

# Neurosurgery Interns

## Outline

- I. Rotation 'Manual'
- II. Learning Objectives
- III. Faculty- Intern Conference
- IV. Study References

## I. Rotation Manual

### First Day Details:

- Read this rotation manual prior to first day. Begin suggested readings if possible.
- Meet Chief Resident at Neurosurgery Conference – HRC12D03, 7 to 8 am, or page.
- Sign rotation objectives document with Neurosurgery Residency Co-ordinator, Ms. Joanie Mastrandrea, Mackenzie Hall 3<sup>rd</sup> Floor Neurosurgery Departmental Offices.

### Schedule:

5:15 AM	Preround on patients on floor
6:00 AM	Rounds on 7A
6:30 AM	Rounds on 9C with nurse practitioners and case manager or conference
5:00 PM	Paper rounds – checkout 7A
weekends	8 am rounds. The interns round and write notes on all ward patients (OHSU, Peds, and VA) if on duty

### Conferences:

Monday 7:00 – 9:30	general surgery conference
Tuesday 7:00 – 8:00	neuropathology conference 12D03
Thursday 7:00-8:00	Spine conference/Vascular conference 12D03
Friday 7:00-8:00	Brain tumor board 14D03

## General Goals

Become proficient in managing neurosurgery ward patients.

Learn how to perform a complete neurological exam, and be able to distinguish normal from abnormal findings.

Learn about neurosurgery critical care on ICU rounds. The interns are encouraged to ask questions and be involved in decision-making.

Perform supervised basic procedures including central lines, arterial lines, and ICP monitors.

Learn to interact with neurosurgical team in interdisciplinary, systems-based care environment, particularly in the context of complex trauma care.

Assist in neurosurgical operating room to become familiar with nervous system procedures, risks, complications, etc.

## **Responsibilities**

1. Care of ward patients. Check labs on each patient daily.
2. Log work hours and keep weekly hours under 80
3. Adult discharge summaries. Pediatric discharge summaries on weekends.
4. When both interns are in house one should come to the OR.
5. Keep list updated with patient locations. This includes early in the day entering the operative patients for the day.
6. Attendance one half-day per week in adult neurosurgery clinic with Dr. Kim Burchiel for teaching re: indications and management.
7. You may be asked to help with preoperative evaluations, although much of this is done by neurosurgery mid-level providers (NP/PA). The neurosurgery resident will consent the patient.

## **Nurse Practitioners**

We have several nurse practitioners on the adult service that the intern will work closely with. They are an important source of experiential learning. They coordinate patient care in the clinic and ward, and will be closely involved in letting the intern know which patients they are to see.

## **GUIDELINES FOR PATIENT MANAGEMENT**

### **Lumbar Drain Management**

A lumbar drain is a catheter that is inserted into the lumbar spine, either in the OR when asleep or on the ward, to drain CSF. The CSF is usually drained to allow for dura to heal, or to treat spinal fluid leaks. The leaks can be in the lumbar dura, or intracranial from transphenoidal surgery, or any craniotomy.

The drain should be open, and allowed to drain at the level of the dural repair. i.e. the level of the ear for pituitary surgery. The drain can temporarily be clamped while the patient gets up, and the level reset for ambulation/activity/bathroom privileges.

It is important not to drain too much CSF. This can produce a herniation syndrome where the patient becomes sleepy on to obtunded. Thus careful management of the lumbar drain should be done by a 9C nurse.

### **Pituitary Surgery**

Many of our patients have transphenoidal resection of pituitary tumors. They often have pituitary hormone deficiencies (i.e. Cushing's disease, prolactinoma, acromegaly). All these patients have endocrinology and ENT following them. ENT manages the nasal packing.

If there was a CSF leak in surgery then the patients will have a lumbar drain for 3 days. Dripping of clear fluid from the nose should be noted and reported to the resident.

Endocrinology will typically order postoperative cortisol levels. Let them manage the hormone replacement.

**DVT prophylaxis**

1. All patients have SCD (or plexipulse of obese) in bed
2. Spine patients who are inactive should get SQ lovenox or SQ Heparin.
3. Brain tumor patients without hemorrhage, starting 48 hrs after surgery, should have SQ Lovenox. However, ask resident before starting.
4. Patients with prior history of DVT or Pulmonary embolism should be carefully managed expectantly usually with temporarily IVC filter and early anticoagulation. Ask Resident.

**Pediatric VPS Patients**

Pediatric services manage a significant number of patients with ventriculoperitoneal shunts (VPS) who may be at risk for unexpected neurological deterioration from shunt malfunction. Care must be taken to diligently watch for the signs or symptoms of shunt failure. Consistent with other care areas of neurosurgical care, interns contacted for neurological change should **immediately** involve their supervising resident (or faculty) and should not attempt to manage these changes independently.

All patients with a VPS, whether or not they have possible shunt failure, if on the ward should be on a special shunt monitoring protocol orders that has constant pulseox/EKG monitoring of SaO<sub>2</sub> and pulse. These orders are on both wards work-room, and on the neurosurgery reference web.

Signs of shunt failure:

1. Parents say that the patient isn't right – always believe them
2. bradycardia – very worrisome
3. depressed mental status
4. CT scan, shunt series abnormalities

Symptoms of shunt failure (hydrocephalus)

1. headache
2. emesis/nausea
3. personality change
4. change in activity level
5. any subjective change typical of prior shunt failure according to parents

**Sedation and Pain Control in Neurosurgery Patients**

*Intracranial disease:*

Neurosurgery patients often need careful observation for decreased mental status due to their brain process. The rule of thumb is not to give medications that cause significant sedation, or that are at least short acting. Thus, when a patient has a mental status change the possibility of medication related changes is not a complicating factor.

DO NOT use: droperidol, haldol, phenergan, ativan, xanax, valium

For nausea use: zofran

Night time sleep: OK to use benadryl

*Per JCAHO patient safety guidelines, all medications should be checked for allergy history and for possible adverse interactions, and should be dosed appropriately by age and weight. Please check with the pharmacy and/or supervising resident/faculty as needed.*

*Spine Surgery:*

The above rules do not apply. OK to use phenergan and benzo's for nausea and agitation.

## COMMON CLINICAL CONDITIONS

### Hyponatremia and Hypernatremia Management

Neurosurgery patients often have electrolyte disturbances. Those with abnormalities should have daily Chem7 labs

**SIADH** (syndrome of inappropriate antidiuretic hormone) is when the Na level drops  $< 130$  due to retention of free water. Patients are usually isovolemic or hypervolemic.

If $130 < \text{Na} < 135$	Observe, daily labs
If $120 < \text{Na} < 130$	Treat. <ol style="list-style-type: none"> <li>1. First with complete fluid restriction to about 2 L per day</li> <li>2. IVF should be normal saline, no <math>\frac{1}{2}</math> normal saline</li> <li>3. If on tube feeds add 2 packs (g) of salt per can of tube feeds</li> <li>4. 3%NaCl bolus of 150 cc over 3 hours – this increases Na load and also diuresis of free water.</li> </ol>
If $\text{Na} < 120$	Call neurosurgery resident

**Diabetes Insipidus** (the lack of ADH) leads to marked hypernatremia ( $\text{Na} > 145$ ). It commonly occurs in severe brain injury or after pituitary surgery. Thus all pituitary surgery patients should be monitored for DI for at least 2 to 3 days after surgery.

Signs of DI:

Urine output  $> 200$  cc/hr for  $> 2$  hours

Urine specific gravity  $< 1.005$

Serum Na  $> 145$

If all 3 signs are met then DI is diagnosed and treatment begins. It is common for patients to have large diuresis after surgery with  $> 200$  cc/hr, even with urine specific gravity  $< 1.005$ . However, if the Na level is  $< 140$  then it is unlikely DI.

Treat:

- IVF to D51/2 NS
- Unlimited PO intake, encourage water
- Strict I/O totaled Q3 hrs. If the patient is unable to keep up PO intake with urine output then bolus with 1 L NS.
- Often if DI will be chronic we give the patient DDAVP either IV or nasal. However, ask the resident before giving.
- Q6 hr Na, I/O, Urine specific gravity
- If  $\text{Na} > 150$  call neurosurgery resident.

### Decadron (dexamethasone) in Neurosurgery Patients

Decadron reduces vasogenic edema seen in patients with brain tumors, but not head trauma or intracranial hemorrhage. Nearly all patients after brain tumor resection need postoperative decadron, which is eventually tapered and discontinued.

## Inpatient Neurological Exam

All Interns should become completely proficient at doing a full neurological exam. This is the simple details of a complete exam

- Language**
1. articulation (clear, slurred, dysarthric), a problem with cranial nerves
  2. Understanding and production
    - Productive aphasia – can't make the right words
    - Receptive aphasia – can't understand or follow commands
    - Total aphasia – can't talk or follow commands
- Test: Naming 3 objects, repeating a sentence "No ifs, ands or buts", follow complex commands
- Note: "Language intact:

### Level of Consciousness and Orientation

1. Wide awake, drowsy – easily awakens, obtunded – difficult to awaken, comatose – cannot wake up to voice or pain
2. GCS score if indicated
3. Oriented to person, place, date, and situation (A&O x 4)

**Cranial Nerves.** Exam depends on level of consciousness.

- II Visual fields – count fingers in all 4 quadrants with each eye covered
- III, IV, VI Eye movement in all directions. Dolls eyes if comatose (EOMI, no nystagmus)
- pupils PEERL – this means pupils are the same size and both react to light
- V face sensation on all three trigeminal distributions
- VII facial grimace. Can be a central loss (preserves eye closure and forehead wrinkle) or peripheral loss (difficult to close eye and complete facial weakness)
- Corneal reflex if comatose – checks V & VII
- IX, X gag if comatose
- XI shoulder shrug
- XII tongue protrusion (tongue midline)

Ex: CN intact means:  
PEERL, EOMI, no nystagmus, visual fields intact, positive corneal, positive dolls eyes, face sensation intact, face grimace symmetric and intact, positive gag, full shoulder shrug, tongue and uvula midline.

### Motor Strength

Pronator drift – watch for subtle supination of hand when outstretched and eyes closed

Fine motor task – finger taps will be slowed on one side if there is subtle weakness

Scale:

5	Full normal strength
4-	Subtle weakness
4	Weak but functional

4-	Significant weakness
3	Antigravity
2	Some movement but not antigravity
1	Slight twitch
0	No activation of muscles at all

Strength exam should test specific motor groups on each side. For example:

Grasp, bicep, tricep, wrist flexor, wrist extensor

Hip flexor, knee extension, ankle dorsiflexion, ankle plantarflexion

### Reflexes

The key is an asymmetric reflex (one side vs other). This may be more meaningful than the actual level.

Reflexes to test: bicep (C5), tricep (C7), brachioradialis (C6), Patellar (L4), Achilles (S1)

Pathological reflexes:

Babinski – when the lateral aspect of the foot is stroked the large toe moves up transiently

Crossed adductor – when the contralateral leg adducts from medial patellar stimulus

Reflex spread – when stimulation of the bicep activates the pectoralis and fingers

Hoffman's reflex – flicking the middle finger causes the thumb to flex

Clonus – brisk upward push on the ankles produces rhythmic beating of the feet. Normal to have less than 3 beats

4+	Extremely brisk
3+	Elevated and abnormal
2+	Normal reflex
1+	Depressed reflex
0	None detectable

### Normal Exam:

A&O x 4, language intact

PEERL, EOMI, no nystagmus, Visual field intact, face sensation intact, face full strength and symmetric, tongue midline

No Drift. Finger taps symmetric, 5/5 bilateral strength: grasp, bicep, tricep, hip flexor, knee extension, ankle dorsiflexion, ankle plantar flexion

Normal 2+ reflexes symmetric: bicep, tricep, brachioradialis, patellar, and Achilles.

Gait normal, sensation intact to light touch

## Abbreviations

ACDF	Anterior cervical discectomy and fusion. Routine surgery for cervical disc herniation, where the two vertebral bodies are fused with a titanium plate. Post op watch for neck hematoma, and xray of titanium plate.
ACOM	Anterior communicating artery. A common site for aneurysm
CEA	Carotid endarterectomy. Surgery for carotid stenosis. Postop watch for hematoma and stroke.
CVA	Cerebrovascular accident. A Stroke
CT	Computed Tomography of Head, usually without contrast
DI	Diabetes Insipidus (High sodium), common after pituitary surgery
EDH	Epidural hematoma. Bleeding into the epidural space
EVD	Extraventricular drain, i.e. ventriculostomy. A tube from the lateral ventricles out of the scalp. Used to measure and treat ICP.
GBM	Glioblastoma Multiforme. The worst, aggressive brain tumor
GCS	Glasgow coma score
ICH	Intracranial hemorrhage. Can be from hypertension – commonly in the basal ganglia or thalamus. Can be from trauma – usually is a cerebral contusion.
ICP	Intracranial pressure. Abnormal if > 20 cm water
LD	Lumbar drain. A catheter in the thecal sac, like a lumbar puncture. Used to drain spinal fluid to allow dura to heal
MRA	Magnetic resonance angiogram. An alternative to a cerebral angiogram.
MRI	Magnetic resonance Imaging
PCOM	Posterior communicating artery. A common site for aneurysm
POC	Postop Check. Should include: full neuroexam, vitals, labs, and films (xray or CT)
PLIF	Posterior lumbar interbody fusion. A large surgery for lumbar spine fusion. Postop watch for low HCT, large drain output, pain control with PCA in indicated
PT/OT	Physical therapy/Occupational therapy. All patients with a neurological deficit should have an assessment. They help decide on placement between SNFF or rehab.
SAH	Subarachnoid hemorrhage. Bleeding most often due to rupture of aneurysm.
SDH	Subdural hematoma. Bleeding into the subdural space
TBI	Traumatic brain injury. A generic term for trauma related brain injury
TCD	Transcranial Doppler ultrasound: a method for measuring vasospasm in the brain
VPS	Ventriculoperitoneal shunt. A permanent tube from the lateral ventricle to the abdomen to shunt cerebrospinal fluid. All pediatric patients with VPS should be on shunt monitoring protocol orders.

## II. Learning Objectives

### Educational Objectives for Interns rotating through Neurosurgery

#### a) Medical Knowledge

Explain the pathophysiology of increased intracranial pressure and principles of ICP management;

Describe the rostrocaudal progression of patients with altered level of consciousness and the different herniation syndromes;

Explain the concept of cerebral autoregulation;

List the common causes of brain ischemic states;

Describe the pathophysiology of ischemic brain injury, including ischemic thresholds and critical therapeutic window;

List the common causes of intracranial and subarachnoid hemorrhage;

Explain the principles of fluid and electrolyte resuscitation and cardiorespiratory physiology following ischemic and hemorrhagic strokes;

Describe the typical clinical course of patients with subarachnoid hemorrhage and related complications such as hydrocephalus, vasospasm, stroke, etc;

Describe the etiology and management of patients with intracranial and intraspinal abscesses;

Explain the etiology and management of post-operative and posttraumatic seizures;

Explain the etiology, differential diagnosis and management of low back pain and cauda equina syndrome;

Explain the etiology, pathophysiology and management of common degenerative spine disorders such as radiculopathy, myelopathy and neurogenic claudication;

Describe the common syndromes of spinal cord injury;

Describe the pathophysiology and management of patients with spinal cord injuries;

Explain the etiology, pathophysiology and management of different types of hydrocephalus.

Teaching methods: Discussion with residents and faculty on teaching rounds; Discussion with faculty in weekly neurosurgery teaching conference; Discussion with neurosurgery faculty in weekly intern/student teaching conference; reading syllabus

Evaluation: Observation of performance by Chief Resident and faculty. Neurosurgery Intern Teaching Conference attendance and participation and in-service examination performance (see below).

### **b) Patient Care**

Demonstrate the proper performance of a complete and a targeted neurological examination and interpretation of its findings;

Discuss appropriate peri and post-operative sedation and narcotic orders in neurosurgical patients;

Explain the physiology and management of post-operative neurosurgical patients including fluid and electrolyte balance, hemostasis, and metabolic/nutritional issues;

Explain the physiology and management of common post-operative neurosurgical problems, including surgical wound infections, hemorrhage, DVT's, CSF leaks and seizures;

Explain the management of ICP monitors, ventriculostomy catheters and lumbar drains;

Demonstrate the ability to obtain and evaluate appropriate radiological studies such as CT's, angiograms and MRI scans of head and spine;

Demonstrate the ability to evaluate and manage patients with acute hydrocephalus, post-operative hydrocephalus and shunt malfunction.

Teaching methods: Discussion with residents and faculty on teaching rounds; Discussion with faculty in weekly neurosurgery teaching conference; Discussion with neurosurgery faculty in weekly intern/student teaching conference; reading syllabus; Demonstration and practice of skills in the neurosurgery operating room.

Evaluation: Observation of performance by Chief Resident and faculty. Neurosurgery Intern Teaching Conference attendance and participation and in-service examination performance (see below).

### **c) Professionalism**

Communicate effectively and compassionately with patients and their family members;

Demonstrate respect for patients and colleagues from diverse cultural, ethnic and religious backgrounds;

Demonstrate honesty in all professional interactions;

Demonstrate punctuality for scheduled conferences and rounds;

Demonstrate dress, grooming and comportment consistent with institutional guidelines;

Comply with all GME regulations regarding duty hour restrictions.

Teaching methods: Discussion with residents and faculty on teaching rounds; Discussion with faculty in weekly neurosurgery teaching conference including ‘non-clinical core competency’ material (episodic); mentor role-modeling on clinical service. Completion of ‘The Competent Physician’ online learning program (required by General Surgery of all interns).

Evaluation: Observation of performance by Chief Resident and faculty. Neurosurgery Intern Teaching Conference attendance and participation and in-service examination performance (see below).

#### **d) Interpersonal and Communication Skills**

Demonstrate the ability to communicate care plans to patients and families;

Demonstrate the ability to provide sensitive, accurate and complete information to obtain consent for surgical procedures;

Demonstrate the ability to communicate effectively with nursing staff, mid-level practitioners (NP’s, PA’s) and fellow residents;

Provide complete and effective sign out and sign in with on call interns and residents.

Teaching methods: Discussion with residents and faculty on teaching rounds; Discussion with faculty in weekly neurosurgery teaching conference including ‘non-clinical core competency’ material (episodic); mentor role-modeling on clinical service. Completion of ‘The Competent Physician’ online learning program (required by General Surgery of all interns).

Evaluation: Observation of performance by Chief Resident and faculty. Neurosurgery Intern Teaching Conference attendance and participation and in-service examination performance (see below).

#### **e) Practice-Based Learning**

Accept responsibility for the care of neurosurgical patients on the ward, learning and modifying practice management style as needed;

Facilitate the learning of medical students and mid-level practitioners on the team;

Demonstrate the use of OHSU library or other medical databases to access medical information and review recent literature.

Teaching methods: Discussion with residents and faculty on teaching rounds; Discussion with faculty in weekly neurosurgery teaching conference including ‘non-clinical core competency’ material (episodic); mentor role-modeling on clinical service. Completion of ‘The Competent Physician’ online learning program (required by General Surgery of all interns).

Evaluation: Observation of performance by Chief Resident and faculty. Neurosurgery Intern Teaching Conference attendance and participation and in-service examination performance (see below).

#### **f) Systems-Based Practice**

Explain, utilize and review clinical pathways and practice guidelines for neurosurgical patients in the ward;

Practice cost-effective health care without sacrificing quality of care.

Teaching methods: Discussion with residents and faculty on teaching rounds; Discussion with faculty in weekly neurosurgery teaching conference including ‘non-clinical core competency’ material (episodic); mentor role-modeling on clinical service. Completion of ‘The Competent Physician’ online learning program (required by General Surgery of all interns).

Evaluation: Observation of performance by Chief Resident and faculty. Neurosurgery Intern Teaching Conference attendance and participation and in-service examination performance (see below).

### **III. Faculty-Intern Conference**

A one-hour weekly conference for interns and students on the service (typically two interns and one to two students) will be taught personally by neurosurgery and neuro-intensive care faculty. The conference provides an opportunity for interns to receive didactic information about the pathophysiology of neurological diseases/injuries and about the management of neurosurgical and neurotrauma patients, as well as to assess the interns’/students’ understanding of assigned rotation readings and to answer questions. The following topics will be presented during each month long rotation:

- Neurological examination in acute care setting (didactic and ICU exam based) – Dr. Bhardwaj
- Basic management of neurological/surgical emergencies: status, herniation, stroke – Dr. Bhardwaj
- Trauma imaging: basics of head injury CT and cervical xrays/CT – Drs. Nemecek/Ellegalla
- Head injury physiology and treatment – Drs. Nemecek/Ellegalla

Interns will sit a brief in-service examination at the end of the 4<sup>th</sup> session (multiple choice) and attendance, discussion performance and in-service results will be considered by faculty along with clinical service performance in intern evaluations for the rotation.

#### **IV. Study References**

Last Revised February, 2006

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