Cadaveric Anatomical Dissection Study

see also Neurosurgical Training Laboratory

A **cadaveric anatomical dissection study** is a type of **descriptive, observational research** conducted on preserved human cadavers to explore and document **anatomical structures, relationships, and surgical access routes**.

🧠 Definition

> A cadaveric anatomical dissection study involves **systematic dissection** of donated human bodies to provide detailed insights into **normal** or **surgically relevant** anatomy. It is often used to test new surgical approaches, validate anatomical knowledge, or train surgeons in a controlled environment.

🔬 Key Characteristics

- Non-clinical, no living subjects.
- Typically uses embalmed or latex-injected cadavers.
- Employs surgical tools, microscopes, and/or endoscopes.
- Often conducted in **anatomy labs** or **surgical simulation centers**.

Importance

Cadaveric dissection has been an essential component of medical education for centuries, and it remains an important tool for understanding the complex anatomy of the human body. Through dissection, medical students and healthcare professionals can learn about the structures, organs, and systems of the body, as well as how they are interconnected and function together.

Cadaveric dissection also plays an important role in medical research, as it allows researchers to investigate disease processes, develop new surgical techniques, and test medical devices and treatments. However, the use of human cadavers in medical education and research is a sensitive topic, and there are ethical and legal guidelines that must be followed to ensure that these bodies are treated with respect and dignity.

Microsurgical dissection of human cadaveric specimens is the optimal way to learn and train on neuroanatomy and neurosurgical procedures before performing them safely in the operating room. Fava et al. provided a “neurosurgery booklet” with progressive milestones for neurosurgical residents. This step-by-step program may improve the quality of training and guarantee equal skill acquisition across countries. They believe that more efforts should be made to create new microsurgical laboratories, popularize the importance of body donation, and establish a network between universities and laboratories to introduce a compulsory operative training program [1)]

Adequate training based on cadaveric dissection is essential to acquire a practical knowledge of surgical anatomy and microsurgical/endoscopic dissection techniques. Endoscopic procedures for the treatment of pathologies of the skull base are becoming increasingly common. The endoscopic training curve for tool handling and detailed knowledge of the topographic anatomy of the skull base requires intensive training on cadavers before approaching living patients, which is why cadaver laboratory experience should be mandatory for every resident and surgeon preparing to use microsurgical and endoscopic techniques.

Tschabitscher and Di Ieva describe the basic principles of the philosophy of anatomic dissection and the equipment necessary to set up an endoscopic cadaver laboratory [2)].

With the advent of pedicle screws and advanced instrumentation techniques, internal fixation and stabilization of upper cervical vertebrae are possible in fractures of an axis. However, the proximity of vertebral arteries (VAs) poses a unique challenge to surgeons during these procedures and can result in profound physical impairment to patients. Cadaveric studies contributing to fine anatomical details necessitate conducting such studies [3)]

Prospective educational intervention studies

While cadaveric dissections remain the cornerstone of education in skull base surgery, they are associated with high costs, difficulty acquiring specimens, and a lack of pathology in anatomical samples. This study evaluated the impact of a hand-crafted three-dimensional (3D)-printed head model and virtual reality (VR) in enhancing skull base surgery training.

Research question: How effective are 3D-printed models and VR in enhancing training in skull base surgery?

Materials and methods: A two-day skull base training course was conducted with 12 neurosurgical trainees and 11 faculty members. The course used a 3D-printed head model, VR simulations, and cadaveric dissections. The 3D model included four tumors and was manually assembled to replicate tumor-modified neuroanatomy. Trainees performed surgical approaches, with pre- and post-course self-assessments to evaluate their knowledge and skills. Faculty provided feedback on the model's educational value and accuracy. All items were rated on a 5-point scale.

Results: Trainees showed significant improvement in understanding spatial relationships and surgical steps, with scores increasing from 3.40 ± 0.70 to 4.50 ± 0.53 for both items. Faculty rated the educational value of the model with a score of 4.33 ± 0.82, and a score of 5.00 ± 0.00 for recommending the 3D-printed model to other residents. However, realism in soft tissue simulations received lower ratings.

Discussion and conclusion: Virtual reality and 3D-printed models enhance anatomical understanding and surgical training in skull base surgery. These tools offer a cost-effective, realistic, and accessible alternative to cadaveric training, though further refinement in soft tissue realism is needed [4)]

A growing body of literature describing use of high-fidelity surgical training models is challenging long-held dogma that cadavers provide the best medium for postgraduate surgical skills training.

A neurosurgical skills course for residents was structured to include 7 spinal and 3 cranial learning stations, each with its own model and assigned attending expert. Resident and attending neurosurgeons were asked to complete surveys on their overall impressions of the course and models, and on workload comparisons between models and real cases. Student t-tests were used for statistical comparisons.

Survey responses were collected from 9 of 16 participating residents (56.3%) and 3 of 10 attending neurosurgeons (30.0%). Both groups believed the course was very helpful overall to resident education. Respondents furthermore felt the course was more helpful overall than cadaveric courses. Task load index testing revealed no significant workload difference between models and real cases ($P \geq 0.17$), except in temporal demand ($P < 0.001$).

Resident and attending neurosurgeons subjectively feel that high-fidelity synthetic models were superior to cadavers as a surgical skills teaching platform. This study raises the question of whether cadavers should remain the gold standard for surgical skills courses. Expanded use of these teaching models and further study are warranted [5].

Cadaveric head preparation is very important prior to dissection. The desired properties are: Good long-term structural preservation with minimal distortion, no desiccation, no bacterial or fungal growth, and minimal environmental chemical hazards [6].

The embalming fluid mixture used to preserve the cadaver is an important factor in achieving both good dissection properties, and long term preservation. Formaldehyde has been the main component in embalming fluids since the late 19th century due to its excellent preservation properties, low cost, and ready availability [7]

see http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3775188/

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Endoscopic procedures

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