SURGICAL DIAGNOSIS

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Preface

Diagnosis is the first and most important part of surgery. Correlation of the reduced morbidity and mortality that accompany an accurate diagnosis certify to this.

The student and clinician should have a plan or method which guides him in his investigation of a medical problem. Such a plan must be simple, concise and workable. A method that satisfies these requisites and has served me well for the past 25 years consists of the following:

1. A well-taken history.
2. A careful evaluation of the present symptom complex.
3. A properly conducted physical examination.
4. Consideration of pertinent laboratory data.

Little can be overlooked or forgotten if such a method is scrupulously followed. The modern approach to diagnosis unfortunately tends to make the laboratory primary. It is not my intent to minimize laboratory findings; indeed, on occasion, they are a vital if not our sole source of information. However, most diagnoses can be made correctly long before such information is available.

In writing this book some dogmatism was inevitable if basic principles were to be retained and properly stressed. Purists and supercritics will frequently censure such pedagogy and offer the rare case or diagnostic minutiae to support their criticism. It is true that exceptions and rare instances must always be kept in mind, but these should be relegated to a secondary place, particularly in a book of this type.

I have made little or no distinction in the method of presenting this material for undergraduate and postgraduate students. The basic principles and practices remain the same for both levels. Constant exposure to clinical material and diagnostic dilemmas are necessary prerequisites for the development of the master diagnostician, and no book can presume to accomplish this.

It is my sincere hope that the method of presenting this material will help my colleagues as it has helped me. I shall be most grateful to those who read this book if they will call to my attention errors and omissions of important items. In this type of presentation, a bibliography and list of references seem redundant, and they have been omitted.

A word of sincere gratitude is due the artist, Carl Linden. His artistic skill and creative execution of the illustrations give clarification to the text.

I wish to thank my chief, Dr. Warren Cole, for the opportunities afforded me at the University of Illinois College of Medicine.

To the J. B. Lippincott Company I wish to say, in this our third venture, "Thank you for your continued co-operation and warm understanding."

PHILIP THOREK, M.D.

Contents

1

Head

SCALP

Anatomy

The scalp consists of 5 layers; skin, subcutaneous connective tissue, epicranial aponeurosis, subaponeurotic areolar layer and pericranium. It is well supplied with blood vessels; hence, it bleeds readily, resists infection and maintains its viability.

Wounds

Scalp wounds do not gape unless the epicranial aponeurosis has been divided; therefore, one can tell at a glance the depth of a given wound. A blow on the head may be severe enough to produce a hematoma without causing a scalp wound. When such *closed wounds* are present, the extravasation of blood takes place in the loose subaponeurotic layer beneath the epicranial aponeurosis. The spread of such a hematoma is limited by the attachments of the aponeurosis around the base of the calvarium. Such a subaponeurotic hematoma is exceedingly deceptive, since its softer center may be mistaken for a depressed skull fracture. An *open* wound of the scalp increases the risk of infection.

Cephalhematoma is a collection of blood between the pericranium and one of the cranial bones. The areas most frequently involved are the frontal, the parietal and the occipital. It is the result of birth injury and must be differentiated from a *caput*

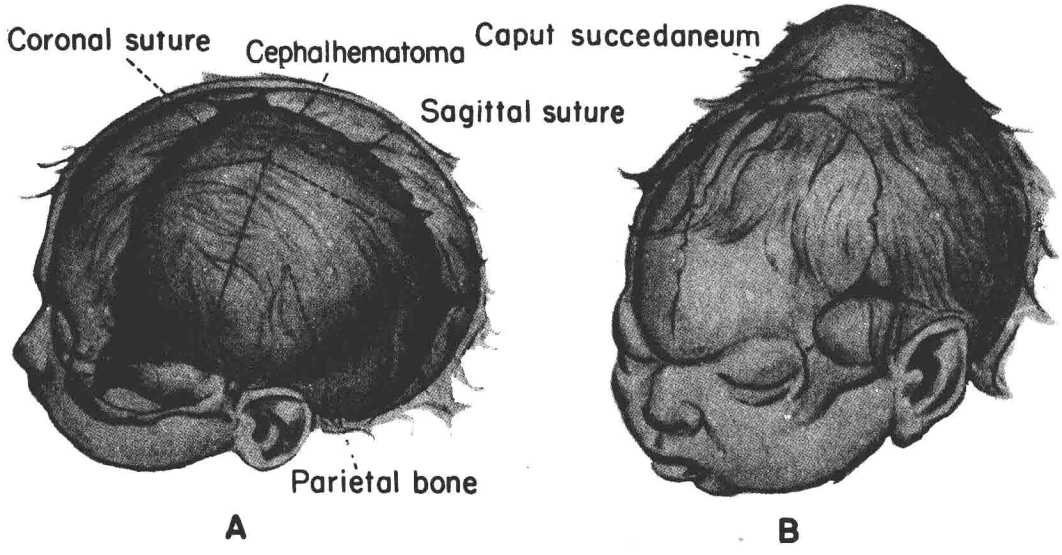

Fig. 1. Cephalhemotoma or caput succedaneum? Both may be associated with birth canal trauma. The caput succedaneum is not limited by the cranial sutures.

succedaneum. The latter is a circumscribed edema with ecchymosis which results from prolonged pressure in the birth canal. It is differentiated from cephalhematoma by the fact that a caput is not limited by the cranial sutures (Fig. 1).

Avulsion of the scalp is the tearing away of this structure from the skull. The most common causes in modern times are beauty parlor and industrial accidents. The separation occurs in the subaponeurotic layer; usually the pericranium is left intact.

Infections

Boils and carbuncles of the scalp are extremely painful, since this structure is thick and inelastic. In the aged, diabetic or asthenic, serious sequelae can result. The infection penetrates beneath the aponeurosis. In such instances the distribution would be the same as that described under "Hematoma" (p. 1). Erysipelas and cellulitis may follow abrasions or trivial wounds. Pain, edema, fever, regional lymphadenitis and leukocytosis are characteristic.

Osteomyelitis of the cranial bones usually is associated with a superimposed infection. *Pott's puffy tumor* is a circumscribed edema of the scalp associated with such osteomyelitis. A roentgenogram isolates the involved bone.

Cysts

Sebaceous cysts frequently occur in the scalp (wens); they are often multiple. Suppuration, ulceration or epitheliomatous degeneration are sequelae of such cysts. A localized swelling *in* the scalp can be moved on the skull. A swelling which originates from the bony skull permits the scalp to be moved over the swelling (Fig. 2).

Dermoid cysts are rarely seen. They occasionally communicate by a narrow neck with the subdural space.

Tumors

Both benign and malignant tumors can originate from the scalp. These must be suspected when the lesion moves with the scalp over the underlying bone. In this respect

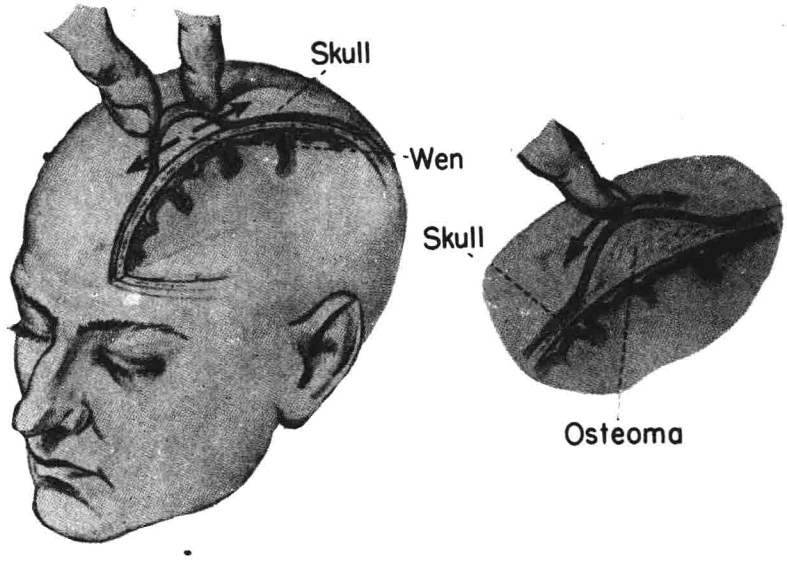

Fig. 2. A sebaceous cyst moves with the scalp over the skull. The scalp moves over an osteoma.

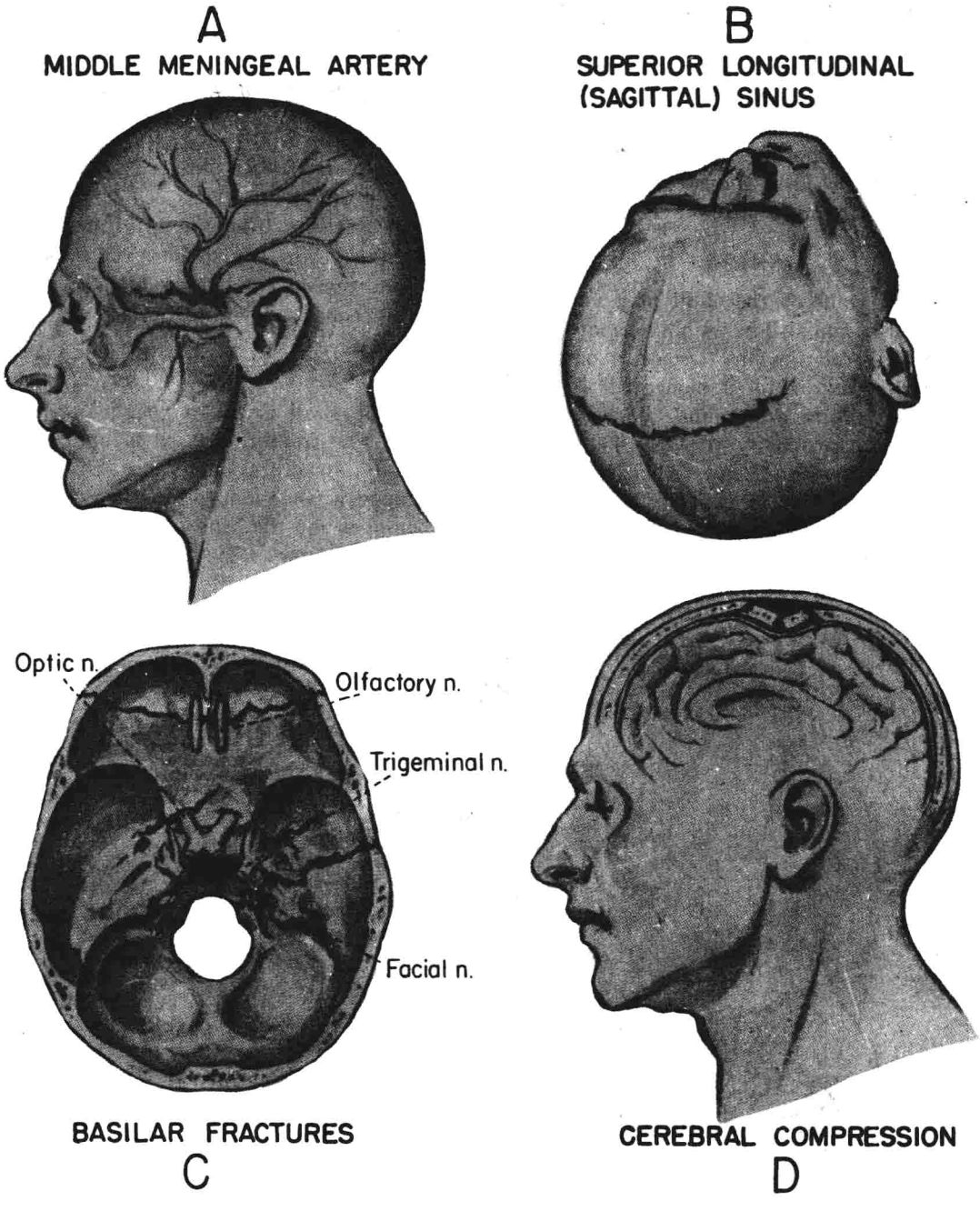

FIG. 3. Soft tissues which may be injured in skull fractures.

the tumor resembles a sebaceous cyst. Secondary tumors may also affect the scalp.

A cirsoid aneurysm occasionally involves the scalp, particularly in the region of the superficial temporal artery. It results from an arteriovenous fistula (congenital or traumatic). Enormous tortuous veins and arteries course over the scalp and the temple of the involved side.

SKULL

The contour of the skull may vary tremendously and still be within normal limits. A definite relationship to race is noted. A *dolichocephalic* skull is elongated. *Brachycephalic* skulls are round. *Megacephalic* skulls have a capacity of over 1,450 cc. and are found in the highly civilized. *Microcephalic* skulls have a capacity of less than 1,300 cc. and are found in the more primitive types.

Diseases

Osteomyelitis may occur as a primary condition, or secondary to furuncles, carbuncles, burns and infected hematomas. This has been alluded to on page 2.

Other diseases which affect the skull are: rickets, syphilis, tuberculosis, Paget's disease and xanthomatosis.

Tumors arising from the skull are usually osteomas. Also, benign giant cell tumors have been reported. Sarcoma may be primary or secondary.

Fractures

Since the skull is not a weight-bearing structure, the fracture per se is unimportant from a structural standpoint. Of great significance is the damage to the vessels, the meninges and the brain (Fig. 3).

These fractures will be discussed as

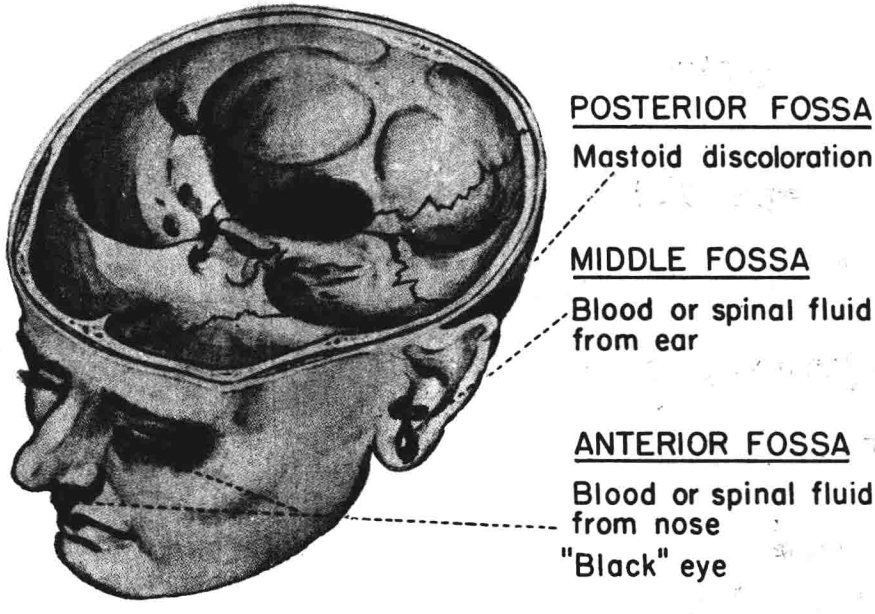

Fig. 4. Basal skull fractures may involve any one or all of the 3 fossae in the base of the skull. The outlet of the anterior fossa is the nose; of the middle fossa, the ear. The posterior fossa has no outlet but must be suspected of having a fracture when a hematoma develops in the region of the mastoid process.

vault, basal and *depressed* fractures. Any combination of these may occur.

Vault Fractures. Fractures of the vault are the most common type and are usually *linear*. If uncomplicated they are of little significance, except that they serve as evidence of injury. *In children* such fractures lead to absorption of the surrounding bone and for some unknown reason may produce a round defect in the bone. The margins of these defects are smooth and regular. Vault fractures which occur in the temporal region may cause a laceration of the middle meningeal vessels (p. 8). Extension of linear vault fractures into the base of the skull is not uncommon. *Healing* of linear fractures usually is complete in normal children from 6 to 12 months of age, but in adults such fracture lines may remain open for years. In the latter instance the edges of the fracture are smoother and round.

Basal Fractures. Basal skull fractures may involve one or more of the 3 fossae (Figs. 3 C, 4). Unlike fractures of the vault, fractures of the base are often overlooked on the roentgenogram; hence, the importance of their clinical evaluation.

Anterior Fossa Fractures. Fractures of the *anterior fossa* often involve the cribriform plates of the ethmoid bone and the paranasal sinuses (Fig. 5). Fractures involving the orbital roof may be associated with intra-ocular extravasation of blood with resultant ecchymosis of the eyelids. A gradual increase in the suffusion of blood in the *eyelids,* particularly the lower lids, in the absence of direct trauma is strongly suggestive of an anterior fossa basal skull fracture. In severe cases exophthalmos may result; this may be severe enough to endanger the eye. Involvement of the paranasal sinuses and/or the cribriform plate is of importance in that they provide an entrance for infection. Fractures of the *cribriform plate* are frequently associated with the escape of blood, cerebrospinal fluid or brain tissue from the nose. A fracture through the frontal sinus may also be associated with a pneumocephalus (air in the cranial cavity). Such air may become encysted in the frontal lobe or enter the ventricular system. Fractures in this fossa may injure the *optic* and the *olfactory* nerves. If the olfactory nerves are involved, a partial or

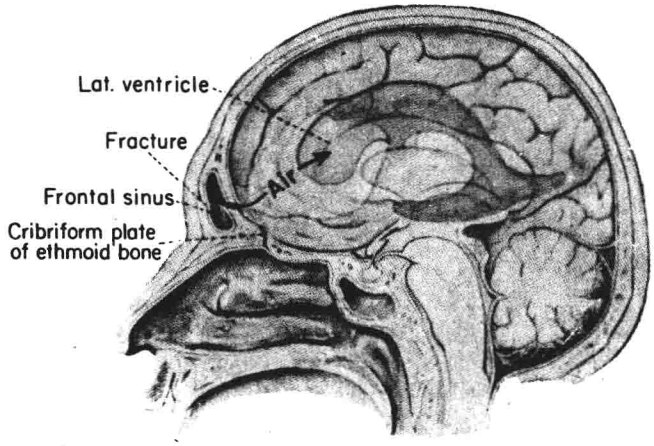

FIG. 5. Basal skull fracture involving the anterior fossa. This illustration depicts a fracture involving the frontal sinus, and air entering the cranial cavity.

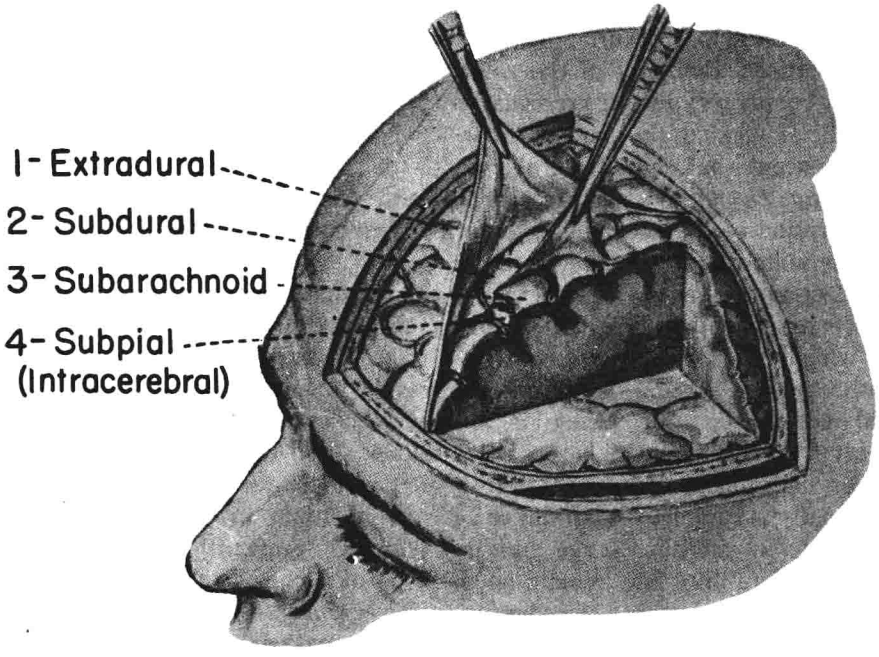

FIG. 6. The 4 intracranial spaces and associated intracranial hemorrhages. Extradural hemorrhage is usually arterial hemorrhage (middle meningeal artery). Subdural hemorrhage originates from the blood sinuses and is therefore venous. Subpial hemorrhage is intracerebral and is associated with hypertension (apoplexy) or ruptured aneurysms of the circle of Willis.

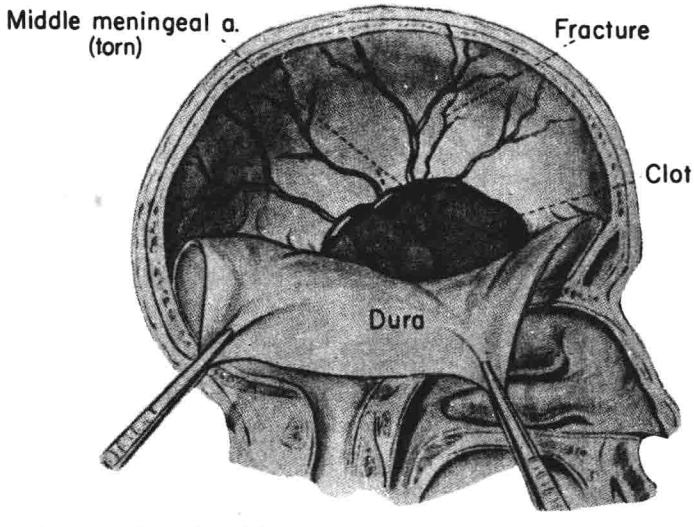

FIG. 7. Extradural hemorrhage (middle meningeal artery hemorrhage). The fracture that produces this type of bleeding involves the temporal bone. As the hemorrhage progresses the dura is stripped away from the bone.

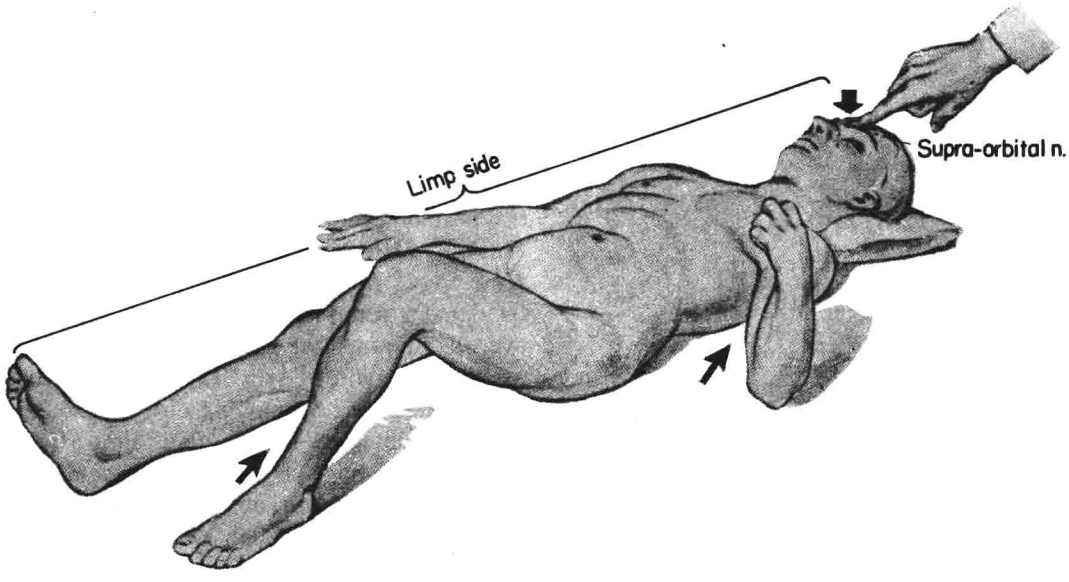

FIG. 8. The supra-orbital test applied to an unconscious patient. If a hemiplegia is present the patient responds to this painful stimulus by moving the sound side. The affected side remains limp.

total loss of the sense of smell may result. If the fracture extends through the optic foramen, usually the optic nerve is injured (p. 13)

Middle Fossa Fracture. These injuries may involve the temporal bone. In such instances blood, spinal fluid or brain tissue may appear at the external auditory meatus. The cranial nerves which can be involved in this fossa are: 3, 4, 5, 6, 7 and 8. The seventh (facial) and the eighth (auditory) are involved most commonly; this results in facial paralysis or auditory-vestibular involvements, respectively.

Posterior Fossa Fracture. When this fossa is involved, blood or spinal fluid may pass into the pharynx. *Battle's sign* (post-auricular ecchymosis) is suggestive of a posterior fossa fracture. Unfortunately, this does not appear for 24 to 36 hours. The nerves that may be involved in this fossa are the ninth, the tenth and the eleventh (p. 13).

Depressed Fracture. Depressed skull fractures are important because they may produce brain injury and convulsions. Depressed fractures in the central area over the motor and the sensory zones or in the occipital region over the visual areas are particularly dangerous. Those involving the frontal or temporal region are not as serious.

Contrecoup injury is found at a site away from the direct location of the trauma.

The interpretation and the value of spinal puncture and the study of spinal fluid are discussed on page 10.

MENINGES AND RELATED BLOOD VESSELS

The meninges, the pia, the arachnoid and the dura mater are vulnerable in head and spinal injuries. The pia mater dips into each fissure of the brain, thereby fitting very much as a glove would fit a hand. However, the dura and the arachnoid do not dip into the fissures but rather cover the brain as a mitten would cover the hand.

Clinically, it is helpful to discuss intra-

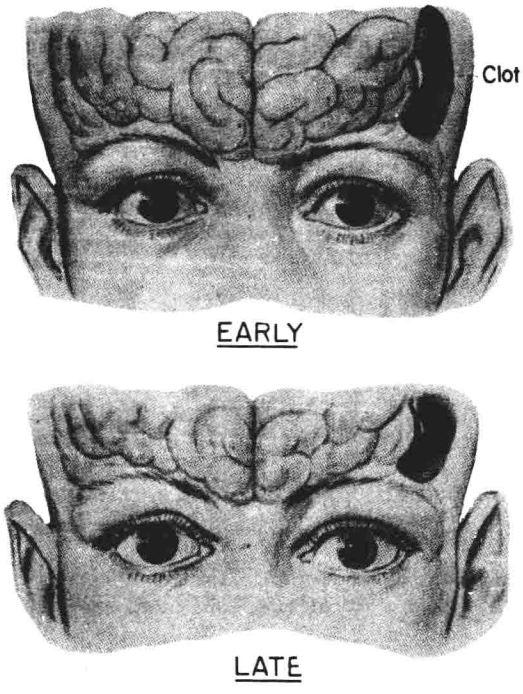

FIG. 9. The pupil as a diagnostic aid in extradural hemorrhage. In the early stage the pupil on the involved side is small and reacts to light. In the late stage the pupil on the involved side is dilated and does not react to light. Prognosis is poor when both pupils are dilated and fixed.

cranial hemorrhage as related to 4 spaces (Fig. 6):

1. The extradural space
2. The subdural space
3. The subarachnoid space
4. The subpial space

INTRACRANIAL HEMORRHAGE

Extradural Hemorrhage. This type of hemorrhage may occur with or without a skull fracture. Fractures involving the vault, particularly the temporal region, cause a laceration of the middle meningeal vessels. Many authorities believe that it is the bleeding middle meningeal artery which strips the dura away from the skull. (Fig. 7). In the classical picture the patient becomes unconscious following a blow on the head. He then recovers consciousness (lucid interval), but later becomes drowsy, lapses into coma and if untreated he dies. This clinical picture is subject to the widest of variations, even occurring without a lucid interval.

The clot produces increased intracranial tension with pressure upon the brain. *Hemiplegia* in an unconscious patient can be demonstrated by making firm pressure over a supraorbital nerve. (Fig. 8). This produces a painful stimulus to which the patient responds by moving only the sound side. The affected side remains limp. Corroborating signs such as the presence of increased deep reflexes, absent abdominal reflexes and Babinski's sign should be sought on the affected side. A monoplegia may be the first sign of an extradural hemorrhage. The arm is affected more often than the leg.

The *pupils* may be of value in both localizing and diagnosing the lesion. At first the pupil on the involved side is small and reacts to light; however, later it becomes dilated and fixed (Fig. 9). The *spinal fluid* is also a valuable diagnostic aid. Following a head injury an insidious onset of coma and hemiplegia, along with a clear spinal fluid, is suggestive of *extradural hemorrhage*. Any force sufficiently great to rupture the meningeal vessels may rupture cerebral vessels also; hence, both intradural and extradural bleeding may occur together. The differential diagnosis of bloody spinal fluid is discussed on page 10. Increased pressure of spinal fluid suggests increased intracranial pressure, which may be due to one of many causes.

Subdural Hemorrhage. The condition of so-called chronic subdural hematoma is more common than extradural hemorrhage. The trauma responsible for the hemorrhage may be trivial and forgotten. In about a fourth of these patients a history of loss of consciousness is elicited. The condition usually manifests itself 2 or 3 weeks after the head injury. The common complaints are headache and diplopia. Intermittent somno-

lence and weakness of one side of the body are due to a seepage of blood over the cerebral hemispheres. The superior sagittal sinus is fixed to the skull and is immovable in contrast with the brain, which moves on impact. The superior cerebral veins pass from the superior surface of the brain into the superior sagittal sinus. A blow on the head may tear one or more of these veins (Fig. 10). Examination of the eye grounds will show blurring of the optic disk or papilledema in about half of the cases. Spinal fluid examination reveals an elevated pressure; the fluid has a yellowish tinge (50%). The pupil on one side may become dilated and fixed. Roentgenograms of the skull at times show a shift of a calcified pineal body away from the side of the lesion. Electro-encephalograms, pneumo-encephalograms and ventriculo-encephalograms are helpful if the patient's condition permits.

Chronic subdural hematoma in infants occurs usually between 6 months and 2 years of age. The etiology is obscure; however, some are of the opinion that it is associated with mild head trauma, particularly in children who are malnourished and have a vitamin C deficiency and a bleeding tendency.

Subarachnoid Hemorrhage. This may or may not be associated with trauma. Its value in traumatic lesions has been discussed under the caption of "Extradural and Subdural Hemorrhages" (p. 8). The condition referred to as *spontaneous subarachnoid hemorrhage* is a vascular accident which occurs in younger and middle-aged people. It is due to a rupture of an aneurysm of the circle of Willis. Such aneurysms are usually congenital but in older people are arteriosclerotic. Severe meningeal irritation with stiff neck and positive Brudzinski and Kernig signs is demonstrable. If the bleeding is massive, deep coma results. A dilated pupil may be present on the side of the hemorrhage; cranial nerve involvement will help to lo-

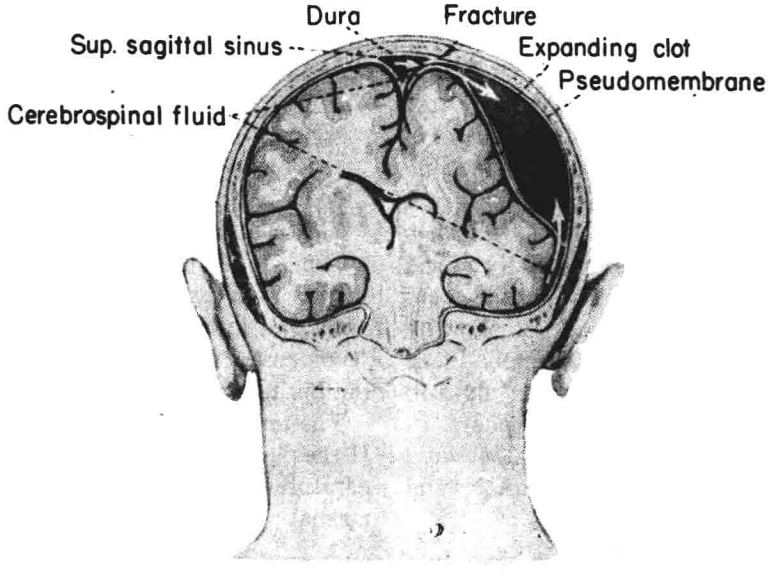

FIG. 10. Subdural hematoma. The superior cerebral veins pass from the superior surface of the brain to the superior sagittal sinus. A blow on the head may tear one of these veins or the sinus.

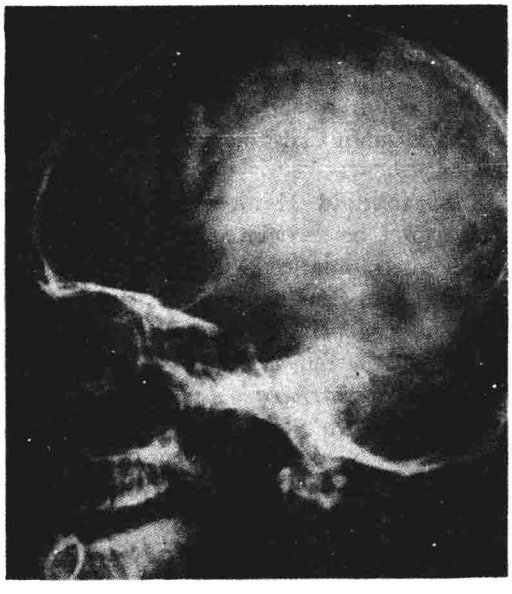

FIG. 11. Roentgenogram revealing typical digital impressions of the skull in a case of brain tumor.

calize the lesion. A final diagnosis is made by the demonstration of frank blood in the cerebrospinal fluid which is under high pressure. The question may arise as to whether or not the blood is due to the spinal puncture. This can be determined in 2 ways: In using the first method the bloody spinal fluid should be collected in 3 marked test tubes (about 3 cc. in each); if the blood is due to trauma of the spinal puncture the fluid becomes clearer and less bloody from the first to the third tube. If the blood is due to a head injury it is intimately mixed with spinal fluid, and the 3 test tubes contain an equal amount of blood and show no color changes. In the second method one permits the collected bloody spinal fluid to stand in a given test tube for 24 hours. In intracerebral bleeding the supernatent fluid is yellow; otherwise it remains crystal clear.

Cerebral vascular spasm, hemorrhage, thrombosis and embolism also must be considered in the differential diagnosis of spontaneous cerebrovascular accidents.

Subpial Space Hemorrhage. This is intracerebral hemorrhage, since the pia is so intimately connected with brain tissue that both structures act as one unit.

BRAIN

Cerebral Edema and Increased Intracranial Pressure

Brain swelling may be caused by other conditions besides trauma; however, it is the latter that is pertinent to this discussion. Since the brain and the meninges are enclosed within the rigid bony skull, little room is available for expansion. As the brain swells, intracranial pressure increases and presents definite signs and symptoms. These are important guides for the clinician, since prognosis and treatment directly depend upon them.

Signs of Cerebral "Decompensation"

The greater the brain swelling the greater the intracranial pressure. Swollen brains "decompensate." The signs of such "decompensation" are:

1. Deepening coma
2. Increasing fever
3. Slowing of the pulse
4. Irregularities of respiration
5. Elevation of blood pressure

Coma is in direct proportion to cerebral edema. If a patient enters the hospital in coma and later becomes lucid, the brain is "compensating." Should the reverse be true the brain is "decompensating."

The temperature rises as the brain swells. If the patient is in a state of shock the temperature will drop rapidly and become subnormal.

FIG. 12. The 12 cranial nerves. These nerves originate from the base of the brain and therefore are exposed to injury in basal skull fractures. Simple and rapid tests must be utilized to determine such injuries. A test for each nerve is discussed in the text.

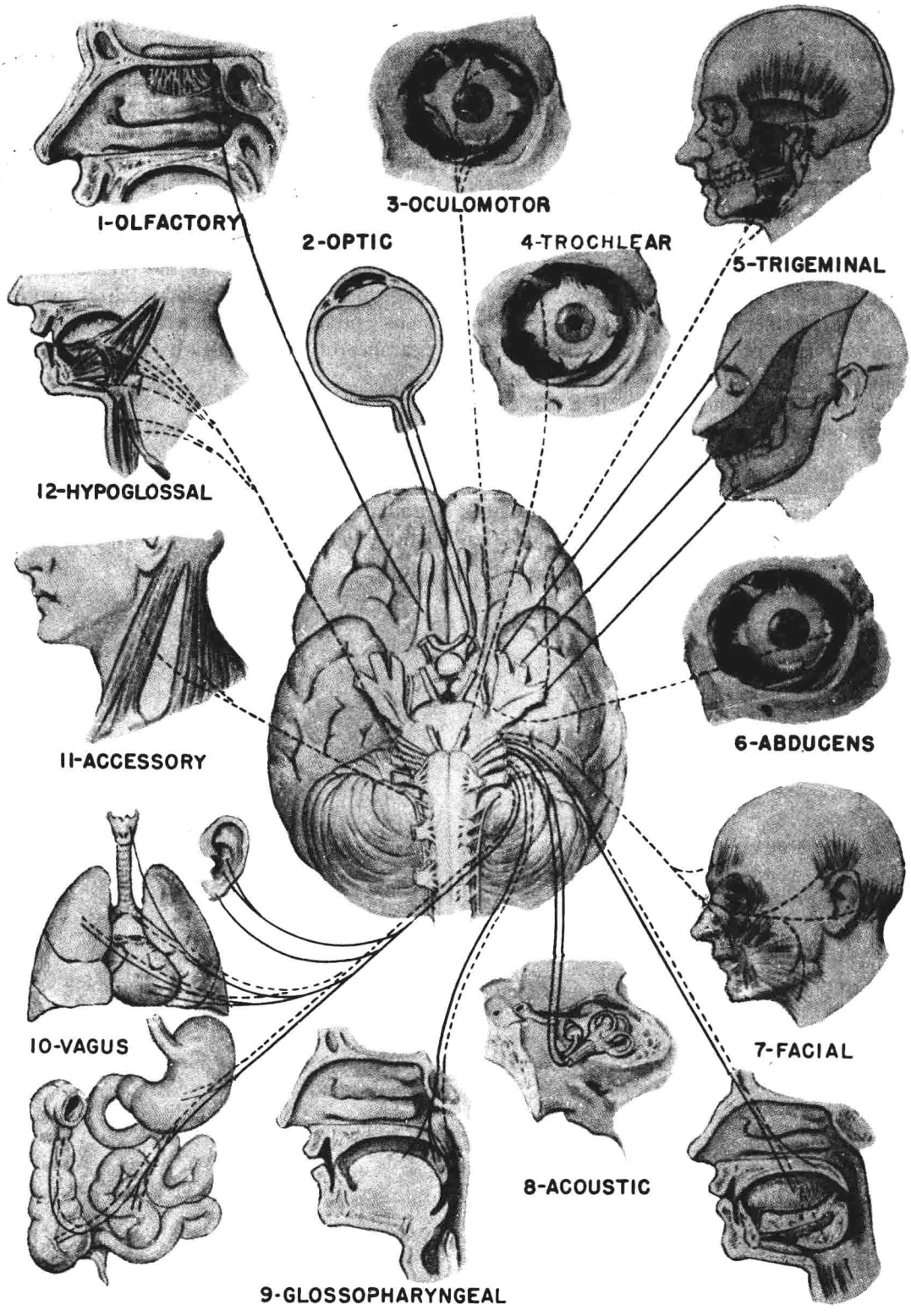

FIG. 12 (*Caption on facing page*)