TRAUMATIC PNEUMOCEPHALUS WITH SPONTANEOUS VENTRICULOGRAMS

REPORT OF A CASE*

COMDR. ABRAHAM KAPLAN (MC), U.S.N.R.
Surgical Service, U. S. Naval Hospital, Newport, Rhode Island

(Received for publication March 10, 1944)

TRAUMATIC pneumocephalus, though still rare, is now being recognized at post mortem that air had entered the frontal lobe and ventricular system through a rent communicating with the ethmoidal cells. It was not until 1913 that Luckett first reported X-Ray evidence of air in the ventricles of the brain following a skull fracture. Since then similar reports have been more frequent and in 1926 Dandy collected 25 cases and added 3 of his own. Nevertheless further discussion of this condition may be of interest.

Cerebrospinal rhinorrhea with pneumocephalus may be due to various causes. It may occur spontaneously in a patient with congenital arachnoidal prolongations along the olfactory nerve after a severe sneezing spell. Most often, however, pneumocephalus is secondary to a fracture of the skull involving the posterior wall of the frontal sinus or cribiform plate of the ethmoid bone. As the bone is fractured there is an accompanying tear of the dura which may extend through and communicate with the arachnoid, brain substance or ventricles, thereby establishing a sinus through which there is an exchange of fluid and air. The air may then be trapped in the subdural, subarachnoid, or ventricular spaces. Air may even pocket itself within the brain substance. Not infrequently the dural tear and sinus tract may be so small as to escape detection at operation. Coleman states that cerebrospinal rhinorrhea occurs in about 2 to 5 per cent of skull fractures. Other and more unusual causes of cerebrospinal rhinorrhea and pneumocephalus are intranasal manipulation, chronic infection in the region of the cribiform plate, erosion into the anterior cranial fossa by an orbito-ethmoidal osteoma, downward extension of a pituitary neoplasm through the sphenoidal sinus, and craniotomy.

Meningitis is, of course, the greatly feared complication of cerebrospinal rhinorrhea and in untreated cases the mortality varies from 40 to 50 per cent. However, with the use of sulfonamide drugs the outlook today is more favorable. Measures including rest, dependent posture, and a decrease in intracranial pressure favor the stoppage of cerebrospinal rhinorrhea and may be followed by a spontaneous cure. Adson, Cairns, Coleman and Dandy advocate surgical repair of the meninges if rhinorrhea does not dis-

* This article has been released for publication by the Division of Publications of the Bureau of Medicine and Surgery of the U. S. Navy. The opinions and views set forth are those of the writer and are not to be construed as reflecting the policies of the Navy Department.
appear within 4 to 6 days after the injury. Surgical intervention in properly selected cases, adequately prepared with sulfonamide drugs, carries a minimal risk. In a recent report by Adson there were no deaths in eight consecutive cases treated surgically.

The following case is reported because of the unusual delayed appearance of cerebrospinal rhinorrhea, and the unusual X-Ray findings.

F.J.L. a 30 year old Q.M. 2/c, was admitted to the Naval Hospital in a critical condition 26 days after a serious automobile accident. At daybreak on July 8, 1943 he had fallen asleep at the wheel of his automobile, veered to the left, and collided head-on with an automobile traveling in the opposite direction. He was brought to a nearby hospital in a desperate condition of shock. After the administration of intravenous fluids and intramuscular injections of coramine, adrenal cortex and thiamine hydrochloride his condition improved. Examination, which was necessarily incomplete, showed a depressed fracture of the right frontal bone involving the orbital margin, multiple fractures of the lower jaw and a comminuted fracture of the left femur. A Kirschner wire was put through the lower end of the femur and the leg put in a Thomas splint. Urine showed a few red blood cells only upon first examination. From the day of the accident until July 27, 1943 he was very restless, noisy, and at times maniacal. The temperature varied from 99 to 101. Abscesses under the chin which developed at the sites of fracture of the mandible were incised. He was given paraldehyde and bromides for restlessness. 50 rag. of ascorbic acid twice a day, as well as daily intravenous fluids. On July 27, 1943 his condition permitted his transfer to a nearby Naval Hospital and after two days' observation there he was transferred to this hospital.

Examination. He was a critically ill, dehydrated young man who could hardly be aroused and who, most of the time, was uncommunicative. At times he was very irritable and abusive. There was a conspicuous depression and deformity involving the right frontal bone and orbit. The lower jaw was so swollen and inflamed that the mouth could hardly be opened. The alignment of the teeth was seriously disorganized. Under each submental region there was a draining sinus from which pus could readily be expressed. The left femur was fractured at the midshaft with two inches overriding. Except for impaired bilateral grasp reflex, neurological examination was essentially negative. Temperature was 97, pulse 80 per minute, and blood pressure 130 systolic. 80 diastolic. Urine was negative. Hgb. 75 per cent; red blood cells 4,560,000 per c. mm., leucocytes 16,000 per c. mm. with 86 per cent polymorphonuclear cells, and 14 per cent lymphocytes.

Course. The patient was placed on a regime of intravenous fluids, warm irrigations of the mouth with potassium permanganate, and local wet dressings for the abscesses. Within 24 hours he was able to take small quantities of fluids by mouth, and sulfathiazole (15 gr.) was administered orally every 4 hours without interruption. After two days of this supportive regime the patient's general condition improved sufficiently for X-Ray examination.

Roentgenograms. Films of the skull showed a compound depressed comminuted fracture of the right frontal bone through the frontal sinus and cribriform plate with pneumoventriculogram showing asymmetrical dilatation of the lateral ventricles and striking cortical atrophy (Fig. 1). The lateral film, with the patient in supine position, and the X-Ray beam horizontal, showed distinct fluid levels (Fig. 2). The pineal shadow was not displaced. X-Ray films of the mandible showed an oblique fracture through the left condyle, and compound fractures in the left molar and right cuspid regions, with several sequestra.

Because of the surprising and unusual finding of pneumoventriculograms further studies of the skull were arranged for the following day. It was then, while the patient was being turned in the prone position, that clear fluid began to escape from the right nostril. About 5 cc. of this fluid was collected which showed 22 cells per c. mm., but no organisms on smear or subsequent growth. X-Ray films of the skull taken at this time showed a well outlined ventricular system with only slight dilatation of the right anterior horn (Figs. 3 and 4). The cerebrospinal rhinorrhea continued.
Operation. Craniotomy was performed on August 3, 1943, under intratracheal ether (Lt. George J. Matusak (MC), U.S.N.R., anaesthetist), supplemented with local novocaine for the scalp. The right frontal bone was exposed after reflecting the scalp by a curved incision within the hairline. A loose triangular fragment of the frontal bone had to be sacrificed, and in so doing the right frontal sinus was exposed. The depressed frontal bone was then elevated and the fractured orbital ridge brought into alignment. The mucous membrane of the exposed frontal sinus was removed. The dura appeared normal in color, and pulsated freely. Bleeding from the orbital ridge was controlled with bone wax. The right frontal lobe was elevated exposing the cribriform plate where a linear fracture was visualized to the right of the crista galli. The dura was carefully inspected but no defect could be found. A stamp of fascia taken from the temporal region was placed over the site of fracture. Two silver clips were attached to the fascial stamp to mark the location of the plastic repair. After careful hemostasis, sulfanilamide powder was dusted into the wound and closure was carried out in layers using silk throughout.

Postoperative Course. Convalescence was smooth. On the day after operation the cerebrospinal rhinorrhea ceased and has not recurred since. The wound healed by primary union. Sulfathiazole (15 gr. daily) was continued orally for a fortnight.

The patient became progressively more alert, calmer, and more responsive to questioning. One could observe almost daily mental improvement. Neurological examination showed only bilateral anosmia.

Roentgen films of the skull taken one week after operation showed a triangular bony operative defect over the right frontal region and two small metallic bodies in the region of the cribriform plate. The depressed frontal bone had been elevated (Fig. 5). The air seen in...
Figs. 3 and 4. Spontaneous ventriculograms showing size and shape of lateral and third ventricles. Note slight dilatation of right frontal horn.

previous skull films was no longer present. X-rays of the fractured left femur held in position with Kirschner pin traction showed satisfactory alignment and healing with good callus formation. Following the removal of sequestrae at the site of the mandibular fractures, Winter's arch splints were applied. The mandible then healed without further difficulty.

At present the patient's mentality, personality and behavior have returned to his previous normal state. Except for bilateral anosmia, neurological examination is negative. There are no subjective complaints of headache, dizziness or visual disturbance. The only residual

Fig. 5 (left). Postoperative view after elevation of depressed fracture. Note silver clips at the site of plastic repair over the cribriform plate.

Fig. 6 (right). Patient at time of discharge.
is a minimal asymmetry of the eyes and forehead (Fig. 6). On February 11, 1944 the patient was returned to duty.

REFERENCES