



Operating Room Setup and Workflow

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The organization of the operating room has undergone a dramatic evolution since the early history of our discipline.



Figure 1: The young Harvey Cushing and his operating room at Johns Hopkins, circa ~1908 (upper image). At the peak of his career, in August 1929,

Cushing performed an operation for visiting Professor I.P. Pavlov (lower image)(photos courtesy of the Cushing Brain Tumor Registry at Yale University).

The surgeon is “the captain of the ship” and responsible for all the actions of the individuals and the workflow in the operating room. This responsibility demands a leader who leads by example. **The factor that distinguishes great from average surgeons is the ability of the former to succeed in the face of adversity, technical difficulty, or crisis while unifying the team to secure an excellent outcome.**

Effective planning to deal with unexpected events and disaster is the centerpiece of a successful operative strategy. Anticipation of technical difficulty and cogent preparation is the first step. The surgeon’s decision-making process must be flexible so that alternative options to handling the pathology based on momentous intraoperative findings can be accommodated if the initial plan is deemed unfit. ***The pathology, rather than the surgeon, must dictate the plan.*** Forcing the operator’s agenda without pursuit of flexible alternative strategies often leads to disappointing results.

The surgeon needs to periodically step back and investigate the flow of the operation and the expected versus anticipated findings. Surgery under high magnification can also “magnify my errors” and I often step back so that I do not to “miss the forest for the trees.”

Surgical intuition should not be dismissed, but scrutinized. **Surgical intelligence is difficult to define, but it is the ability to monitor one's own operative maneuvers, to discriminate**

between different operative strategies for efficient handling of the lesion, and to use important intraoperative findings to guide the overall plan.

Operating Room Setup

It is an integral responsibility of the operator to be intimately familiar with the nuances of the operating room arrangement and organization. An efficient use of the space is important for practical workflow.



Figure 2: A modern operating room setup must accommodate the location and arrangement of its components in relation to the patient. These components include the operating and anesthesia teams, the ancillary staff, and a variety of equipment.

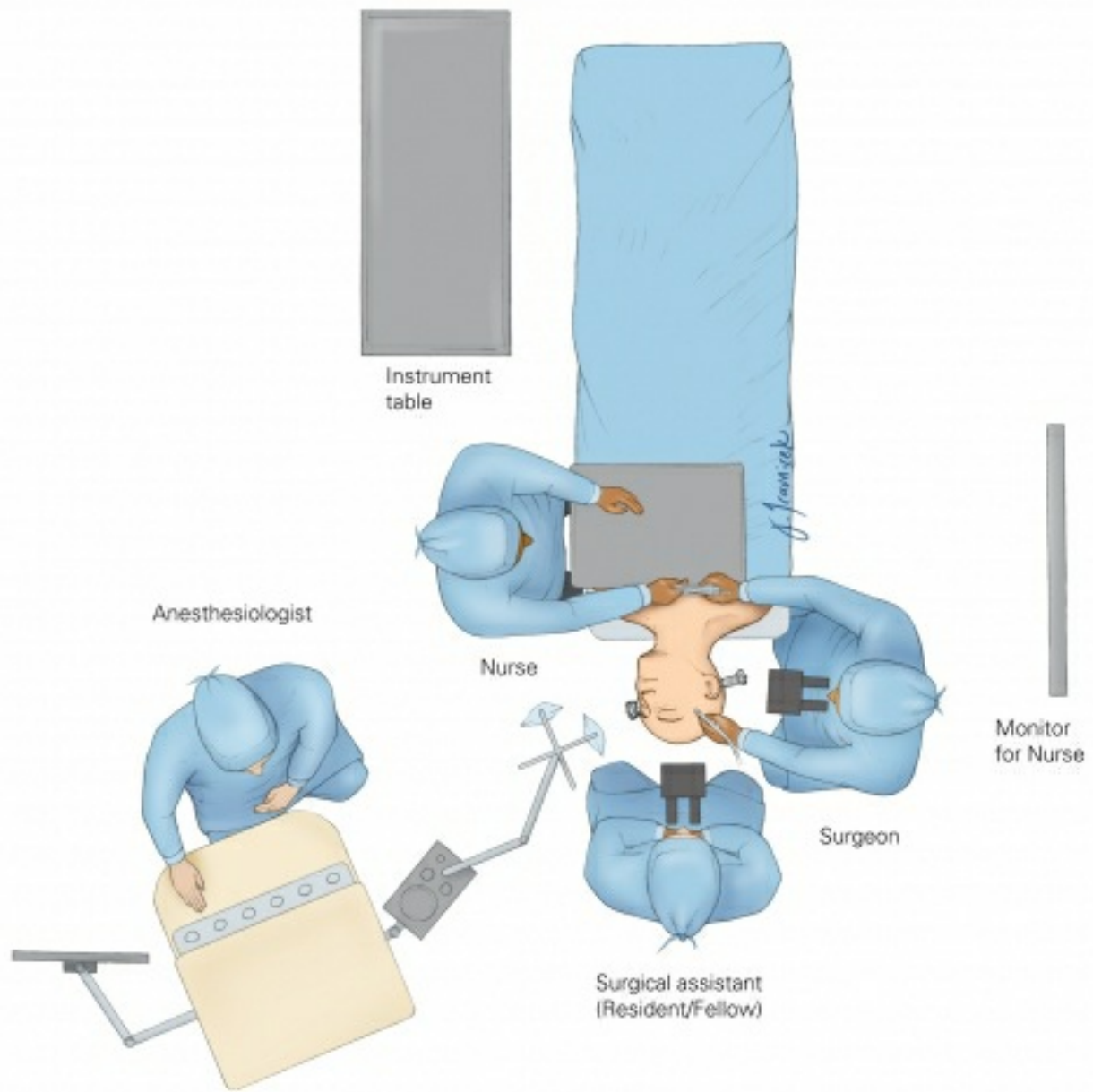


Figure 3: The strategic position of the patient defines the location of all other components in the room. **The anesthesiologist should be able to easily reach the patient's airway and vascular access. The surgeon and surgical technician (nurse) are positioned across the patient to facilitate seamless exchange of instruments. Multiple monitors in the room allow the assistants to view the operative field and follow the workflow of microsurgery. The experienced surgical technician's anticipation of the operator's next maneuver significantly improves the efficiency of the**

operation. This level of invaluable teamwork is only possible if the same supporting staff operate with the same surgeon consistently.

In select cases, the anesthesiologist may be positioned at the foot of the table if additional room is required for the operating team. I sit during microsurgery because sitting offers numerous advantages. Standing may lead to arm and hand fatigue, whereas a sitting position allows the use of an armrest and promotes relaxed and steady hands. A comfortable and ergonomic position also facilitates my ability to improve my surgical technique by sharpening my focus to eliminate nondeliberate and unintentional dissection maneuvers.

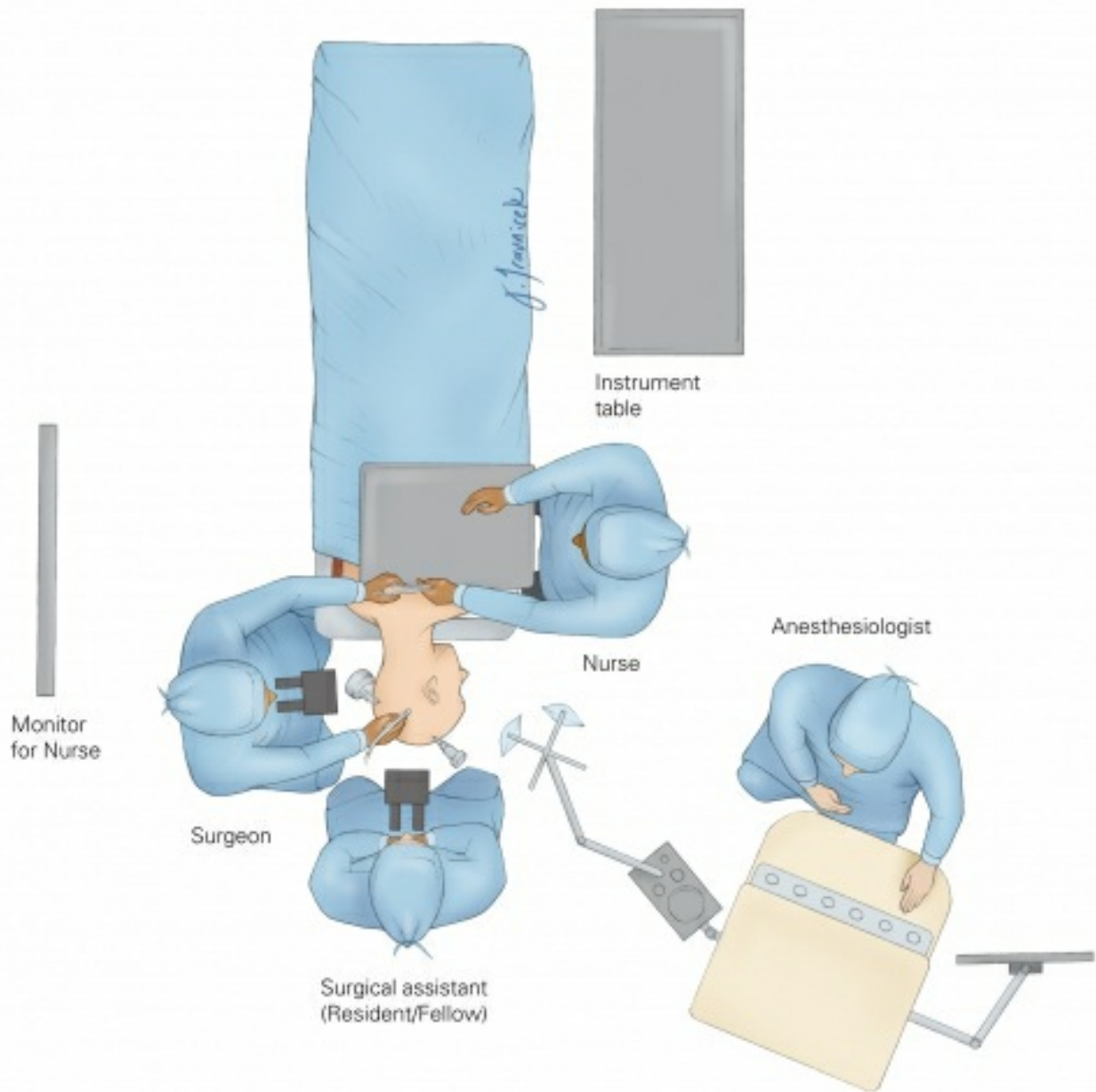


Figure 4: The operating room setup for a left-handed surgeon in the case of a retromastoid operation.

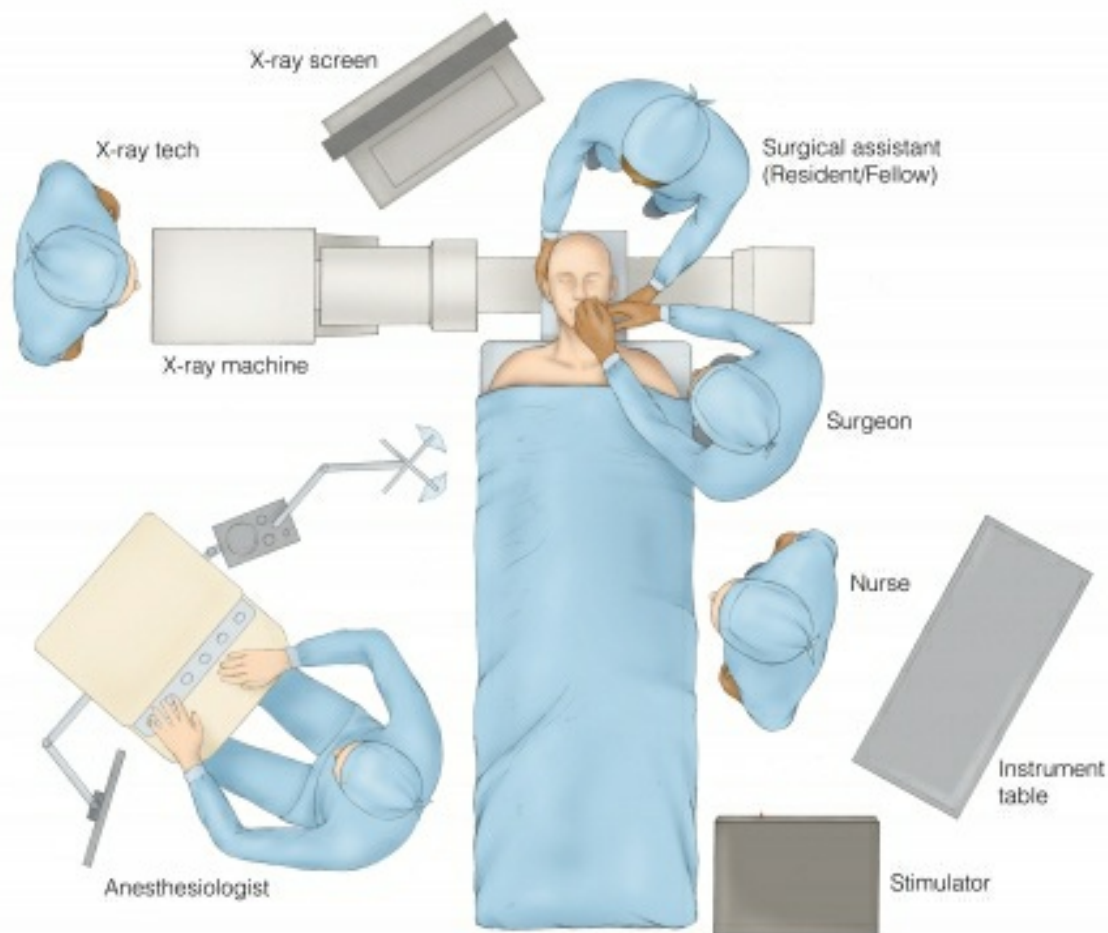


Figure 5: The organization of the operating room for a percutaneous trigeminal rhizotomy.

The operating room team includes one or two circulating nurses, a surgical technician or nurse, an anesthesia team that includes an attending anesthesiologist, resident or fellow, a certified registered nurse anesthetist (CRNA), and an anesthesia technician. The surgical team is comprised of the attending neurosurgeon and a resident, fellow, or medical students. Other accessory personnel include neurophysiological monitoring technicians, X-ray technicians, and other visiting physicians.

All members of the team should have their own dedicated space. This arrangement enhances workflow and allows

unobstructed movements of the circulating staff in the room. Roaming of visiting staff in the room can significantly compromise workflow and increase the risk of infection.



Figure 6: Operating room setup for an expanded transnasal endoscopic procedure. Dedicated monitors are available for the surgeon and assistant.

Preparing for Surgery and the Workflow: Personal Perspectives

I arrive in the OR after the patient is anesthetized and proceed to position the patient on the table and mark the incision. I then discuss the necessary steps of the operation and anesthetic needs with the entire OR team while the wound is being prepared and draped. All of the team's important questions are cordially answered and the satisfaction of each team member is confirmed. The preoperative images and plan are also reviewed with the operating team.

I also alert the staff regarding the need for special surgical supplies and equipment. For example, the need of a femoral artery sheath for an arteriovenous malformation operation in expectation of an intraoperative angiography should be discussed with the staff before the patient enters the room. As previously mentioned, **it is best to standardize and simplify the OR setup because this practice will improve the safety and efficiency of the surgery. Inconsistent requests leads to operating room staffs' confusion.**



Figure 7: As part of preparation for surgery, I check the balance of the microscope and ensure the correct height and configuration of the mouth switch. It is important that the surgeon is intimately involved in OR setup and familiar with the equipment.



Figure 8: The surgeon should receive the instruments seamlessly while his or her attention and eyes remain on the operative field. The number of instruments and interchanges used should be kept to a minimum, and each instrument should be used for multiple purposes. **The repertoire of instruments should be standard and limited.**



Figure 9: A dedicated comfortable chair with armrests is mandatory for microsurgery. An ergonomic posture helps the operator improve surgical technique by eliminating nondeliberate or unintentional dissection maneuvers.

Marking the Incision and Draping the Operative Field

The first step of the operation should always include a thorough review of the preoperative radiological studies and confirmation of the side of the lesion to define the location of the operator and the rest of the team in relation to the patient. The operative plan should be reviewed once again.

After the patient's head is immobilized in the skull clamp and its position finalized, I use neuronavigation to plan the incision. **I always use superficial anatomic landmarks (the ear, zygoma, sagittal suture,inion, or superior nuchal line) to verify the approximate location of the lesion relative to the incision.** Errors in navigation can lead to irreversible results.

I typically shave a strip of hair around the incision, but avoid shaving the entire head; I do not believe the risk of postoperative infection is dependent on the extent of hair removal. I use clippers, not razors, for this purpose.



Figure 10: Once the incision is marked, I scrub the skin, first with alcohol and then with ChloroPrep skin antiseptic, a rapid-acting and persistent preoperative skin preparation, to further clean the skin. Next, I generously inject the subcutaneous space of the incision line with lidocaine hydrochloride and epinephrine solution to minimize bleeding during the incision. I then reprep the operative field with ChloroPrep and wait until the skin is completely dry. A local anesthetic may also ameliorate postoperative pain through preconditioning mechanisms.

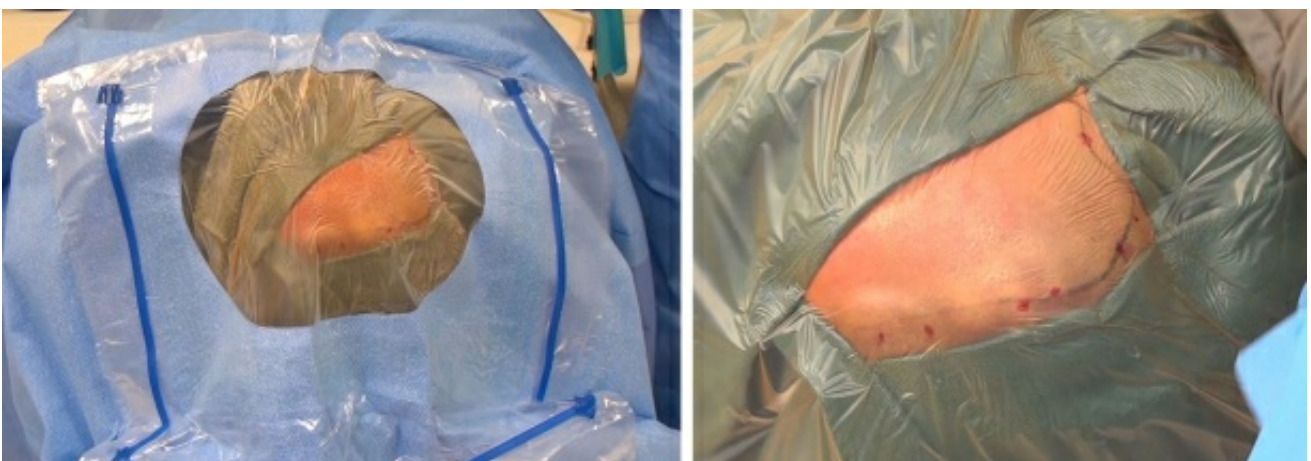


Figure 11: The incision is then draped in the standard fashion. If a ventriculostomy or another form of drainage system is contemplated, adjacent areas of the skin are prepped for tunneling the drainage

catheter.

Intraoperative Workflow

The exposure/craniotomy portion of the surgery should proceed expeditiously so the operator can dedicate most of his or her energy and focus to the critical intradural portion of the operation.

The intraoperative workflow is very dependent on the specifics of the case. It is advantageous to think ahead at every step of each surgical maneuver and ask for the instrument before you are ready to exchange so that it is ready for you. Such measures improve efficiency tremendously.

If an intraoperative angiogram is contemplated, the operating room setup should accommodate the space required for fluoroscopy. I do not usually use the radiolucent head holder and have not had any significant difficulty acquiring the appropriate images while working around the regular skull clamp.

The use of a mouth switch is paramount for improved visualization and operative efficiency. For more details, please refer to the chapter on the [Surgeon's Philosophy and Operating Position](#). During surgery, the reasoning behind each operative maneuver is thoroughly described to the residents, fellows, and visiting surgeons.

Additional Considerations

I record all of my surgeries with the microscope-integrated camera for later critical review and advancement of the safety and efficiency of my operative maneuvers in the

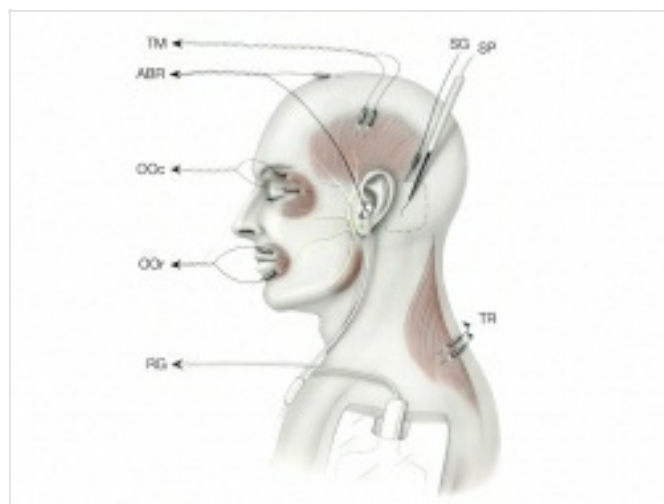
future operations.

The operative plan should be carefully re-reviewed days before the surgery. I often solicit my colleagues' opinions about my operative plans for complex operations, and I have never been disappointed in doing so. I also discuss the plan of action with my fellows and residents the night before surgery.

Pearls and Pitfalls

- The operating room setup is crucial for advancing the safety and efficiency of operative organization, workflow, and teamwork.
- The surgeon is “the captain of the ship” and should pay close attention to all details of operating room events, including OR setup.
- Operating room set up should be simplified and standardized so that complexity and inconsistency are not leading to confusion and error.

For additional illustrations of cranial nerve monitoring, please refer to the Jackler Atlas by clicking on the image below:



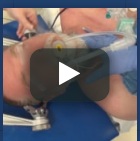
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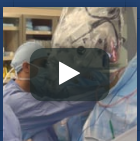
Navigating the OR Table



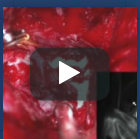
Placement of the Pins (Skull Clamp)



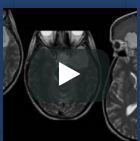
Patient Positioning and Myocutaneous Flap for Retromastoid Craniotomy



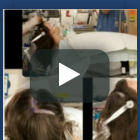
Acoustic Neuroma: The Sitting Position



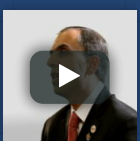
Parasagittal/Parafalcine Meningioma: Avoiding Ischemia



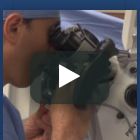
Medial Sphenoid Wing Meningioma: Orbitozygomatic Osteotomy



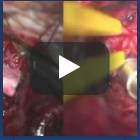
Grand Rounds-Patient Positioning for Intracranial Surgery: A Guide for Residents and Fellows



The Introduction to the Use of OR Microscope: Interview



Preoperative Microscope Setup



Nuances of Technique for Optimal Microscope Image



Nuances of Maintaining Microscope Balance



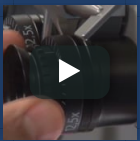
Mouthswitch and Footpedal: Advantages



Maximizing the Microscope's Potential: OR Ergonomics



Lightfield Adjustment to Minimize Tissue Injury



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