

Intracranial Hemorrhage: Diagnosis and Management

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KEYWORDS

- Intracranial hemorrhage • Intracerebral hemorrhage
- Intraparenchymal hemorrhage • Subarachnoid hemorrhage
- Subdural hemorrhage • Epidural hematoma

Intracranial hemorrhage (ICH) is defined as bleeding within the intracranial vault. ICH subtypes are further defined by the anatomic site of the bleeding (**Fig. 1**). Intraparenchymal hemorrhage (IPH) is defined as bleeding within the brain parenchyma, which can be spontaneous or posttraumatic. Subarachnoid hemorrhage (SAH) signifies blood within the subarachnoid space and is commonly from a ruptured intracranial aneurysm (aneurysmal SAH) or trauma. Subdural hematoma (SDH) indicates bleeding underneath the dural membrane, whereas epidural hematoma (EDH) indicates bleeding exterior to the dura. Intraventricular hemorrhage (IVH) indicates blood within the ventricular system, which normally contains cerebrospinal fluid. This article reviews the approach to the diagnosis and general management of ICH, followed by a focused discussion of specialized ICH subtype management for IPH, SAH, SDH, EDH, and IVH.

DIAGNOSIS OF ICH

ICH is diagnosed through a combination of history, physical examination, and, most commonly, noncontrast CT examination of the brain,^{1–3} which discloses the anatomic bleeding location. The approach to ICH diagnosis should begin with a detailed history

Disclosures: The authors report no conflict of interest or funding for this manuscript.

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Neurol Clin 30 (2012) 211–240

doi:10.1016/j.ncl.2011.09.002

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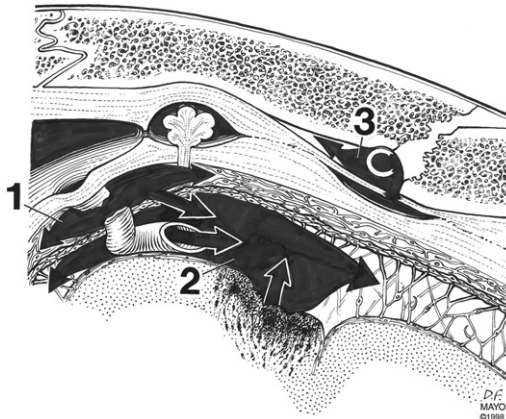


Fig. 1. Different ICH anatomic locations. (1) Bleeding within the subdural location, which is typically from torn bridging veins, that drain spinal fluid into the draining dural venous sinuses. (2) Bleeding within the subarachnoid space from either the brain cortex (cortical IPH or cortical contusion if traumatic) or a ruptured artery, such as ruptured aneurysm or pial vessel. (3) Skull-fracture ruptures the middle meningeal artery in the epidural space near fractured skull causing epidural hematoma, which can cause downward displacement of brain with hematoma expansion but may stop at skull suture lines (*far upper left*).

if available. If the patient cannot provide the history because of unconsciousness or altered mental state, a witness or other historian should be interviewed. Important historical clues include time and activity of onset if sudden deficits appeared, or loss of consciousness, fall, or presence or absence of seizure at onset. If the patient was “found down,” and unresponsive by a witness, a description of the scene is often useful. Other historical information that should be collected includes medications, such as antithrombotic agents or anticoagulants; medical and surgical history; allergies; family history; and social history such as drug or alcohol use.

Laboratory values that should be checked in patients with ICH include a complete blood cell count, electrolytes, blood urea nitrogen, and creatinine (**Box 1**).¹⁻³ Serum glucose is reasonable to screen for hypoglycemia. A 12-lead electrocardiogram is useful to screen for arrhythmias, heart block, or myocardial ischemic changes. Coagulation parameters, including prothrombin time, activated partial thromboplastin time, and international normalized ratio (INR) are particularly useful in patients taking warfarin or heparin anticoagulation. Patients suspected of having sepsis and disseminated intravascular coagulation may have abnormal coagulation function tests, thrombocytopenia, leukocytosis/leucopenia, and additional fibrinogen and fibrin split products, and D-dimer levels should be checked. A pregnancy test is reasonable to perform in women of childbearing age before radiographs or CT scans are considered.¹⁻³ A drug screen may be useful in patients with hypertensive IPH from amphetamines or cocaine, or in those found unresponsive from barbiturate or opiate overdose with secondary traumatic ICH.

A stat noncontrast head CT can provide clues regarding the primary cause of ICH if the history is unclear. **Table 1** provides differential diagnoses for patients with ICH based on the initial history and CT findings. Traumatic ICH may have a telltale or characteristic “coup–countercoup” (eg, left occipital head injury creates right frontal contusion) ICH pattern that is caused by acceleration–deceleration forces of the brain tissue

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