TWO UNUSUAL CASES OF INTRACRANIAL INFLAMMATION FOLLOWING PURULENT OTITIS MEDIA WITH MASTOIDITIS

BY

E. B. DENCH, M.D.

AURAL SURGEON, NEW YORK EYE AND EAR INFIRMARY

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IN the following brief report of two cases which have come under my own observation, I desire to call the attention, not only of otologists, but also of the general practitioners, to a danger which attends suppurative inflammation of the middle ear with involvement of the mastoid, and which, though not unknown, is of such unfrequent occurrence as to be frequently forgotten.

The danger to which I refer is the involvement of the intracranial structures in an inflammatory process, from the extension of the inflammation from the external surface of the temporal bone. As is well known to every surgeon, when grave intracranial complications arise during an inflammation of the middle ear or the surrounding bony parts, the inflammation usually gains access to the cranial cavity, either through the roof of the tympanum, by rupture or by metastasis; or the lateral sinus is infected in either of the above ways by the suppurative process in the mastoid; or the channel of invasion is the internal auditory meatus, along the sheath of the auditory nerve to the meninges.

Sometimes, but with the greatest rarity, the infection takes place in the following manner. The pus formed in the middle ear or mastoid appears beneath the periosteum, giving rise to the ordinary post-auricular abscess, so familiar to every one who has seen even a few neglected cases of purulent otitis media. With the appearance of the pus

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beneath the periosteum, the symptoms are apt to abate somewhat, since the tension is relieved, hence such an abscess may be neglected for a considerable period of time. During the interval, however, the purulent material burrows, dissecting up the periosteum from the bone over a large area, and thus depriving it of its nutrition to a great degree. There is practically no limit to the extent to which the bone may be thus denuded. The next step is a necrosis of this bone over a small area, and as the small sequestrum breaks down, pus is absorbed by the internal periosteum or dura, and a meningitis set up. It is not necessary even for necrosis to take place, in order to set up an inflammation of the dura. Numerous venous channels exist between the external and the internal periosteum of the cranial bones, and these, passing through the parietes of the skull, can easily carry the infection to the interior.

In young children, before the ossification of the petro-squamous suture, or rather its continuation, the suture between the mastoid and squamous portion of the temporal bone, infection is especially liable to take place, for the reason that, in many instances, this suture encloses a fold of dura mater and this increases the chances of infection, in case the external surface of the mastoid and the neighboring parts are constantly bathed in pus. It thus happens that all danger has not passed when we incise a post-auricular abscess, and evacuate the pus; it is only by a most careful exploration of the denuded bone that we can say with any degree of certainty what the termination will be. A small necrotic area may be present, through which communication with the intracranial structures may already exist, and the infectious process may have already passed beyond the limits of simple operative procedure before the abscess has been incised. Two cases which I have seen during the past two and one half years will show that this danger is not an imaginary one.

Case 1 was that of a child of about ten months, who, when first seen, was suffering from a purulent otitis media of about nnie months' duration. Behind the auricle was a diffuse fluctuating mass, extending fully one inch behind the posterior attachment

of the auricle, and superiorly about the same distance above the auricular attachment in this direction. The mother stated that this tumor had been present for about three weeks. The discharge from the external meatus at this time was profuse. At no time, according to the mother's statement, had the child appeared to suffer much pain. The fluctuating swelling behind the ear was opened by a free incision, and a large quantity of pus evacuated. The underlying bone was found rough and denuded in every direction, and thus the canal superiorly and posteriorly was dissected completely away from the underlying bony structures. As the operation was performed without anæsthesia, no prolonged attempt was made to find a sinus entering the structure of the mastoid, the wound was packed with iodoform gauze, and a compress and bandage applied.

The wound was dressed daily by the nurse, the child being brought to the hospital each morning for this purpose, while the mother was directed to cleanse the ear frequently during the day by means of the syringe.

Upon examining the wound a few days after the operation, a sinus was found, which admitted the probe into the mastoid, and fluids injected into this opening easily returned through the meatus ; the secretion soon diminished in amount, and the child seemed to be doing very well.

In the course of a few weeks, the external wound had nearly closed, and the discharge from the ear was also growing much less in quantity ; fluids injected into the sinus leading to the opening into the mastoid still returned through the meatus, showing that the drainage was efficient. The margins of the external opening, however, presented the exuberant granulations so characteristic of dead bone, and a probe introduced showed that the denuded area which existed when the abscess was first opened, had not decreased in size. As the child was doing well, however, no change was made in the treatment, and the orifice of the sinus over the mastoid at last contracted, until it would just admit the point of the syringe ; the discharge from the sinus was so slight that frequently a crust would form over it under the dressing, it being necessary to separate it each time the wound was dressed, which was now every second or third day, this procedure having been entrusted to the mother, on account of the difficulty of bringing the child to the hospital during the winter months.

No further improvement taking place, I proposed to the mother the advisability of reopening the wound under anæsthesia, and removing the carious bone with the curette; this she finally acceded to, and nearly a week later chloroform was administered and an incision made over the affected region, following the course of the old incision and extending upward, and somewhat backward, about two thirds of an inch above the superior margin of the bony canal. On separating the edges of this incision, and exploring the deeper parts with the probe, this instrument was found to enter an opening at the upper part of the incision, and to pass without encountering the least resistance, for a distance of two and one half inches directly inward; the hemorrhage from the wound was very free, the blood being decidedly venous in character. Recognizing at once that the wound opened into the cranial cavity at the line of the squamo-mastoid suture, and further, as the meninges had not been encountered, that infection and subsequent meningeal disintegration had taken place at this point, the wound was packed and the child permitted to come out from under the influence of the anæsthetic. The serious nature of the discovery was imparted to the parents, and close questioning elicited the fact that a few days previously, and during the interval in which I had not seen the child, the tumefaction behind and above the ear had re-appeared, and that the child had been drowsy, or, when awake, irritable. On the day preceding the operation, the mother had removed the dressing, and the crust covering the sinus, and immediately a large amount of pus was discharged, and the child appeared relieved and hence did not attract my special attention immediately before the operation.

On the following morning, the wound was dressed, and the child appeared natural, but the next day marked cerebral symptoms, indicative of meningeal inflammation, appeared, and the case terminated fatally at the end of a few days. No autopsy was permitted.

In this case there seems to be no doubt that although the mastoid cortex had been perforated, and satisfactory communication with the middle ear established, yet during the time the post-auricular abscess remained unopened, the periosteum had been stripped from the bone over a large area, which subsequently failed to regenerate; in this way

perforation at the sutural line took place, and as the external opening over the mastoid gradually closed, infection occurred through the sutural perforation from the purulent material within the abscess cavity, leading to meningeal inflammation and disintegration at this point.

The history carries with it the suggestion that, in young children especially, a thorough examination of the entire denuded area should be made upon opening any abscess connected with the mastoid, and the sutural lines examined in case the bone is denuded in these situations, and also that although an inflammation within the mastoid may have terminated in spontaneous perforation of the cortex, the pus in this location is still a potent factor for evil.

Schwarze [1] cites a case of abscess of the temporal lobe in a child, the result of a suppurative process in the middle ear, the infection having taken place through the petro-squamous suture; such cases are not as rare as those in which the infection takes place, as in my case, through the continuation of the suture which marks the junction of the squamous and mastoid portions of the temporal bone.

It would seem that, while the sutural junctions in young children might be somewhat easy points of invasion for purulent material, the compact mass of the adult temporal bone would naturally furnish a barrier to such an inroad. This we find is not the case, as the following history will show:

Case 2.—J. C., æt. forty, was admitted to the hospital with a history of a purulent discharge from the right ear of four weeks' duration. The pain had been severe until the discharge appeared, after which time it had caused him very little trouble. Patient had been treated for syphilis, and there was evidence of a former iritis in the left eye. Examination revealed a great amount of swelling and œdema of the tissues above and behind the right auricle; the œdema extended forward, involving the right eyelid, almost closing the eye. The external auditory canal was greatly swollen, especially along the postero-superior aspect and in its deeper parts. The membrana tympani exhibited a perforation of small size in the postero-superior quadrant, through which pus could be seen to exude slowly.

[1] *Archiv für Ohrenheilk.*, vol. xxxii., p. 295.

Pressure over the œdematous region above and behind the auricle, elicited a moderate amount of tenderness ; the patient also complained of a dull pain over the entire right side of the head.

Operation : After a thorough cleansing of the parts, an incision was made from the tip of the mastoid to a point three fourths of an inch above the level of the superior wall of the canal, close to the attachment of the auricle. The tissues were greatly thickened and the bone was found denuded throughout the entire extent of the incision, and over a considerable area beyond the limits of the incision, in all directions. The chisel was applied and an attempt was made to open the antrum. The entire mastoid was found to be sclerotic, and after chiselling over a broad area for a considerable depth, the posterior wall of the canal was broken down and communication with the middle ear established in this way. The wound was dressed in the usual manner and the patient returned to the ward.

The history of the case was uneventful for eight days, except for the persistence of the œdema of the right eyelids, as well as of a certain amount of thickening and infiltration in front of the tragus. On the eighth day the patient complained of headache, and the temperature, previously normal, rose to 100.5° in the evening ; the appearance of the wound was unchanged, and the following morning the temperature was normal and the unpleasant symptoms had disappeared. The night, however, was an uncomfortable one, the patient complaining of intense headache upon the right side. This persisted throughout the following day, and was not attended with any rise of temperature ; the mental condition was perhaps a little dull, but at the time I attributed this more to the general temperament of the patient than to any other cause. Upon visiting him in the afternoon, an inspection of the wound revealed an increase in tension of the parts lying in front of the tragus, together with a more marked œdema in the right anterior temporal region. Believing that there was deep-seated suppuration beneath these swollen tissues, I anæsthetized the patient and prolonged the former incision forward and downward, liberating about two drachms of pus from beneath the periosteum. The bone over the area was very rough, and so much degenerated that in tilting the flap downward it easily crumbled under the elevator. The removal of these fragments revealed the meninges bulging into the wound. The dura was deeply congested and granular ; pulsation could be felt. Exploratory puncture with a hypodermic needle yielded only a bloody fluid.

After removing all softened bone, thus enlarging the opening considerably, the wound was packed and the patient returned to bed.

On the following day, there was considerable headache and the condition of hebitude was well marked. The wound was dressed, and was found to be doing well; the intradural pressure appeared less marked than at the time of the operation. During the night there was mild delirium; in the morning the patient at first seemed a little brighter than upon the preceding day, but he soon passed into a condition of stupor, from which he could only be aroused with difficulty; in the afternoon the breathing became stertorous, and assumed the Cheyne-Stokes type, and a well marked paresis of the right upper and lower extremities was developed. Dr. Abbe kindly saw the case with me, and concurred in the opinion as to the advisability of exploring the cranial cavity. The patient was anæsthetized and, assisted by Drs. Abbe and Bacon, and by Drs. Esson and Ard of the house staff, I enlarged the opening into the cranial cavity in all directions by means of the rongeur. A dural flap was then raised, and an aspirating needle was passed into the cerebral substance in several directions, without revealing any collection of fluid. A director was passed beneath the meninges, inward along the petrous portion of the temporal bone, and forward toward the frontal region, without evacuating any fluid. The lateral sinus was exposed and found to be healthy. No further exploration appearing advisable, the dural incision was closed with catgut sutures, the external wound dressed with iodoform and bichloride gauze, and the patient returned to bed. The coma remained unchanged after the operation, and death ensued eighteen hours later. The temperature, except for the rise already noted, had been normal throughout.

The POST-MORTEM EXAMINATION by Dr. Weeks revealed a hemorrhagic pachymeningitis extending over the entire right side, but most marked over the frontal and temporo-sphenoidal regions. The effusion had in a marked degree flattened the convolutions, especially in the frontal region. In addition to the hemorrhagic lesion, a small amount of purulent exudation was found upon the internal surface of the dura, possibly due to the breaking down of the fibrin of the clot. The brain itself was normal. The roof of the tympanum exhibited nothing abnormal, and the meninges in this region were healthy.

In this case then, the pus resulting from the inflammatory process in the middle ear, not being able to find an exit through the mastoid cells, owing to the osteo-sclerosis which existed in this region, dissected up the periosteum of the external auditory meatus, and entering the temporal fossa burrowed beneath the periosteum, denuding the squamous and mastoid portions of the temporal bone over a large area, causing a circumscribed necrosis of the squamous portion of the temporal bone. At this point an inflammation of the dura was set up, and this inflammation, instead of following the ordinary course of an infective pachymeningitis, took on the hemorrhagic form of inflammation, characterized, as we know, by the formation of a large number of thin-walled blood-vessels, the subsequent rupture of a number of these vessels giving rise to the submeningeal effusion, which terminated the life of the patient. Had the subdural effusion been evacuated by the surgical procedures instituted, the life of the patient might have been prolonged, although from the nature of the affection the ultimate result must almost necessarily have been fatal.

These two cases furnish us with sufficient evidence that a subperiosteal abscess of the mastoid region may in itself constitute a somewhat grave condition, and that even when a free channel is established from the middle ear to the outer surface of the mastoid, the danger of purulent infection of the cranial contents has not passed. I am aware that this mode of infection is not a discovery. Attention was first called to it by Andeer,[1] who reported a case of meningitis following a caries of the external surface of the temporal bone, consecutive to a subperiosteal mastoid abscess in a child of one and a half years. The child had suffered from a purulent otitis media previously. Somewhat similar cases have been reported by Pomeroy,[2] and Reinhard and Ludewig,[3] as occurring in children, while Moore[4] observed an

[1] *Arch. für Ohrenheilk.*, 1874, vol. ix., p. 139.
[2] Internat. Otolog. Congress, 1876, *Arch. für Ohrenheilk.*, vol. xii., p. 313.
[3] *Arch. für Ohrenheilk.*, vol. xxvii., p. 218.
[4] ARCH. OF OTOLOGY, vol. xi., p. 25 ; translation in *Zeitsch. für Ohrenheilk.*, vol. xi., p. 254.

instance occurring in a male of fifty years. Andeer in his paper calls special attention to the infection of the cranial contents from a subperiosteal abscess, a point which is not especially emphasized by the other writers. In none of the cases reported, however, has the metastatic meningeal inflammation been of the hemorrhagic type, and I am of the opinion that this is an exceedingly rare occurrence.

In closing, I desire to thank Dr. Ard of the house staff of the New York Eye and Ear Infirmary for the careful notes of Case 2 which he has so kindly furnished.

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