Chapter 3
Management of Patients with Focal Neurological Deficits in the ICU

3.1 Introduction

Patients in the intensive care unit (ICU) who present with focal neurological deficits require immediate and precise assessment to prevent further deterioration and to optimize outcomes. These deficits may stem from various underlying conditions, including hemorrhagic and ischemic strokes, subarachnoid hemorrhage, hydrocephalus, brain tumors, or abscesses. This chapter provides a step-by-step algorithm for managing such patients, emphasizing critical clinical evaluations, diagnostic procedures, and initial treatment strategies (Ref. Algorithm 3.1).

3.2 Conduct a Comprehensive Neurological Assessment

A. **National Institutes of Health Stroke Scale (NIHSS) (Table 3.1)**

- Purpose: The NIHSS is a systematic tool used to measure the severity of a stroke by assessing specific neurological functions [1, 2].
- Components:

1. Level of Consciousness: Alertness and ability to respond to questions and commands.
2. Best Gaze: Horizontal eye movements.
3. Visual Fields: Presence of visual field cuts.
4. Facial Palsy: Facial muscle movement.

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Table 3.1 National Institutes of Health Stroke Scale (NIHSS) components

1. Level of consciousness: alertness and ability to respond to questions and commands	
(A)	
Scale definition	
Alert; keenly responsive	0
Not alert; but arousable by minor stimulation to obey, answer, or respond	1
Not alert; requires repeated stimulation to attend, or is obtunded and requires strong or painful stimulation to make movements (not stereotyped)	2
Responds only with reflex motor or autonomic effects, or totally unresponsive, flaccid, and areflexic	3
Score	
(B)	
Scale definition	
Answers both questions correctly	0
Answers one question correctly	1
Answers neither question correctly	2
Score	
(C)	
Scale definition	
Performs both tasks correctly	0
Performs one task correctly	1
Performs neither task correctly	2
Score	
2. Best gaze: horizontal eye movements	
Scale definition	
Normal	0
Partial gaze palsy; gaze is abnormal in one or both eyes, but forced deviation or total gaze paresis is not present	1
Forced deviation, or total gaze paresis is not overcome by the oculocephalic maneuver	2
Score	
3. Visual fields: presence of visual field cuts	
Scale definition	
No visual loss	0
Partial hemianopia	1
Complete hemianopia	2
Bilateral hemianopia (blind including cortical blindness)	3
Score	
4. Facial palsy: facial muscle movement	
Scale definition	
Normal symmetrical movements	0
Minor paralysis (flattened nasolabial fold, asymmetry on smiling)	1
Partial paralysis (total or near-total paralysis of lower face)	2
Complete paralysis of one or both sides (absence of facial movement in the upper and lower face)	3

(continued)

Table 3.1 (continued)

Score			
Motor function:			
A) Arm: ability to hold arms up			
Scale definition			
No drift; limb holds 90 (or 45) degrees for full 10 seconds			0
Drift; limb holds 90 (or 45) degrees, but drifts down before full 10 seconds; does not hit bed or other support			1
Some effort against gravity; limb cannot get to or maintain (if cued) 90 (or 45) degrees, drifts down to bed, but has some effort against gravity			2
No effort against gravity; limb falls			3
No movement			4
Amputation or joint fusion, explain			UN
Score	5a: left arm	5b: Right arm	
B) Leg: ability to lift legs			
Scale definition			
No drift; leg holds 30-degree position for full 5 seconds			0
Drift; leg falls by the end of the 5-second period but does not hit the bed			1
Some effort against gravity; leg falls to bed by 5 seconds but has some effort against gravity			2
No effort against gravity; leg falls to bed immediately			3
No movement			4
Amputation or joint fusion, explain			UN
Score	5a: left leg	5b: Right leg	
6. Limb Ataxia: Coordination tests (finger-to-nose, heel-to-shin)			
Scale definition			
Absent			0
Present in one limb			1
Present in two limbs			2
Amputation or joint fusion, explain			3
Score			
7. Sensory: Response to pinprick in face, arms, and legs			
Scale definition			
Normal; no sensory loss			0
Mild-to-moderate sensory loss; patient feels pinprick is less sharp or is dull on the affected side; or there is a loss of superficial pain with pinprick, but patient is aware of being touched			1
Severe or total sensory loss; patient is not aware of being touched in the face, arm, and leg			2
Score			
8. Language: ability to name objects, describe pictures, and read			
Scale definition			

(continued)

Table 3.1 (continued)

No aphasia; normal	0
Mild-to-moderate aphasia; some obvious loss of fluency or facility of comprehension, without significant limitation on ideas expressed or form of expression. Reduction of speech and/or comprehension, however, makes conversation about provided materials difficult or impossible. For example, in conversation about provided materials, examiner can identify picture or naming card content from patient's response	1
Severe aphasia; all communication is through fragmentary expression; great need for inference, questioning, and guessing by the listener. Range of information that can be exchanged is limited; listener carries burden of communication. Examiner cannot identify materials provided from patient response	2
Mute, global aphasia; no usable speech or auditory comprehension	3
Score	
9. Speech: clarity of speech and articulation	
Scale definition	
Normal	0
Mild-to-moderate dysarthria; patient slurs at least some words and, at worst, can be understood with some difficulty	1
Severe dysarthria; patient's speech is so slurred as to be unintelligible in the absence of or out of proportion to any dysphasia, or is mute/anarthric	2
Intubated or other physical barrier, explain	3
Score	
10 Extinction and inattention (neglect): awareness of surroundings and stimuli	
Scale definition	
No abnormality	0
Visual, tactile, auditory, spatial, or personal inattention, or extinction to bilateral simultaneous stimulation in one of the sensory modalities	1
Profound hemi-inattention or extinction to more than one modality; does not recognize own hand or orients to only one side of space	2
Score	

5. Motor Function:
    - Arm: Ability to hold arms up.
    - Leg: Ability to lift legs.
6. Limb Ataxia: Coordination tests (finger-to-nose, heel-to-shin).
7. Sensory: Response to pinprick in face, arms, and legs.
8. Language: Ability to name objects, describe pictures, and read.
9. Speech: Clarity of speech and articulation.

10. Extinction and Inattention (Neglect): Awareness of surroundings and stimuli.

- Scoring:
- Total score ranges from 0 to 42.
- Interpretation:
  - 0: No stroke symptoms.
  - 1–4: Minor stroke.
  - 5–15: Moderate stroke.
  - 16–20: Moderate to severe stroke.
  - 21–42: Severe stroke.
- Clinical Use:
  - Establish baseline neurological status.
  - Guide treatment decisions (e.g., eligibility for thrombolytic therapy).
  - Monitor changes over time.

B. **Glasgow Coma Scale (GCS)** (Table 3.2)

- Purpose: Assesses the level of consciousness based on eye, verbal, and motor responses [3, 4].

Table 3.2 Glasgow Coma Scale (GCS)

Scale definition	Score
Eye opening (E)	1–4
Spontaneous	4
To speech (to sound)	3
To noxious stimulation (to pain)	2
No response (none)	1
Verbal response (V)	1–5
Alert and oriented (oriented)—5	5
Confused/disoriented (confused)	4
Inappropriate words (words)	3
Incomprehensible sounds (sounds)	2
No response (none) or in intubated patients	1
Motor response (M)	1–6
Obeys commands—6	6
Localizes to noxious stimuli (localizing)	5
Withdraws from pain	4
Decorticate posture (abnormal flexion)	3
Decerebrate posture (abnormal extension)	2
No response (none)	1

- Scoring:
- Eye Opening (E): 1–4 points.
- Verbal Response (V): 1–5 points.
- Motor Response (M): 1–6 points.
- Total Score: 3 (deep unconsciousness) to 15 (fully alert).
- Interpretation:
- Helps identify patients at risk of deterioration.
- Useful for monitoring trends in consciousness level.

C. **Evaluate for Signs of Brain Herniation**

Recognizing signs of brain herniation is critical for prompt intervention:

- Uncal Herniation:
  - Clinical Signs:
  - Ipsilateral pupil dilation and non-reactivity (due to oculomotor nerve compression).
  - Ptosis and impaired eye movement.
  - Contralateral hemiparesis.
  - Decreased level of consciousness.
- Central (Transtentorial) Herniation:
  - Clinical Signs:
  - Bilateral fixed and dilated pupils.
  - Loss of brainstem reflexes (e.g., corneal, gag reflexes).
  - Decerebrate posturing.
  - Abnormal respiratory patterns.
  - Rapid progression to coma.
- Management:
  - Immediate measures to reduce intracranial pressure (ICP).
  - Potential surgical intervention (e.g., decompressive craniectomy).

3.3 Perform Urgent Neuroimaging

A. **Computed Tomography (CT) Scan or Magnetic Resonance Imaging (MRI)**

- CT Scan:
  - First-line imaging modality.
  - Quick and effective in detecting intracranial hemorrhage, hydrocephalus, and mass effect.

- MRI:
  - Provides detailed images of brain parenchyma.
  - More sensitive for detecting early ischemic changes, brainstem lesions, and demyelinating diseases.

B. **Vascular Imaging**

- CT Angiography (CTA) or Magnetic Resonance Angiography (MRA):
  - Indicated if vascular abnormalities are suspected (e.g., aneurysms, arterial occlusions).
  - Essential for planning surgical or endovascular interventions.

3.4 Identify the Underlying Condition and Initiate Appropriate Management

A. **Intracerebral Hemorrhage (ICH)**

- Management Protocol:
- Blood Pressure Control: Maintain systolic BP < 140 mmHg unless contraindicated.
- Reversal of Anticoagulation: Administer appropriate reversal agents if the patient is on anticoagulant and has deranged coagulation parameters.
- Surgical Consideration: Hematoma evacuation may be necessary for large hemorrhages or those causing significant mass effect (for details, refer to Chap. 7).

B. **Ischemic Stroke**

- Management Protocol:
- Thrombolytic Therapy: Consider intravenous alteplase if within 4.5 h of symptom onset and no contraindications.
- Mechanical Thrombectomy: Indicated for large vessel occlusions within 24 h in selected patients.
- Secondary Prevention: Antiplatelet agents, statins, and management of risk factors (for details, refer to Chap. 8).

C. **Aneurysmal Subarachnoid Hemorrhage (SAH)**

- Management Protocol:
- Securing the Aneurysm: Endovascular coiling or surgical clipping.

- Preventing Vasospasm: Administer nimodipine and monitor with transcranial Doppler.
- ICP Management: Monitor and control intracranial pressure (for details, refer to Chap. 9).

D. **Hydrocephalus**

- Management Protocol:
  - External Ventricular Drainage (EVD): Immediate relief of increased ICP.
  - Long-Term Solutions: Ventriculoperitoneal shunt placement if necessary (for details, refer to Chap. 10).

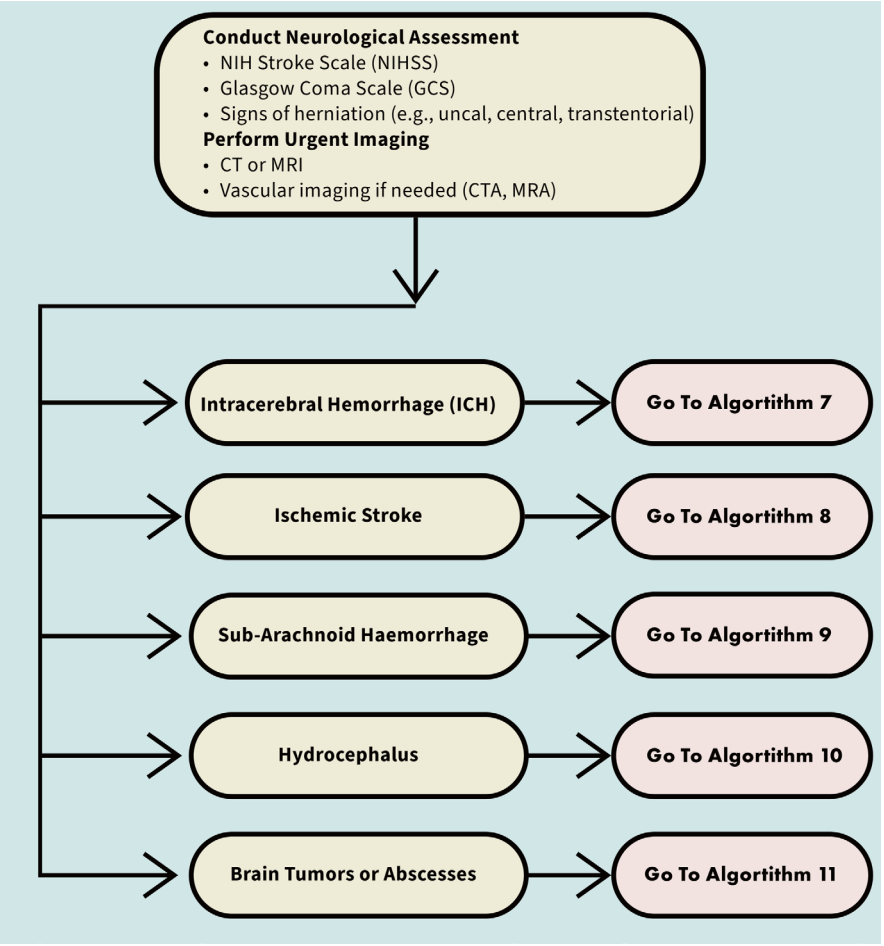
E. **Brain Tumors or Abscesses**

- Management Protocol:
- Brain Tumors:
  - Surgical Resection: Removal of tumor mass when feasible.
  - Adjunct Therapies: Radiation and chemotherapy as indicated.
- Brain Abscesses:
  - Antimicrobial Therapy: Broad-spectrum antibiotics tailored to culture results.
  - Surgical Drainage: Aspiration or excision if abscess is large or causing mass effect (for details, refer to Chap. 11).

3.5 Conclusion

Managing patients with focal neurological deficits in the ICU requires a prompt, systematic approach to assessment and intervention. Early recognition of signs and symptoms, coupled with rapid diagnostic imaging and identification of the underlying cause, is essential for initiating appropriate treatment. By following this algorithm, healthcare providers can improve patient outcomes through timely and targeted therapies.

Algorithm 3.1: Management of patients with localizing neurological lesions in the ICU



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