Treatment of Basal Skull Fractures With and Without Cerebrospinal Fluid Fistula

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The primary goal of therapy in fractures of the base of the skull is the prevention of intracranial infection; in all such cases the subarachnoid space must be considered potentially contaminated. Before the advent of antibiotics, this risk was high, and whenever a cerebrospinal fluid fistula was present, many felt that meningitis was inevitable. There are no large studies of the incidence of meningitis in head injuries before the advent of antibiotics. Teachner's study in 1927 was able to lower the mortality from infections in fractures through the frontal sinus from 68% to 13% by early repair of the dura and drainage of the sinus in a small series of patients. Munro reported a 60% mortality in five cases of persistent rhinorrhea following head injury. Calvert noted that 50% of 20 patients with cerebrospinal fluid (CSF) rhinorrhea developed meningitis.

With the use of antibiotics, the risk of meningitis in the acute state of basal skull fractures has been markedly reduced. Most neurosurgeons advocate surgical repair of the dura only in cases of persistent cerebrospinal fluid rhinorrhea or otorrhea. The other hand, advocated operative closure of the dura in all patients with rhinorrhea and basal skull fractures as soon as their condition permits. He based this conclusion on a comparison of 26 patients with rhinorrhea who were not operated on and 55 patients who had craniotomy and dural closure. Six of the 26 unoperated patients developed meningitis, four of whom died, while only one of the 55 operative patients developed meningitis and this was not fatal.

However, if operative treatment is confined to cases with cerebrospinal fluid leak, some cases will not be treated which will later develop meningitis. Of 128 cases of paranasal sinus fracture, Calvert noted six cases of meningitis in patients who had no history of rhinorrhea or otorrhea. It seemed worthwhile to review our own case material to determine the risk of infection in basal skull fractures with and without CSF leak to see if the cases of recurrent meningitis could not be predicted during the acute illness.

Case Material

All cases of basal skull fracture at King County Hospital for the 5-year period from 1953 to 1958 were reviewed and follow-up attempted to determine the incidence of infection in an unselected group of cases with this diagnosis. In addition, all cases of meningitis associated with a previous basal skull fracture over a 15-year period, 1947 to 1962, at the same hospital were reviewed in a further attempt to see how frequently recurrent meningitis occurred following a basal skull fracture. We have included two additional cases to demonstrate our indications for the occasional patient who needs operative repair of a dural defect.

The diagnosis was determined on clinical grounds since only a small portion of basal skull fractures can be located by x-ray. Significant clinical findings included the drainage of blood or cerebrospinal fluid from the nose or ears, bilateral periorbital ecchymosis, Battle's sign, and anosmia. Undoubtedly, some patients were treated as basal skull fractures who did not have a fracture because we were using clinical criteria for diagnosis. The treatment was uniform except for the type of antibiotics given. Procaine Penicillin 600,000 units with Streptomycin 0.5 gm twice daily or Chloromycetin 250 mg four times daily were used. Patients were placed on antibiotics as soon as the diagnosis was made and were kept on them for a minimum of 5 days after the leakage had stopped. All patients received a lumbar puncture on admission; frequently the diagnosis of CSF leak was further substantiated.

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by a very low CSF pressure. If rhinorrhea or otorrhea were present, repeat lumbar punctures were done daily or twice daily, each time draining off enough fluid to lower the intracranial pressure to that of the atmosphere or until the patient developed headache. This was done to reduce abnormal drainage of CSF through the fistulous tract and to facilitate natural repair. In addition, the patient was placed in semi-Fowlers position and instructed not to blow his nose. For otorrhea, care was taken not to allow any cotton or bandages to obstruct the external auditory canal.

Results

Group 1. Of 1250 head injuries seen in the 5-year period from 1953–1958, 303 were basal skull fractures (24%). There were 35 cases with a documented CSF leak; this represented 2.8% of the head injuries and 11.5% of the basal fractures (Table 1). All cases with rhinorrhea or otorrhea ceased to leak within 2 weeks under the above regimen of multiple lumbar punctures and elevation of the head. No case of otorrhea persisted beyond 5 days, while one case of rhinorrhea persisted for 2 weeks and required a total of 13 lumbar punctures. Three cases of meningitis developed during the acute illness but all three patients had entered the hospital more than 2 days after their injury and had the infection on admission. None of the 300 patients who received antibiotics from the day of their injury developed meningitis in the acute period. Setting a minimum follow-up of 1½ years, we were able to get detailed information on 77 cases which included 27 cases with CSF leak and 50 cases without a leak. The average interval of follow-up was 5 years, with a range from 1½ to 12 years. There were no cases of recurrent meningitis in this group with or without otorrhea or rhinorrhea.

Group 2. In the 15-year period from 1947 to 1962, we were able to find nine cases of meningitis which were associated with a previous basal skull fracture. Seven of the nine cases entered the hospital 2 days to 1 week after their injury and had meningitis when admitted. One case with pneumocephalus developed staphylococcal meningitis while on Penicillin and died with an associated subdural hematoma. Only one case over this 15-year period had a delayed meningitis. This 12-year-old girl had a severe diastatic fracture and rhinorrhea. She was decerebrate for 2 to 3 weeks post-injury and was not considered for surgical repair. Eighteen months later she developed meningitis, but repair could not be carried out because she was no longer eligible at the charity hospital. As we review her x-rays in retrospect, we consider that she should have had early operative repair because of the diastasis of the fracture site across the cribiform plate.

We have three indications for operative closure of a dorsal defect in basal skull fractures not due to a missile: (1) Recurrent meningitis, (2) X-ray evidence of herniation of the brain into the sinuses through a large diastatic fracture, (3) X-ray evidence of a spicule of bone projecting into the brain. In order to demonstrate herniation of soft tissue into the ethmoid air cells, laminography in the frontal plane is essential. We are reporting two recent cases to emphasize these points.

Case Reports

Case 1. A 42-year-old man was admitted to the Neurological Surgery Service during his fourth episode of meningitis. He had had an auto accident 5 years before in which he had sustained a right frontal skull fracture, but had had no rhinorrhea with his acute injury. Following his third bout of meningitis a right radical mastoidectomy was performed because of a chronic mastoiditis that was considered to be a possible source of infection. Since the accident he had had generalized seizures which were controlled with medication. Physical examination was normal except he was unable to smell out of the right nostril. Skull x-rays showed an old frontal fracture, and frontal laminograms (Fig. 1) demonstrated soft tissue herniation through a defect in the floor of the frontal fossa into the ethmoid air cells. Pneumoencephalography revealed enlargement of the