

## 4. Conclusion

After 18 years of experience performing not more than 500 very difficult microsurgical, endoscopic (which is relatively not a high number) live operation in different region and more than 3000 fresh cadaver exercsises (first author experience), (**Figure 21** and **Figure 22**) modelizing several very difficult neurosurgical operative situations, we can state, the supratentorial intraventricularand pontocerebellar angle region which are the most challenging regions needs should be part of the daily fast fresh cadaver microsurgical practice routine one


**Figure 21.** Case 2. Acute neurological progression. Intraventricular huge meningeoma.


**Figure 22.** Case 2. Postop. CT. Total evacuation of tumor (daily inductive fresh cadaver practice useful) Fast recovery.

time/week/person. The main advantage of this concept not only obtaining professional anatomical practical knowledge, but practicing daily within "almost" life like situations, because of continous venous bleeding in fresh cadavers, and modeled pathology implantations as well. To organize practice sessions is relatively simple, not costly and available in any regional hospital where the pathology department and autopsy is accessible. The previously described training model provides an excellent possibility to not only reduce the number of complications of learning curve [5] [8], but to improve the practice of well skilled neurosurgeons as well [9] [10] [12]. In the course of 60 - 80 minutes long daily training sessions the microsurgical skills can be improved more than we had expected. The concept is to challenge ourselves to stay consistent in lifelong for daily training as in sport or in artistic performance. Last two years we introduced the endovascular practicing on fresh cadavers. We continue further practical nuanches in this field.

## Acknowledgements

We apply the contemplative Jesus prayers in the course of fresh cadaver practicing and living operations as the one of the most important sources of neurosurgical innovations. It is personal experience of first author.

Special thanks to Papp Sándor Balázs for the medical illustrations and Pejkó József assistant of the Department of Pathology.

## Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional Hungarian Defence Forces Medical Center and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

For this type of study formal consent is not required.

This article does not contain any studies with human participants performed by any of the authors.

## Conflicts of Interest

All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

## References

[1] Aboud, E., Al-Mefty, O. and Yaşargil, M.G. (2002) New Laboratory Model for Neurosurgical Training That Simulates Live Surgery. *Journal of Neurosurgery*, **97**, 1367-

1372. https://doi.org/10.3171/jns.2002.97.6.1367

[2] Carey, J.N., Minneti, M., Leland, H.A., Demetriades, D. and Talving, P. (2015) Perfused Fresh Cadavers: Method for Application to Surgical Simulation. *The American Journal of Surgery*, **210**, 179-187. https://doi.org/10.1016/j.amjsurg.2014.10.027

[3] Coelho, G., Warf, B., Lyra, M. and Zanon, N. (2014) Anatomical Pediatric Model for Craniosynostosis Surgical Training. *Child's Nervous System*, **30**, 2009-2014. https://doi.org/10.1007/s00381-014-2537-x

[4] Csókay, A., Papp, A., Imreh, D., Czabajszky, M., Valálik, I. and Antalfi, B. (2013) Modelling Pathology from Autolog Fresh Cadaver Organs as a Novel Concept in Neurosurgical Training. *Acta Neurochirurgica*, **155**, 1993-1995. https://doi.org/10.1007/s00701-013-1727-8

[5] Craven, C., Baxter, D., Cooke, M., Carline, L., Samuel, J.M., Alberti, M., Beard, J. and Murphy, M. (2014) Development of a Modelled Anatomical Replica for Training Young Neurosurgeons. *British Journal of Neurosurgery*, **28**, 707-712. https://doi.org/10.3109/02688697.2014.913775

[6] Delpech, P.O., Danion, J., Oriot, D., Richer, J.P., Breque, C. and Faure, J.P. (2017) SimLife a New Model of Simulation Using a Pulsated Revascularized and Reventilated Cadaver for Surgical Education. *Journal of Visceral Surgery*, **154**, 15-20. https://doi.org/10.1016/j.jviscsurg.2016.06.006

[7] Espinoza, D.L., Carranza, V.G., Chico-Ponce de León, F. and Martinez, A.M. (2015) PsT1: A Low-Cost Optical Simulator for Psychomotor Skills Training in Neuroendoscopy. *World Neurosurgery*, **83**, 1074-1079. https://doi.org/10.1016/j.wneu.2014.12.022

[8] Faure, P., Breque, C., Danion, J., Delpech, P.O., Oriot, D. and Richer, J.P. (2017) SIM Life: A New Surgical Simulation Device Using a Human Perfused Cadaver. *Surgical and Radiologic Anatomy*, **39**, 211-217. https://doi.org/10.1007/s00276-016-1715-9

[9] Greenberg, M. (2020) Handbook of Neurosurgery. Thieme Medical Publishers, Leipzig. https://doi.org/10.1055/b-006-161147

[10] Hicdonmez, M., Hamamcioglu, K., Parsak, T., Cukur, Z. and Cobanoglu, S. (2006) A Laboratory Training Model for Interhemispheric-Transcallosal Approach to the Lateral Ventricle. *Neurosurgical Review*, **29**, 159-162. https://doi.org/10.1007/s10143-005-0014-4

[11] Moon, K., Filis, A.K. and Cohen, A.R. (2010) The Birth and Evolution of Neuroscience through Cadaveric Dissection. *Neurosurgery*, **67**, 799-810. https://doi.org/10.1227/01.NEU.0000383135.92953.A3

[12] Olabe, J. (2009) Microsurgical Training on an *in Vitro* Chicken Wing Infusion Model. *Surgical Neurology*, **72**, 695-699. https://doi.org/10.1016/j.surneu.2008.12.008

[13] Meredith, M.A., *et al.* (2019) Cadaver Rounds: A Comprehensive Exercise That Integrates Clinical Context into Medical Gross Anatomy. *Academic Medicine*, **94**, 828-832.

[14] Rehder, R., Abd-El-Barr, M., Hooten, K., Weinstock, P., Madsen, J. and Cohen, A.R. (2016) The Role of Simulation in Neurosurgery. *Child's Nervous System*, **32**, 43-54. https://doi.org/10.1007/s00381-015-2923-z

[15] Scholz, M., Mücke, T., Hölzle, F., Schmieder, K., Engelhardt, M., Pechlivanis, I. and Harders, A.G. (2006) A Program of Microsurgical Training for Young Medical Students: Are Younger Students Better? *Microsurgery*, **26**, 450-455. https://doi.org/10.1002/micr.20269

[16] Doormaal, T.P., Zwan, A., Aboud, E., van der Sprenkel, J.W.B., Tulleken, C.A.F., Krisht, A.F. and Regli, L. (2010) The Sutureless Excimer Laser Assisted Non-Occlusive Anastomosis (SELANA); a Feasibility Study in a Pressurized Cadaver Model. *Acta Neurochirurgica*, **152**, 1603-1609. https://doi.org/10.1007/s00701-010-0717-3

[17] Tubbs, R.S., Loukas, M., Shoja, M., Wellons, J.C. and Cohen-Gadol, A.A. (2009) Feasibility of Ventricular Expansion Postmortem: A Novel Laboratory Model for Neurosurgical Training That Simulates Intraventricular Endoscopic Surgery. *Journal of Neurosurgery*, **111**, 1165-1167. https://doi.org/10.3171/2009.3.JNS081653

[18] Zada, G., Bakhsheshian, J., Pham, M., Minneti, M., Christian, E., Winer, J., Robison, A., Wrobel, B., Russin, J., Mack, W. and Giannotta, S. (2018) Development of a Perfusion-Based Cadaveric Simulation Model Integrated into Neurosurgical Training: Feasibility Based on Reconstitution of Vascular and Cerebrospinal Fluid Systems. *Operative Neurosurgery*, **14**, 72-80. https://doi.org/10.1093/ons/opx074