before death. The guarded and scanty admissions of relatives at the inquest contrast forcibly with the authentic reminiscences of disinterested friends whose evidence has not been called. But, humanly speaking, it is too much to expect a really honest biography when claims for compensation are in the wind; the expectant heirs must naturally be to the "virtues very kind," to the "faults a little blind."

To sum up: In those cases where death has been preceded by well-marked signs of plumbism, with previous suspension (and it is only fair to say that such cases form a majority), the clinical history is sufficiently decisive to warrant a verdict of death from lead poisoning. A *post-mortem* examination supports the clinical evidence to the limited extent indicated above, presuming that it does not disclose another more reasonable, but previously unsuspected, cause of death.

To a minor degree the same conclusion holds for those cases of fatal illness of rapid intermensual development, with no prodromal troubles demanding suspension, but with clinical characters entirely compatible with acute lead poisoning. The *post-mortem* evidence in such instances will most probably be of an absolutely negative character, and valueless as a confirmatory contribution to diagnosis, but a verdict of death from lead poisoning will follow legitimately on the recital of an adequate clinical history.

But the vague, anomalous illnesses of which I have spoken, irreconcilable with any known form of lead poisoning, can never be delimited and defined by an appeal to the negative indications of morbid anatomy. A *post-mortem* examination will be valueless unless it happens to demonstrate the existence of independent organic lesions, discovery of which serves to exculpate the suspected lead.

If a coroner and jury expect mathematically-exact statements in these matters, where the limitations of pathological research make absolute certainty impossible, they must remain disappointed; and I hold it unworthy conduct on the part of a medical witness to maintain a dogmatic attitude, when his statements are based mainly on untested prejudices, and but slightly on observed truths.

ON OPERATION FOR CLOSURE OF CLEFT PALATE IN INFANTS.*

BY SIR THORNLEY STOKER, F.R.C.S.I.,

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OPERATIONS for the closure of clefts in the hard palate have not undergone any striking developments in late years, except in one particular, and that is the introduction by Mr. Brophy, of Chicago, of a new method of closing the cleft soon after birth by approximation of the superior maxillae and palate bones. The development of the surgical treatment of cleft hard palate divides itself readily into three periods:—

1. That commencing with the practice of closing the cleft by operation, introduced by Warren, of Boston, about 1843.

2. That dating from developments of methods during the years immediately preceding 1868.

3. That inaugurated by the operation of Mr. Brophy, described in his paper in *The Dental Cosmos* of April, 1901.

1. Dr. Warren must be regarded as the pioneer of the operations for cleft hard palate. Up to the time when his paper appeared in the *American Journal of Medical Science*, in 1843, no method existed of dealing with this deformity, except by the application of obturators, which are never satisfactory, and are only in these days resorted to where special measures have failed.

2. The work of Sir Thomas Smith has probably lent itself more to the perfection of the operation on the hard palate than that of any English surgeon. His paper, published in the *Med. Chir. Trans.* for 1868, inaugurated the second period in the history of uranoplasty. He advocated the operation in patients of tender years, recommended the use of chloroform, and devised his well-known gag to assist the surgeon; and this when Fergusson two years later could only say that he had resorted to the proceeding with partial success, and recommended it for further trial. It is true that in the list of cases published in 1868, Smith in all operated on the soft palate only, and left those in which a cleft hard palate existed, to be dealt with later on. This will be admitted by those who have practised Brophy's operation to be inadmissible to-day, when it will be found better to defer the closure of the cleft in the soft palate, until the defect in the hard structures has been corrected.

Since the years preceding 1868, the age selected for closing the hard palate has steadily become earlier. At first it was usually done after puberty. In 1870 we find Mr. Pollock advising that it should be delayed for two or three years after birth, and now it is open to operate by Brophy's method at any time during the three months after birth.

3. The operation of Mr. Brophy has been done by him at from ten days to three months of age. It constitutes a new departure, not only on account of the early period of life at which it is done, but because it is novel both in principle and method. It consists essentially in drawing the upper maxillae and palate bones of opposite sides together by wire sutures, generally two in number, passed transversely through the alveolar processes above the level of the palate processes of the maxillae and palate bones. There are details of the operation which will be best understood by following Mr. Brophy's own description. The method cannot be successfully carried out after the child is three months old, as the bones are then too fully ossified to be displaced by any force that could be safely applied. I have had the opportunity of using this treatment in three cases, and may at once say that I shall use it in future when suitable subjects offer, reserving, however, a few minor points of the procedure about which to offer an independent opinion.

I may epitomize Mr. Brophy's plea for his method as follows. He advocates its employment during early infancy for the following reasons:—

1. "The surgical shock is less, because the nervous system of a child is not well developed, and it is not, therefore, capable of receiving the same impressions that it would later in life, for young children usually react better. Moreover, all mental apprehension is eliminated, and we know that alarm and dread are among the most powerful factors in producing shock."

2. "Before the bones are fully calcified they may be bent or moved without fracture, etc."

3. "If the muscles are very early brought into action they develop instead of atrophy, and hence a good return is secured, with plenty of tissue; whereas if the operation is undertaken later in life, after the parts are shrunken through non-use, they can rarely be made to subserve the same purposes as organs which develop through natural employment, etc."

4. "When the palatal processes of the maxillae are united, it will be observed that the development of the bones of the alveolar processes of the upper jaw assume a form nearly or quite normal, and when the teeth are erupted they will properly occlude with the lower ones, or nearly so. . . . It was predicted by my surgical friends that the upper jaw would be much narrower than the lower one, and that it must always remain contracted." Mr. Brophy then proceeds to show that this has not been the case, and that no such deformity is likely to occur beyond what may be corrected by orthodontal methods.

5. "Following early operations there is much less deformity, for all the tissues, bony as well as soft, develop naturally and according to accepted types."

6. "When the operation is made in early infancy, the parts are sufficiently advanced to give possibility for normal speech when the time comes for learning to articulate. If the operation is not made until faulty habits are acquired it is with difficulty that they can be overcome, even supposing the muscular parts could be made sufficient."

These arguments are too sound to require much comment. With reference to the first I may say I have been struck with the absence of shock or other grave symptoms. In none of the cases I have done has there been any cause for alarm. Even when the anaesthesia was prolonged for nearly three-quarters of an hour, or when a good deal of blood for a tender infant to lose was lost, I have seen far less disturbance than is frequent in shorter operations, with less severe bleeding, at a later period of life. One of the matters, however, requiring attention when operating on very young children is the avoidance of bleeding, and some suggestions later on in alteration of Mr. Brophy's technique are worthy of attention.

The second observation, with reference to the absence of tendency to fracture, requires a remark. In the last case I operated on the child was six weeks old, and the gap in the hard palate of great width. The sides could not be brought

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completely together, and in trying to do so I fractured the alveolus of one jaw but without tearing its soft coverings. This enabled me to get better apposition, and no deformity or ill effect ensued.

The stages of Brophy's operation as described by himself are as follows:—

1. "Thorough paring of the edges of the fissure, including in the incision the edge of the semicartilaginous bone."

2. "Then raise the cheek, and well back towards the posterior extremity of the hard palate, just back of the maxillary process, and high enough to escape all danger of not being above the palate bone, insert a large braided silk suture, carrying it through the substance of the bone to the central fissure by means of one of the strong needles,* with the opposite needle carrying a corresponding silk suture through the opposite side. We then have two silk suture-loops carried to the centre of the cleft, and passing one through the other enables us to carry the one loop through both of the maxillary bones."

"The silk is more easily introduced by the needle than wire, but a silver wire should always be substituted for it, and drawn through to take its place. The wire should be No. 20, and may be doubled in case the condition of the parts and the tension upon the tissues necessary to approximate them seem to require it. Nearer the front portion of the maxilla insert another wire, carrying it through the substance of the bone above the palate plate, and through the other side in a position corresponding to the place of entrance. Thus we shall have one wire passing over the palate in front of the malar process of the bone and another behind it."

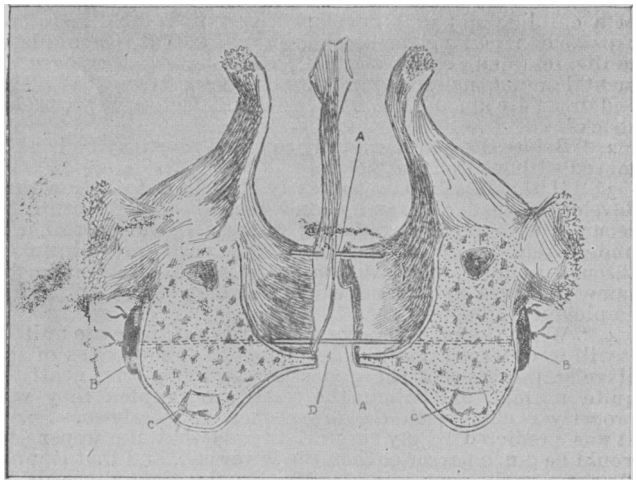

Fig. 1A.—Vertical section of the superior maxillary bones of a child five weeks of age, showing congenital cleft palate. A, A. Silver tension sutures. B, B. Lead-plates. C, C. Germs of the first temporary molar teeth. D. Cleft palate. (From the *Dental Cosmos*, April, 1901.)

With regard to this stage of the operation I may give another practical reason for using double wires of moderate gauge instead of a single thicker one. When much resistance is experienced it will be found more easy when tightening the suture to twist two thin wires than one thick one.

3. "The next step is to make lead plates (No. 17, American gauge†) to fit the convexity of the buccal surfaces of the bones. Have them provided with eye-holes, through which are passed the protruded ends of the wire on each side. Twist these together—that is, the right end of the posterior with the right end of the anterior wire, and the same on the left side. These form heavy tension sutures, and the parts when once approximated by their use, cannot be separated, as *the sutures do not cut out*. If the cleft is a very wide one, and we are not able to close it by twisting the wires together on the lead-plates, force may be exercised with the thumb and fingers, or by means of a forceps designed for that purpose. If by such force the edges of the cleft do not approximate, there is a further step to be taken which will obviate these difficulties. After the cheek is well raised, divide the mucous membrane and the bone, through the malar process, carry the knife in a horizontal direction, and when well inserted sweep the handle forward and backward. In this way a maximum amount of bone and a minimum amount of mucous membrane will be divided. This done on either side the bone can readily be moved towards the median line."

The next step in the operation is the insertion, should they be found necessary, of some points of interrupted suture in the soft coverings of the hard palate, and, if it be decided to close it at the same time, in the soft palate.

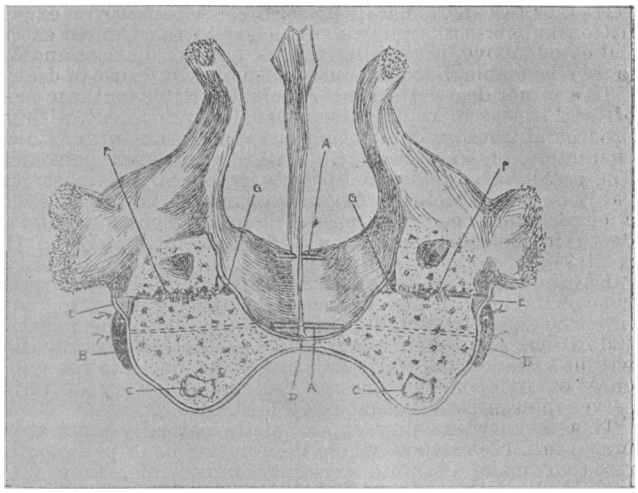

Fig. 1B.—Vertical section of the superior maxillary bones of a child five weeks of age, showing method of closing cleft of hard palate. A, A. Silver tension sutures. B, B. Lead-plates. C, C. Germs of first temporary molar teeth. D. Cleft closed. E, E. Muco-periosteum, forming extended wall of the triangular space by forcing the lower fragment of the bone inward. F, F. Lines of fracture made by approximation of the palatal process. G, G. Triangular space on nasal surface of bone made by approximation of the palatal process. (From the *Dental Cosmos*, April, 1901.)

The premaxilla is then dealt with. Its sides are trimmed, a V-shaped piece of bone removed from the vomer so as to allow it to be moved back, and a suture inserted to hold it between the alveolar processes.

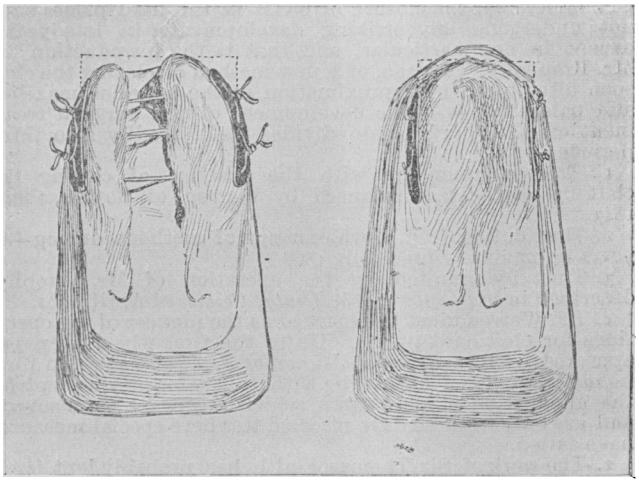

Fig. 2A.—Drawing of a plaster cast of the mouth of a child, showing lead plates and wire sutures in place.

Fig. 2B.—Drawing of a cast of the same mouth one week after cleft was closed.

(From the *Dental Cosmos*, April, 1901.)

At a later date, when the sutures have all been removed, and when no further wide access to the mouth is likely to be required, the hare-lip can be operated on.

In practice I have found certain slight departures from Mr. Brophy's methods advisable. They are as follows:—

When performing the operation, paring the edges of the palate should be deferred until the sutures have been inserted and the bones moved towards the middle line. The period

* The needles he describes are essentially those of Liston.

† The American gauges referred to in this paper are practically the same as the Imperial or B.W. gauges, and the lead plates are measured by a wire gauge and not by a lead-plate gauge.

for haemorrhage is thus lessened. Also, if it be found that the bones cannot, with reasonable effort, be brought together, it is better not to pare the soft parts at this time. It must be remembered that the sutures act in two ways, at first by drawing the parts together and subsequently by holding them fixed so that they approximate by the process of their growth. In two of the three cases I have operated on I failed to get the maxillae to touch each other, and yet union soon occurred in one, and is being completed in the other and later case. It is therefore better, where full approximation of the maxillae cannot be effected at the time of operation, not to waste tissue by an ineffectual paring, but to wait and do it later on when the bones are touching. Again, the lower edge of the vomer is often very thick and vascular, and in one instance I saw it grow into the cleft and help to close it.

Although he does not explicitly state it, I gather from Mr. Brophy's paper that he advises the soft palate to be operated on at the same time as the hard. In my first case I pared the whole palatal edge, and got union of the soft as well as the hard palate, except the uvula. In the second case the soft palate did not unite, although sutured, and its treatment has been deferred for a year or two. In the third case the gap was so wide that I could not get the sides of the hard palate into apposition. I did not pare or attempt to deal with the soft palate, and propose to operate on it later on.

The proper course seems to be to pass the sutures and move the bones. If they can be got into close apposition to pare the edge of the hard palate and fix the sutures; if they cannot be thoroughly approximated to defer the paring process until the maxillae have grown into apposition, and then do it, if necessary. If the hard palate is thoroughly closed at the primary operation it would be best to then trim and suture the soft palate, or under less favourable circumstances to defer its closure.

There can be no reasonable objection to the practice of leaving the hare-lip without operation until the hard palate has been closed. Free access to the mouth is thus obtained and the surgeon's work done under the easiest circumstances. Of course, if the soft palate remains deformed, either because the attempt to procure union has failed, or has been deferred, it would be necessary to close the lip as soon as may be convenient after the bony defects have been remedied, and postpone the closure of the soft palate until a later date.

I have made extensive use of Mr. Brophy's words, because I am not aware of any previous publication of them in this country, and wish to put his own case. The more so as I only venture to criticize some minor details, and do not take exception to any of his general principles or practice.

The operation requires some neatness, but is by no means a difficult one. In this, as in all procedures of its class, Rose's position should be employed, as it gives both facility and safety. I use no gag, except the jaws are developed enough to permit the use of one such as Lane's. The tongue is best kept out of the way by a depressor, shaped like the curved end of Fergusson's director, which is not bulky, and can be used as a tractor. No special instruments are required, as a couple of Liston's naevus needles of different curves suffice to pass the sutures. The plates and sutures do not seem to cause inconvenience to the child nor have I seen stenosis of the nasal cavity produced by their use. In the cases I have operated on, the infants have rapidly put on condition. The three cases in which I have done this operation were all of extreme deformity. In each hare-lip, projecting premaxillae, and complete and wide separation of the hard and soft palates was present.

CASE I.—J. M'K., aged 12 weeks, was admitted to the Richmond Hospital, October 6th, 1903. He was healthy and well nourished, and suffered from wide cleft of the soft and hard palates, with complete left hare-lip, fissure, and separation of premaxilla on the left side. There was much projection of the premaxilla. On October 10th the soft and hard palates were pared, the malar ridges on both sides divided and the clefts closed, the soft one by horse-hair sutures, the hard by two wires and plates. The premaxillary bone was then moved back and sutured in its place. The temperature rose to 100° for two days after operation, and then became normal. On November 7th the wires were removed, and on November 11th two points of suture placed in the soft structures where they were inclined to separate. On December 19th the hare-lip was operated on, and on January 5th the child was taken home. The lip, premaxilla, hard palate, and all the soft palate except the uvula being in normal condition. Fig. 3 shows the appearance of this patient at the age of 1 year and 10 months.

CASE II.—J. M., aged 4 weeks, was admitted to the Richmond Hospital on March 15th, 1904, but, being in very poor condition, the operation was deferred to May 4th, when at the age of 9 weeks he was operated on. The condition of the child was of much deformity double hare-lip, projection of premaxillary bone, and complete and wide cleft of both hard and soft palates. The steps of the operation were the same as in the first case. There was no subsequent rise of temperature of any moment. The child was taken home five days after operation, and brought back to have the wires removed at the end of four weeks. The lip was then operated on. The result in this case was excellent, the whole of the surfaces uniting thoroughly except the uvula. I cannot show a picture of this child's condition after operation, as it died of bronchitis ten months after its treatment had concluded—a fact only discovered when we sent for it to have a photograph done.

Fig. 3.

CASE III.—I. N., aged 6 weeks, admitted to the Richmond Hospital, February 20th, 1905; suffered from double hare-lip, premaxillary projection, and complete and wide clefts of both hard and soft palates (Figs. 4 and 5). These pictures give a fair average idea of the degree of deformity in all three cases. This child was in unusually good condition, having been fed with human milk, given with a spoon. She was operated on two days after her admission in the same way as the two other cases, except that as the cleft in the hard palate could not be completely closed no attempt was made to deal with the soft palate. The premaxilla was moved into line with the alveoli. It is now eleven weeks since the operation; the cleft in the hard palate has become steadily narrower, is quite closed in front behind the premaxilla, and will probably soon be closed behind. The hare-lip was operated on on May 10th, and has united favourably. In due course I shall attempt to get union of the soft palate.

Fig. 4.

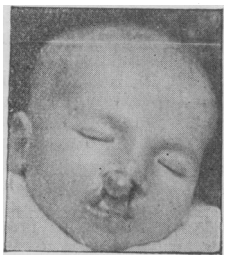

Fig. 5.

The second of the above cases is a test one, as it shows what a good result may be got in even a very feeble and ill-nourished child. It is my usual practice to defer all operations for hare-lip or cleft palate until every effort has been made to improve the condition of the child, but this was a weakly creature in spite of treatment.

Regarding the question as to when the soft palate is to be closed in those cases where it has not united, or in which it has not been thought well to attempt to include it in the primary operation, it is not possible to give a dogmatic opinion. In some instances, no doubt, it may be secondarily attacked before the lip is closed and while free access is obtainable, while in others a delay of two, three, or four years is unavoidable.

One remark may be made in connexion with this operation—namely, not to be discouraged at any unsightliness that may be present at first. It is not always possible to get the case to look pretty at the time of operation, or even always to close the hard palate cleft completely. The parts will gradually fall into line and look nicer, and, as I have before said, the cleft in the hard structures will gradually close more or less completely if it has been securely wired.

Finally, I do not think it is always possible to carry out this operation with academic perfection, but that being said, it is hardly possible to deny that it is of great importance and not to be overlooked.