THE SURGICAL TREATMENT OF ANKYLOSIS OF THE TEMPORO-MAXILLARY ARTICULATION.

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THE subject of ankylosis of the temporo-maxillary joint has received considerable attention from surgical writers, and many cases of operation for this condition have been reported. Like most procedures in surgery, these operations have a post-antiseptic history very different from that which they showed in pre-antiseptic days. Formerly, if the bone was divided and a false joint made, it was a not uncommon experience to have so considerable an inflammatory swelling and so much pain that the bones were fixed and held in apposition by the spasmodically contracted muscles, and when, finally the parts were so far advanced towards healing as to permit of forcible motion being attempted, it was usually found that the ends of the bones were so fastened together that in spite of all endeavour the ankylosis returned and the case was no better than before. In attempting to obviate this difficulty extensive resections of the ascending ramus were undertaken in some cases, with the object of removing so much bone that the severed parts could not afterwards come together and unite. Of the operations devised upon this plan perhaps the most successful has been that of Esmarch, which consists in the removal of a wedge-shaped piece from the junction of the ramus and body of the maxilla through an incision just behind the angle of the jaw. In 1872, when surgery, stimulated by antiseptic teachings and results, was pushing forward along all lines, Bottini reported a case in which a good, permanent result was obtained by division of the neck of the jaw close to the articulation, and it was soon found that under aseptic conditions this method could be relied on to give a good false joint. Since that time these two plans, with occasional modifications by other operators,¹ have been rivals in the treatment of these deformities.

In considering these operations we must carefully distinguish between those cases in which the ankylosis is largely due to extensive cicatricial formations in the soft parts, as a result of noma, lupoid inflammation, or burn, and those in which there is a true bony ankylosis of the temporo-maxillary joint without involvement of the soft parts. When the jaws are bound by cicatricial contraction the section of the bone must be in front of the cicatrix, or at least must be so placed that the portion of the bone that is freed by the operation is no longer held by cicatricial bands. Necessarily, therefore, the division must usually be close to the body of the jaw, and for these cases Esmarch's operation is admirably adapted and obtains the best mechanical condition of the jaw possible under the circumstances. In the second class of cases, however, of true bony ankylosis it is plain that, other things being equal, the nearer the new joint is to the site of the old one the more nearly it conforms to the conditions on which the muscles were designed to act, and on which, *a priori*, they act best. In comparing, therefore, an operation which makes the section of the bone close to the old articulation with one which makes it at or near the angle of the jaw, we have to consider the former as the better operation, unless it has disadvantages either of danger, untrustworthiness, or unsightliness which more than counterbalance its mechanical advantages. My experience of the high section of the bone leads me to think it has none of these disadvantages, for in the seven cases in which I have operated in this way the mechanical result has been uniformly good, showing the trustworthiness of the procedure,

and in none of them has the scar been unsightly. In all but one case it has been so slight as to readily escape observation at the end of a year. It is so placed that the hair can often be drawn forward over it and conceal it altogether. Paralysis of the orbicularis palpebrarum muscle was troublesome in two of the early cases, but finally disappeared. By keeping the incision close up to the zygoma this can be avoided.

I have met with no especial element of danger in these operations except that which is common to any operation upon an ankylosed jaw—namely, the danger of asphyxia under anaesthesia. In one case the breathing was stopped by the falling of the tongue into the throat, and a quick tracheotomy was performed. Recognising this danger, I have always had the tracheotomy instruments laid out during these operations, and this was the only case in which I had to use them. It is true that a case is reported in which the carotid artery was wounded, but this would have been avoided had the section of the bone been carried out inside of the periosteum in the manner I shall presently describe. My operation has been in the main after the manner of Bottini. It has been as follows. In the first place, to discover on which side the ankylosis exists is not always easy. Cases have been reported in which the sound side was operated on by mistake. To determine this point the history should be investigated, and often it will be found that the original osteo-periostitis which led to the ankylosis was distinctly limited to one articulation. The history is, however, often doubtful on this point, and a decision must be reached by an examination of the jaw itself. If the fingers are pressed in on the teeth upon each side, and at the same time the patient makes vigorous attempts at mastication, a springing of the bone on the free side will be noticed, in quite distinct contrast to the fixity on the ankylosed side. Furthermore, as there is usually a loss of cartilage and even of bone in the process which destroys the joint, the jaw naturally falls over to that side, and this lateral displacement may be readily made out by noting the relation of the middle lines of the two jaws as shown by the incisor teeth or otherwise. After a study of these several points a mistake must be exceedingly rare. In my first two cases I made the incision vertically over the neck of the jaw, but later I adopted Bottini's incision along the lower edge of the zygoma, with a vertical cut added if more room was needed. The vertical incision should not extend far down in front of the ear lest the facial nerve suffer injury, but it may run up over the zygoma. The incision is carried at once down to the bone, which is cleared by a periosteum elevator. The division is then made with a chisel, which cuts out a wedge across the whole width of the bone which represents the neck of the jaw, even when this is a mass involving both the condyloid and coronoid processes. With care this division can be kept within the limits of the periosteum, and all danger of injury of the carotid artery is thereby avoided. To ensure safety a curved retractor may be carried under the posterior edge of the bone during the use of the chisel, thus wholly obviating any danger of injury to the vessels lying there. In none of my cases has the internal maxillary artery even been injured. When the bone is completely divided the final separation may be accomplished by pushing a wedge-shaped screw gag into the cleft in the bone and so forcing it apart. The ends of the bone are then readily rounded off with rongeur forceps. The hæmorrhage is trifling and the wound may be tightly closed. A cork should be kept between the teeth on the injured side for the first week or fortnight while the healing is going on, but may be taken out as often as is desired for passive motion after the first three or four days. The following is a brief summary of the seven cases on which I have operated.

CASE 1.—A girl, aged thirteen years, suffered from ankylosis of the left temporo-maxillary joint for ten years the result of scarlet fever. She was operated upon in August, 1887, the neck of the condyle being chiseled through just below the point where it became welded into the temporal bone. This was done through a vertical incision about one inch in length. Slight loss of power over the eyelid supervened, but this disappeared after a few months. The patient was seen on Jan. 19th, 1895, eight years after the operation. At that time the scar of the incision was barely visible. She noticed that to tightly close the left eye required more effort than in the case of the other, but the ordinary movements of the eyelid were perfect. The left side of the jaw was somewhat undeveloped as compared with the other. The mouth opened three-fourths of an inch,

¹ Dr. J. E. Mears has reported an operation through the mouth in which he saws the ramus through on a level with the last molar tooth, and after separating the attachment of the temporal muscle he seizes the bone with lion forceps and forcibly twists it out. If it yields at the neck the condyle may be chiseled out and left. This method would not seem to be applicable for those cases in which both condyloid and coronoid processes are welded firmly to the bones of the skull, a condition not always discoverable before operation. The slight scar of the external operation makes it of less importance to attack the bone at a disadvantage within the mouth; and in the cases to which Dr. Mears's operation is applicable it removes more bone than is necessary, and has in that way a mechanical disadvantage. The results that Dr. Mears has figured are certainly very good.

and there had been no change in this since just after the operation. Lateral motion was considerable, one-quarter of an inch or more, and the grinding power was good.

CASE 2.—The patient, a girl aged seventeen years, had ankylosis of the left temporo-maxillary articulation of thirteen years' standing, which followed mastoid disease caused by scarlet fever. She was operated on in July, 1888. The operation was begun with a vertical incision, but as it was found that the coronoid process was also involved in the mass of bone welding the maxilla to the temporal bone a cross incision was made along the lower edge of the zygoma. This patient was examined on Jan. 9th, 1895, eight years after the operation. The scar of the operation was not very noticeable, and she said that its appearance had caused her no annoyance. When her mouth was widely open the gums were $\frac{3}{8}$ in. apart, and with her plates of teeth in place she could open her mouth half an inch. The mastication was vigorous and she had capital grinding power. The eyelid had good motion.

CASE 3.—A woman, thirty years of age, fell when three years old, striking her chin, and this was soon followed by ankylosis of the left temporo-maxillary joint. Forcible attempts to separate the jaw with wedges accomplished a bending of the body of the lower jaw, so that while the molars and even the gums in the back part of the mouth were in close apposition the incisors were about one-half a centimetre apart. An operation was performed in April, 1889, in the manner followed in Case 2, and here, too, the welding of the jaws to the temporal bone was by a thick irregular mass of bone. Some temporary paralysis of the eyelid followed the operation. This patient was seen on Jan. 14th, 1895. The motions of the jaw were well preserved and the grinding power was excellent. When the mouth was open the aperture between the teeth measured between three-quarters of an inch and an inch. The scar of the operation was practically invisible, it being difficult to determine, except by close inspection, which was the side of the operation. While the motions of the eyelid were perfectly preserved there was a perceptible difference between the action of that side of the face and the other. This was mainly noticed when laughing, and consisted in an excessive action of the muscles around the eye on the affected side rather than in any lack of power in them. This was so slight as not to be annoying.

CASE 4.—A woman, aged thirty-two years, received a blow upon the jaw when six years of age. This was soon followed by ankylosis of the right side of the jaw. An operation was performed on Dec. 13th, 1889. The incision was made just beneath, and parallel to, the zygoma and was crossed by a short vertical incision through the skin alone. The condyloid and coronoid processes were both welded to the skull by an irregular mass of bone. This was chiseled through. She left the hospital well on the thirteenth day after the operation. The patient was seen in Dec., 1894. At that time the scar of the operation was barely visible. The motions of the jaw were good. The mouth opened a little over an inch and there was good grinding power with lateral motion of a quarter of an inch. The motions of the eyelid were perfect.

CASE 5.—A woman, aged twenty-six years, suffered from ankylosis of the temporo-maxillary joint, which had followed a blow on the chin in infancy. An operation was performed on July 15th, 1890. The first incision was beneath and parallel to the zygoma, with a short cross incision through the skin. In the midst of the operation the patient became asphyxiated owing to the dropping of the tongue back into the throat. An immediate tracheotomy was performed and the chiseling of the jaw was then finished. The wound suppurated, owing, no doubt, to some contamination of it after the tracheotomy. Still, the recovery was not seriously interfered with and the patient left the hospital twenty-three days after the operation. This patient was seen on Jan. 7th, 1895, four and a half years after the operation, when the possible separation between the incisors was an inch. Lateral motion was one-quarter of an inch. The grinding motion was good, but the grinding was interfered with by the irregular arrangement of the molar teeth, which did not properly correspond in the two jaws. The scar was slightly depressed, but not unsightly. Movements of the eyelid were not in any way interfered with.

CASE 6.—A boy, aged eight years, had scarlet fever when six years old. Otitis followed, and rapidly progressing ankylosis of the jaw occurred. When seen the jaw was fixed by bony ankylosis, with the teeth immovably in apposition.

He was operated upon on Jan. 15th, 1890. A short incision was required as the condyloid process alone was fixed to the temporal bone, and the section and removal of the neck of the jaw was easily performed. The wound healed by first intention, and he left the hospital in nine days. He was seen two years later with perfect control of all the motions of a mouth which opened as widely as in any boy of his age. He had perfect grinding power.

CASE 7.—A woman, thirty-seven years of age, when she was aged seven years, received a blow on the right cheek, followed by much pain about the ear, with gradual closure of the jaws, so that at sixteen years of age they were tightly approximated and fixed. Forcible efforts with wedges accomplished a sufficient separation to allow of the food being pushed between them. She was operated upon on July 19th, 1891. The incision was made parallel to, and close under, the zygoma. As in all but two of my seven cases, the upper end of the ramus was welded to the skull by a large irregular mass of bone which was chiseled through. The recovery from operation was uneventful. This patient was seen on Jan. 8th, 1895. She had had all the lower teeth but one molar drawn, and had not yet had a plate made. There was a distinct downward bend in the body of the lower jaw as a result of the long-continued wedging which had preceded operation. As a consequence of this, the anterior gums did not closely approach the upper teeth, being held apart by the last remaining lower molar. The jaws could be separated an inch, and there was fairly good grinding motion, as appreciated by the rubbing to and fro of the solitary lower molar against the upper range of teeth. The scar was not conspicuous and the motions of the eyelid were good, though she said that when she was tired or nervous she was somewhat troubled by twitching of that eye.

The first two of these cases were published in the Transactions of the American Surgical Association (vol. vii.), the others have never been reported. The restoration of motion in all of these cases was thoroughly satisfactory, and has been maintained now for a sufficient number of years in each case to warrant the belief that it is permanent. It is particularly worthy of note that the grinding power was recovered in every case. In Cases 1 and 6 the division was through the neck of the condyle, so that all of the masticatory muscles retained their proper relations, except the external pterygoid, which was separated from its attachment. In the other cases the coronoid process was involved in the ankylosis, so that in them the attachment of the temporal muscle was also lost. The masseter and internal pterygoid muscles were in no way interfered with, and gave ample support and power to that side of the jaw.

A review of the literature of the subject has yielded reports of sixty-two operations upon cases of bony ankylosis of the temporo-maxillary articulation, and the five hitherto unreported cases of the writer bring this number up to sixty-seven. Of these, forty-seven were done by Bottini's method and twenty were done by other methods involving a section of the jaw through the ramus at some point nearer the angle. These figures would seem to show a preponderance of surgical opinion in favour of the operation close to the zygoma. A careful comparison of the functional results by the various operations is impossible on account of the incompleteness of many of the reports in this regard. As far as could be judged, however, the method of Bottini furnished better power of motion than any of the operations near the angle. This search into the experience of others has thus confirmed the opinion which the writer formed from the study of the mechanical principles involved and of the final permanent results in his own cases, and has led him to consider the operation devised by Bottini to be the best one known, up to the present time, for the relief of this most distressing deformity.

The following references to the literature of the subject, which are all that a rather thorough search has yielded, may be of service to future investigators.

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POINTS OF POSSIBLE MEDICO-LEGAL INTEREST IN CERTAIN CASES OF DISSEMINATED MILIARY TUBERCULOSIS.

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IN disseminated miliary tuberculosis there may be doubts as to the medico-legal aspect of the case during life, the doubts being afterwards completely cleared up by a post-mortem examination; but in other cases points of medico-legal interest may first attract attention at the time of the necropsy. Instances of the first class are sometimes afforded by tuberculous meningitis supervening in adults. The following is an example.

CASE 1.—A German, aged nineteen years, was brought to the German Hospital suffering from fever and delirium. He could answer no questions and there was no history obtainable. The physical signs were not quite the same over both pulmonary apices and this caused tuberculous meningitis to be suspected. There was, however, much albuminuria—a condition not usually associated with tuberculous meningitis—and neither ophthalmoscopic examination nor special nervous symptoms helped us. It was therefore possible that the patient had taken some poison acting on the kidneys and nervous system. He died some days later, and the post-mortem examination cleared up the diagnosis. Tuberculous meningitis was found, together with old and recent tubercle in the lungs, and miliary tuberculosis of the mucous membrane of the glottis. The kidney affection was parenchymatous, probably due to the bacillary toxins which had to be excreted.

Cases of tuberculous meningitis in adults are probably not rare in which, if there were absence of past history, a temporary suspicion of poison or foul play might be entertained. In the foregoing case the absence of past history and the presence of much albumin in the urine led to doubt in the diagnosis. In such cases the doubtful points are cleared up by the post-mortem examination. It is, however, the second class of cases to which I wish to draw attention—cases of disseminated miliary tubercle in which pathological questions of medico-legal interest occur at the time of the necropsy. Their importance arises from the fact that a blow or injury to quiescent tuberculous nodules in any exposed region of the body may give rise to acute miliary tuberculosis of the lungs, thus bringing about death in persons previously in apparent health. The following is a typical example.

CASE 2.—A well-built man, a German, aged thirty-three years, was admitted under my care at the German Hospital on April 5th, 1897. He had fever (temperature 103.6° F.), vomiting, great dyspnoea and cyanosis, intense dryness of the throat, and scanty expectoration, in which a trace of altered blood pigment was at one time visible. On examining

the lungs no definite signs of consolidation could be made out, but a certain amount of fine inspiratory crepitation was heard over both sides, and the case seemed to be one of acute double pneumonia before the outer parts of either lung had become hepatized. The history was that ten days before admission, when on board ship on his way back from the Transvaal, he received a blow on the left testis, which was followed by local and general symptoms. After five days his condition improved somewhat, but two days previously to admission he had a rigor and pains over the whole of the body. Except for some slight improvement soon after admission, due to rest and cessation of the vomiting, his condition underwent but little change. The dyspnoea and orthopnoea increased and the fever remained continuous till he died, practically suffocated, on April 20th, about twenty-five days after receiving the blow on the testicle. In the meantime, owing to the absence of any crisis, and since there were no signs of definite hepatization of the lungs, we had come to suspect that the pulmonary disease was one of acute miliary tuberculosis. The crepitations were variable; on one occasion distinct inspiratory crepitations could be heard below both clavicles. The sputum was examined for tubercle bacilli with negative results. The urine contained a little albumin. At the necropsy both lungs were found to be engorged with blood and absolutely stuffed with miliary tubercles. There was some fibrosis from earlier disease at both pulmonary apices. The bronchial lymph glands were enlarged, and besides miliary tubercles in the pleura there was evidence of older pleurisy, especially over one lung. The left epididymis (i.e., where he had received the blow twenty-five days before his death) contained a softened, caseous nodule, smaller than a small cherry. The cerebral meninges contained no tubercles, nor were tubercles found in any other organs, except a few minute ones in the renal cortex below the capsule. The liver might, of course, have contained microscopic tubercles though no macroscopic ones were found. The heart was distended with blood, but showed no evidence of disease. The spleen was somewhat enlarged and pulpy; it weighed nine ounces and contained one small white infarct.

In this case I think there can be no doubt that the tubercle spores were by the injury set free from the old caseous focus in the epididymis, and were carried by the venous blood to the right heart. Many of the spores were then caught up in their passage through the lungs, and thus gave rise to the miliary pulmonary tuberculosis. This theory amply explains why the pulmonary tubercles were practically all about the same size, why they were uniformly distributed throughout every part of the lungs, and why there was not evidence of general miliary tuberculosis in other parts of the body. A few of the microbes had, however, certainly passed through the pulmonary circulation, otherwise we should have found no miliary tubercles in the kidney. Moreover, by careful microscopic examination we might have found evidence of commencing tubercles in other organs.

Similar cases were observed prior to the discovery of the tubercle bacillus and gave rise to various inquiries as to the possible relation between the injury and the lung disease. A remarkable example was the following, which I have from my father, and which occurred at Bonn about 1849.

CASE 3.—An apparently healthy student, about twenty-one years of age, received some injury to one of his ankle-joints. Shortly afterwards he fell ill with an acute pulmonary affection, characterised by frightful dyspnoea and cyanosis, and, like the previously mentioned patient, died practically from suffocation about twenty-five days after the injury to his ankle. At the necropsy both the lungs were found completely stuffed with miliary tubercles, and in the ankle some caseous material was found. It was known that during childhood the patient had suffered from a disease of his ankle.

Other examples, though perhaps not quite so typical as the two foregoing, cannot, I think, be very rare—i.e., cases in which acute miliary tuberculosis of the lungs is set up by injury to some exposed part of the body which happens to be the site of previous tuberculous disease. The wonder is that such cases are not more often observed. I have not, however, heard of any case which has led to legal proceedings of any sort, though one would expect to hear that the question has frequently occurred in connexion with the foreign systems of workmen's insurance. Fortunately in Case 2 the injury which started the tuberculous dissemination was probably of a purely accidental nature.

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