Sands (H. B.)
Dont strip cover

ON

NASO-PHARYNGEAL POLYPI.

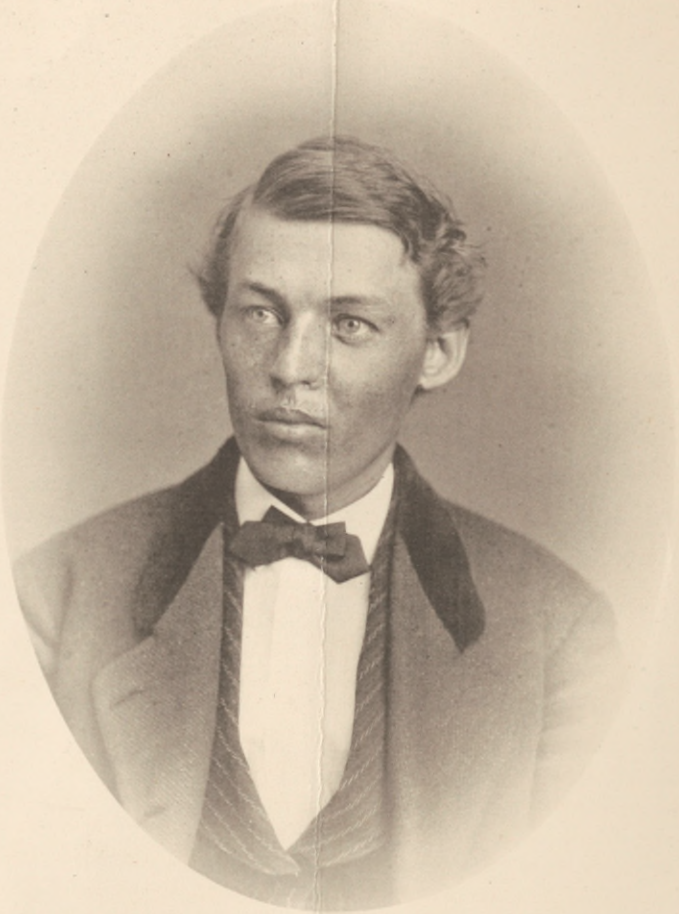
Presented by
A. E. M. Purdy

BY

H. B. SANDS, M.D.

REPRINTED FROM
Dr. Brown-Sequard's Archives of Scientific and Practical Medicine,
No. 6.

NEW YORK:
G. P. PUTNAM'S SONS,
TWENTY-THIRD ST. AND FOURTH AVE.
1874.



ARCHIVES

OF

SCIENTIFIC AND PRACTICAL

MEDICINE.

VOL. I. JUNE, 1873. NO. 6.

Original Communications.

I.

ON NASO-PHARYNGEAL POLYPI.*

BY

H. B. SANDS, M.D.,

PROF. OF ANATOMY IN THE COLLEGE OF PHYSICIANS AND SURGEONS; SURGEON TO THE BELLEVUE AND ROOSEVELT HOSPITALS.

THE experience I have lately gained by the successful treatment of a case of naso-pharyngeal polypus, induces me to believe that a succinct account of this rare and formidable affection may not be without interest to the members of this Society.

With the ordinary soft nasal polypi every surgeon is, of course, familiar. Consisting of gelatinous connective tissue, covered by a layer of mucous membrane, they are essentially outgrowths from the latter, and may be attached by their pedicles to any part of the boundaries of the nasal fossæ, or of the cavities communicating with them. They usually spring from the mucous membrane covering the superior or middle turbinated bone, and are rarely, if ever, connected with the septum narium. Polypi of the same character also occasionally originate in the antrum or frontal sinus; and when situated in

* Read before the New York County Med. Soc., June 23d, 1873.

either of these cavities, can be removed only by penetration of their bony walls. In all other cases, the morbid growth may be readily got rid of by the aid of a forceps, introduced into the nasal cavity through the anterior nares.

But, besides the ordinary mucous polypus, another variety is sometimes met with, which differs from the former in its structure, and usually, also, in its situation and attachments. It is composed essentially of white fibrous tissue, mingled with a few elastic fibres; occasionally, also, round and fusiform cells are present, although very rarely in sufficient number to warrant the appellation of fibro-plastic, which is sometimes applied to the tumors in question. Such polypi are called fibrous, and are, in fact, true fibrous tumors, attached to the part from which they grow by a more or less constricted pedicle. Although they are covered by mucous membrane, the latter merely invests them, and does not indicate their true character as morbid growths.

Fibrous polypi differ from mucous polypi, moreover, in their origin and attachments. While the latter are chiefly outgrowths from mucous membrane, the former originate in the periosteum, with which, as well as with the subjacent bone, they are closely connected. This fact may partly explain the difficulties which are encountered in their removal, and also the failure of certain modes of operation, presently to be mentioned, whereby the tumor is removed by a simple division of its pedicle; thus leaving the periosteal attachments of the latter to favor a recurrence of the disease.

But, in addition to these differences in structure and attachments, the fibrous differs from the mucous polypus in its situation. This rule is not without exceptions. True fibrous polypi are sometimes found in the nasal cavities, where they originate in the periosteum covering some portion of their osseous walls. In 1846, the late Dr. J. Kearny Rodgers removed such a polypus from a patient in the New York Hospital.* The tumor was reached by excising the right nasal bone, and was ascertained to spring from the vomer. Fibrous polypi have also been found to grow from the external lateral walls, or from the floor of the nasal fossæ. In any case, they increase gradually in size, and after a time cause an expansion of the facial bones, with corresponding deformity.

But true fibrous polypi, originating in the nasal cavities, are extremely rare. Such polypi are much more frequently connected with the base of the skull; and here we find two favorite seats of attachment. Sometimes the growth begins in the pterygo-maxillary fossa.

* New York Journal of Medicine, 1851, vol. i., p. 323.

As it enlarges, it may extend outward into the zygomatic and temporal fossæ, and inward through the spheno-palatine foramen into the pharynx. Tumors thus arising form a special group, and should be distinguished, both anatomically and clinically, from the remaining one, which embraces the fibrous growths most often met with in this neighborhood, and to which the name of naso-pharyngeal polypi has been correctly applied.

In recounting the features of naso-pharyngeal polypi, I shall do so in the following order, and consider, 1st. Their seat of attachment; 2d. Their symptoms and clinical history; 3d. Their diagnosis; and 4th. Their treatment.

1*st. Seat of attachment.*—It is exceedingly important to determine, if possible, the exact situation and extent of the surface occupied by the pedicle of a naso-pharyngeal polypus, inasmuch as this is the part which must be reached to effect the removal of the tumor. On this point there is some discrepancy among surgical writers; but all agree that the parts from which these tumors grow form a region of small extent, situated at the base of the skull, and at, or near to, the top of the pharynx. Unquestionably, the pedicle is most often found connected with the inferior surface of the basilar process of the occipital bone, and the adjacent part of the body of the sphenoid. According to some authors, this is invariably the seat of attachment; but there is evidence enough to prove that the tumor may spring from any of the following parts, namely: the upper part of the pterygoid fossa; the internal pterygoid plate; the greater wing of the sphenoid; the apex of the petrous portion of the temporal bone; and the edges of the posterior nares. It is doubtful whether the anterior surface of the atlas ever affords attachment to these tumors, although the fact is affirmed by Michaux, Robert, and others. This surface is directly covered by ligamentous fibres. Over these are placed the anterior recti muscles, which are separated from the mucous membrane of the pharynx by lax, filamentous connective tissue. In none of these tissues are fibrous tumors prone to originate. On the other hand, their formation is favored at the base of the skull, which is invested with a thick and highly vascular periosteum, united firmly to a mucous membrane possessing similar characters. Without doubt, a naso-pharyngeal polypus may be found in contact with the upper cervical vertebræ; but it is highly probable that, in such a case, the union is not intimate, and that the contact has resulted simply from the downward course taken by a tumor having its origin at a higher point. Without attempting to settle this question, however, the fact remains, that the region in which a naso-pharyngeal polypus can originate is one of narrow limits, corresponding with the margins of the posterior

nares, and the summit of the pharynx. It may here be observed, that this region can be satisfactorily explored by the finger; and also, if necessary, by the aid of the rhinoscope. In this manner, a polypus may sometimes be discovered early, and its removal accomplished by safe and easy methods. It is seldom, however, that the tumor is detected until it has attained a considerable size, and has extended far beyond its original site. Now, although there are many directions in which such a growth may extend, there are two in which extension is most common, namely, downward into the pharynx, and forward into the nasal fossæ. It is doubtless owing to the tendency which these tumors exhibit to occupy the spaces mentioned, that they have been denominated naso-pharyngeal. When they extend downward, and have gained a certain size, they press upon the soft palate, which in extreme cases becomes greatly expanded, and so far changed in position that its surfaces may be more nearly vertical than horizontal, while, at the same time, it is pushed correspondingly forward. In many instances the tumor extends downward below the free margin of the velum, so that it may be distinctly seen, and it may even descend low enough to approach the larynx, thus causing difficulty in respiration and deglutition.

It might be supposed, that the growth of these tumors in the direction of the nasal fossæ would be resisted by the narrow boundaries of the posterior nares; yet experience shows that the resistance thus offered is feeble, and that, sooner or later, the bones yield to the pressure of the tumor, which may finally not only penetrate the nasal cavities, but insinuate itself among nearly all the bones of the face. At first, it lies merely in contact with the parts bounding one or both of the posterior nares. As it grows, it extends into one or both of the nasal cavities, and causes either absorption or perforation of the septum, often becoming adherent to the posterior border of the latter. At a later period, it may extend so far forward as to be visible through the nostril. Before this happens, however, the bones which form the boundaries of the nasal fossæ commonly yield to the pressure of the tumor, and either disappear by absorption, or are crowded aside to make way for the advancing growth. The more delicate bones, such as the turbinated, the ethmoid, the palate, and the vomer, yield most readily; and at length the nasal bones, and the nasal processes of the superior maxillary are projected, giving rise to a striking and characteristic deformity at the root of the nose. At other times the tumor passes into the antrum, the walls of which may be distended, thus causing disfigurement similar to that occasioned by morbid growths developed primarily in the antrum itself. Prolongations sometimes extend through the spheno-palatine foramen into the zygo-

matic and temporal fossæ, and through the spheno-maxillary fissure into the orbit, producing in the latter case protrusion of the globe. Such an instance is related by Spence.* Exophthalmia may likewise be occasioned by the upward growth of the tumor through the orbital plate of the superior maxilla. The extension of the tumor into the cranial cavity is comparatively rare; but, when it does occur, it may cause fatal cerebral complications, and, of course, greatly increases the dangers attending a surgical operation. The growth may penetrate the cranium either by absorption of the walls of the sphenoidal sinuses, or the cribriform plate of the ethmoid bone; or, having once entered the orbit, it may pass into the cranial cavity through the sphenoidal fissure.

It has already been remarked, that, as the tumor increases in size, the surrounding osseous and soft parts are absorbed or pushed aside. Should the mucous membrane investing the polypus remain intact, no adhesions will be formed; and, however large the tumor may become, it will be found adherent only by its pedicle to the base of the skull. This is not unfrequently the case; yet, on the other hand, superficial ulceration of the tumor often occurs, followed by adhesions to the surrounding tissues. These secondary adhesions, as they have been named, differ both in kind and degree from the primary adhesion of the tumor at its seat of origin. They are comparatively slight and superficial, and can generally be easily broken down. The surfaces left after their rupture rapidly granulate and cicatrize, and show no tendency to reproduce the morbid growth. The tissues invaded by the tumor are never incorporated with it, as is the case with cancerous and other malignant formations, but are either pushed aside, or become adherent to it in the manner which I have described. This fact has an important bearing on the success of surgical operations.

Naso-pharyngeal polypi do not appear to be confined to any single period of life. They have been seen in old subjects; and Winter† discovered one in a fœtus of seven months. In a large majority of instances, however, they are found in young adults, and the discovery of a polypoid growth at either extreme of age would be presumptive evidence of its malignancy. Naso-pharyngeal polypi are also much more frequent in males than in females.

These tumors, as has been already stated, are composed of fibrous tissue, and are exceedingly firm and resistant. They are generally, however, tolerably vascular; and, when they grow to a large size,

* Edinburgh Medical Journal, vol. ix., page 996.
† Günther, Operationen am Halse, p. 311.

their blood-vessels are correspondingly developed. Moreover, as their vascularity increases, their consistency diminishes, and they are thereby rendered more liable to ulceration and hemorrhage. They grow rapidly; or, at least, they increase in size faster than most varieties of fibrous tumors; so that, after the lapse of a year or two from the first appearance of symptoms, and often at an earlier period, they demand surgical treatment.

2. *Symptoms and Clinical History.*—The symptoms caused by a naso-pharyngeal polypus may be mainly deduced from the facts already mentioned. Sometimes the tumor is discovered while it is yet very small, but it is more apt to remain unnoticed until it has caused some stoppage of the nose. Occasionally, an unnatural sensation during deglutition attracts the patient's attention; and, on examination, he discovers that the soft palate is depressed and pushed forward. Epistaxis is an early and oft-recurring symptom; and the attacks are frequently severe, so that anæmia, with œdema of the lower extremities, results. Whether the hemorrhage, in these cases, is due to ulceration of the tumor, is uncertain; it sometimes occurs, however, at an early date, and when no evidence of ulceration can be found. At a later period, the physical signs of the disease become prominent, and their precise character will depend upon the direction taken by the tumor in its growth. If it extends principally downward into the pharynx, inspection of the mouth will at once reveal the expansion and deflection of the soft palate, below the free margin of which the inferior portion of the tumor may perhaps be visible. Exploration with the finger will also detect the presence of the tumor, and enable the surgeon to obtain important information respecting its size, its seat of attachment, its relations to surrounding parts, and the presence or absence of adhesions.

When the tumor is of large size, and descends low in the pharynx, it will interfere more or less with respiration, especially during sleep; thus causing the patient to awake frequently during the night with a feeling of suffocation. When the tumor grows forward, and occupies one or both nasal cavities, the breathing through the nose is obstructed, and the tumor can be detected by the probe. If it enters the antrum, and distends it, any or all of the walls of this cavity may yield, and corresponding deformity will ensue. The disfigurement produced by displacement of the nasal bones has already been referred to; it seldom happens unless the disease is far advanced. The cases are also rare in which the polypus extends outward through the spheno-palatine foramen. Having passed, however, through this opening, it is apt to extend forward on the outer aspect of the upper jaw, thus giving rise to a characteristic swelling of the cheek. Fi-

nally, when the tumor extends in the direction of the cranial cavity, it may set up inflammation of the brain or its membranes, although this is seldom observed during the natural progress of the disease. Post-mortem examinations have often revealed perforations of the cranial bones, and contact of the polypus with the dura mater, where no cerebral symptoms had occurred during life. Such symptoms are much more likely to happen after a surgical operation, in which the connections of the tumor with the membranes have been forcibly severed. This accident is the more likely to happen, in consequence of such adhesions being often unsuspected at the time of operation.

The natural termination of the disease is almost inevitably fatal, although a few instances are recorded in which the tumor was attacked by gangrenous inflammation, resulting in its detachment and in spontaneous cure. Death may occur from hemorrhage, from exhaustion, from suffocation either gradual or sudden, or from cerebral complications—the latter being very rare.

3. *Diagnosis.*—Much has been said with regard to the uncertainties of diagnosis; but it is only in rare cases that any serious difficulty is encountered in detecting the presence of naso-pharyngeal polypi. The only affections with which they can well be confounded are, 1st, malignant tumors having a similar origin and situation; and 2d, fibrous polypi of nasal origin.

Both cancerous and sarcomatous tumors have been found arising from the top of the pharynx; and, at a very early period of their development, they might be mistaken for naso-pharyngeal polypi. They may be recognized, however, by their lesser consistency, their more rapid growth, and their tendency to ulceration and implication of the surrounding parts, which are not merely pushed aside, but incorporated, as it were, with the advancing tumor. Should any doubt remain, it might be settled by excising a small piece of the tumor, and submitting it to microscopic examination. In this connection, it may be interesting to remark, that the true naso-pharyngeal polypus sometimes undergoes a change of type, losing its purely fibrous character, and acquiring the characteristics of sarcoma. This change is most liable to occur when the tumor penetrates the cranial cavity, and when it recurs after partial removal. Otto Weber * relates an instance in which several operations were performed upon the same patient. The original tumor was distinctly fibrous; but the recurrent growths were soft, and contained the elements of sarcoma. After several incomplete operations, the tumor grew very rapidly, and proved fatal. Also in the case I am shortly to relate, the origi-

* Handbuch der Chirurgie—Pitha and Billroth, Band III., Ab. 1., S. 207.

nal polypus was firm and fibrous, while the recurrent growth contained a considerable number of spindle-shaped cells, and lacked the firmness of the original tumor.

From fibrous polypi of nasal origin, the naso-pharyngeal polypus can generally be distinguished by attention to the following points.

Nasal polypi are not unfrequently confined to the nasal cavity, and at a comparatively early period cause deformity by pressure on the nasal and other bones of the face. If, in a suspected case, on digital examination, the pharynx is found free, the existence of naso-pharyngeal polypus is disproved. But the converse of this proposition is not true. A tumor occupying the pharynx may be of pharyngeal origin, and this is likely to be the case if it is of large size, and the nasal cavities are comparatively unobstructed. Yet a tumor of nasal origin may undoubtedly grow backwards into the pharynx. In such a case, digital exploration would be important; and the finger, introduced into the pharynx above the soft palate, might trace the pedicle, if of nasal origin, into one of the nasal cavities; or if the polypus be naso-pharyngeal, but attached to the edges of the posterior nares, the seat of attachment might then be determined. It has been stated, however, that in the great majority of cases of naso-pharyngeal polypi, the pedicle springs from the base of the cranium, either from the occipital or sphenoid bone. Now I have satisfied myself that this attachment, when it exists, can be plainly felt with the tip of the finger, which, when passed upward along the smooth posterior surface of the tumor, meets with no resistance until it reaches the pedicle, when it is suddenly and completely arrested. In my own case, I experienced no difficulty in tracing, with my forefinger, the inferior and lateral surfaces of the pedicle; its superior surface although free, was beyond my reach. I lay stress upon this means of diagnosis, because the evidence which it affords is conclusive, and because it has received little attention from surgical writers. Indeed, many authors deny that there is any diagnostic sign which can indicate the attachment of a pharyngeal tumor to the base of the skull. An examination of the parts on the cadaver will convince any one that this opinion is incorrect. The finger can be carried quite to the summit of the pharynx, and the pedicle of a tumor occupying this situation cannot fail to be recognized.

4. *Treatment.*—The treatment of the disease is simple in principle, and consists in the removal of the morbid growth. If this can be thoroughly accomplished, the cure is likely to be permanent.

The different modes of treatment are numerous, and much discussion has taken place respecting their comparative value. They may be briefly stated as follows:—

1st. Avulsion or laceration.
2d. Ligature.
3d. Galvano-caustic ligature.
4th. Caustics.
5th. Electrolysis.
6th. Removal by excision, or otherwise, after some preliminary operation.

It is not my intention to describe minutely these various methods, but to indicate their relative safety and efficiency.

Naso-pharyngeal polypi may sometimes be treated successfully by avulsion, and this method is advocated by Schuh.* If the pedicle is quite narrow, and springs either from the posterior edge of the vomer, or any other part of the boundaries of the posterior nares, it may be seized with a pair of curved polypus forceps, and extracted through the mouth. But cases suitable for such an operation are rare; and in most instances the attempt to extract the polypus by the forceps fails. Neither is the operation free from danger.† Dupuytren once tried to extract a polypus with the forceps. He succeeded in removing only a few fragments, and the operation was attended with copious hemorrhage. On the following morning the patient was found dead in his bed. The cause of death was not satisfactorily made out at the autopsy, but was suspected to be hemorrhage.

Mr. J. Cooper Forster‡ recently attempted the same operation. Profuse bleeding occurred at the time; and subsequently headache, aphasia, and convulsions followed,—the patient dying on the twelfth day. On post-mortem examination it was discovered that the cribriform plate of the ethmoid bone had been fractured, the fracture having been doubtless caused by the act of avulsion. It is clear, therefore, that this operation, which is so successful in the treatment of the ordinary nasal polypus, has but a very limited application to the disease under consideration, and should be restricted to the class of cases above mentioned.

Closely resembling the treatment by avulsion, is a plan proposed by Guerin,§ which he followed with success in a single case, and which he unwisely recommends for general adoption. It consists in putting the forefinger of the left hand in contact with the pedicle behind the soft palate, while with the right hand the tumor is torn from its attachments to the bones of the skull by means of a raspa-

* Wiener Med. Wochenschrift, 1865, p. 99.
† Brosse, Rust's Magazine, vol. vii., p. 236.
‡ Transactions of Clinical Soc. of London, vol. iv., 1871.
§ Gazette des Hôpitaux, 1865, p. 144.

torium introduced through the nose. It is hardly necessary to remark that this mode of operation is exceedingly rude and uncertain, and that it would be impossible to carry it into execution, unless the pedicle were exceptionally narrow. Even if the surgeon succeeded in detaching the tumor, a portion of the pedicle would still remain, and the morbid growth would, in all probability, soon be reproduced. Guerin's case was reported very soon after the operation, and the ultimate result is not known.

The ligature has been employed successfully in a few cases, and may be applied in the following manner. The pedicle of the tumor having been surrounded by a loop of strong silk or whipcord, both ends of the ligature are brought out through the nostril. A double silver canula is then made to glide over the threads, through the nose, and when it has come into contact with the pedicle, the ligature is drawn tightly at its opposite extremity. Ulceration of the pedicle gradually takes place, and the tumor finally sloughs off and is withdrawn through the mouth. This mode of operation can be adopted only when the pedicle is small, and the tumor has not become adherent to the posterior border of the septum. In the latter case it would be impracticable, as also in cases where the tumor had insinuated itself among the bones of the face. The operation has been performed a number of times with success; and although a portion of the pedicle is left behind, reproduction does not inevitably follow. Michaux* reports a case in which six years elapsed after such an operation, without recurrence, and Robert† affirms that the portion of the pedicle which remains after the use of the ligature undergoes atrophy. On the other hand, the tumor is apt to return; nor is this the only objection to the ligature. It has often caused death, and the fatal event may happen in various ways. Gunther‡ relates the case of a man who was found dead several days after the application of the ligature. On examination, it was ascertained that the polypus had been detached by ulceration, and had fallen against the superior aperture of the larynx, producing death by suffocation. Œdema of the larynx, and pyæmia, have led to the fatal result in other cases. Even when the patient escapes with his life, his sufferings are extreme. Winter§ operated by the ligature on a woman twenty-one years of age. On the fifth day, the putrid odor of the tumor was insufferable. On the seventh day, respiration and deglutition became so greatly embarrassed, that the surgeon was obliged to seize the growth and com-

* Schmidt's Jahrbücher. Vol. cxxxiv., p. 311.
† Conferences Chirurgicales.
‡ Operationen am Halse, p. 313.
§ Chiron von Siebold, Band iii., St. 2, p. 327.

plete its detachment by avulsion. The patient recovered. In view of these facts, I think that the use of the ligature should be abandoned.

Certain modifications of the ligature are more deserving of approbation. The galvano-caustic ligature,* the écraseur,† and the chain-saw ‡ have all effected the removal of the tumor, and have the great advantage over the ordinary ligature, of causing separation of the growth at the time of the operation.

These methods, however, are liable to many of the objections that apply to the ligature, and can never be depended on to secure a radical extirpation of the morbid growth.

The use of caustics needs only to be mentioned to be condemned. The deep situation of a naso-pharyngeal polypus, and its proximity to the larynx, render the application of escharotics both difficult and dangerous. The actual cautery, chloride of zinc, caustic potash, and the perchloride of iron have all been tried, but with very indifferent success. The destruction of the tumor hardly keeps pace with its growth, and the surgeon is at last compelled to practise excision, after much trouble and loss of time.

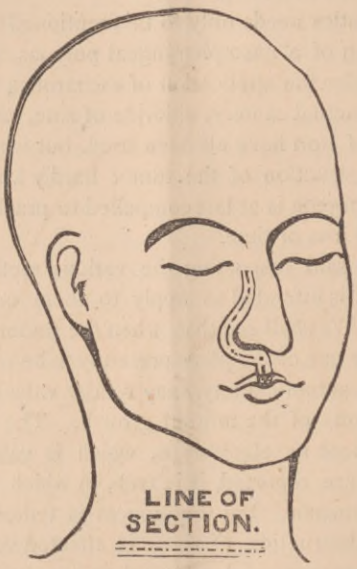
What has been said respecting the various methods of treatment thus far described, is intended to apply to them only when they are employed alone. We shall see that, when the tumor has been excised according to some one of the plans presently to be mentioned; the use of caustics, or the actual cautery, may render valuable aid in destroying the last remnants of the morbid growth. The same remark applies to the treatment by electrolysis, which is valuable only as an auxiliary. Cases are reported, it is true, in which polypi have been got rid of by this means. But the process is tedious, laborious, and uncertain. The destruction of tissue is effected very slowly, and in one case, reported as successful, no less than 130 sittings were required to effect a cure.§ I believe that the treatment by this method would nearly always fail in removing a large polypus, while a small one could be removed more readily and safely by the galvano-caustic ligature or the écraseur. After the tumor has been excised, however, the stump of the pedicle might doubtless be treated with success by electrolysis. I am satisfied that neither in the removal of large naso-pharyngeal polypi, nor of any other large tumor, excepting perhaps one composed of erectile tissue, can electrolysis be accepted as a substitute for the knife; and I believe that the claims which have been put for-

* Middeldorpff, Galvanocaustik, p. 152.
† Chassaignac, Traité de l'écrasement linéaire.
‡ Deroubaix. Presse méd. 1864. No. xvi.
§ Von Bruns, Galvano-chirurgie, p. 86.

ward in favor of this method of treating tumors are extravagant and unfounded.

The last procedures to be described are those that contemplate the extirpation of the tumor, after a preliminary operation has been resorted to for the purpose of rendering it accessible. The tumor may be exposed, either by an operation practised through the mouth, or by resection of some one or more of the bones of the face. The resection may also be either permanent or temporary ;—that is to say,

FIG. 1.



the excised portions of bone may be removed altogether, or they may be replaced after the extirpation of the tumor. In the latter case, the operation is denominated osteo-plastic.

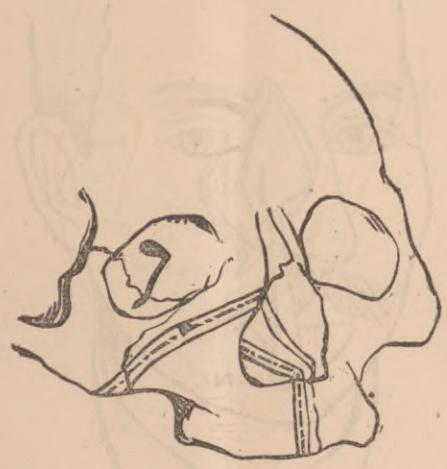
Operations through the mouth are of ancient origin, but have been revived in modern times by Manne (1717), and more recently by Nélaton, their strongest advocate. They consist in laying bare the polypus, either by making a longitudinal slit in the soft palate, or by completely dividing the latter, or by adding to this procedure division or excision of the hard palate. The tumor having been thus exposed, it is seized and removed, after its pedicle has been divided, either with the knife, the scissors, the écraseur, or the galvano-caustic ligature. Should the removal of the tumor be satisfactorily accomplished, the wound in the palate may be closed at once by sutures ; if any portion

of the tumor is left behind and requires subsequent treatment, the wound must be united at a later period by staphyloraphy.

The facial methods of operation embrace, 1st, Excision, partial or total, of the upper jaw; 2d, Various osteo-plastic operations.

Total excision of the upper jaw was recommended, and practised with success in 1840, by Flaubert,* of Rouen. Syme is said to have done the operation in 1832, but I have failed to find anything except a bare allusion to the operation in the Edinburgh Medical Journal. It is unnecessary to describe the steps of the operation, which are the same as when the excision is performed for disease of the maxilla itself. The jaw having been removed, the tumor is then extirpated, and its pedicle destroyed, if possible, by cutting or scraping, or by the

FIG. 2.



LINE OF SECTION.

use of caustics, or the actual cautery. This operation has been repeatedly done on the European continent, and is highly praised by Michaux, Robert, and others. It will be convenient to defer the discussion of its merits until the remaining methods have been described.

Partial excision of the upper jaw for the removal of a naso-pharyngeal polypus was first practised by Maisonneuve, in 1860, and is thus described by him † (Figs. 1 and 2): "If the patient's mouth is large, no

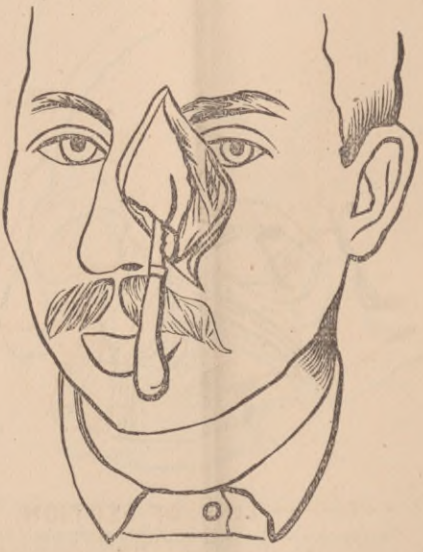
* Schmidt's Jahrbücher, vol. xxx., p 63.

† Gazette des Hôpitaux, 98, 1860.

external incision is necessary. In other cases the upper lip on the affected side is divided from its free edge upwards into the nostril; the external and anterior surface of the upper jaw is laid bare by division of the soft parts of the cheek; the mucous membrane of the hard palate is divided by an incision from behind forward, in the median line, and the soft palate cut transversely from its attachment to the palate bone."

"A stout pair of straight-edged bone-forceps is now employed. One blade having been introduced into the nose, and the other into the mouth, the alveolar process and hard palate are divided. One blade of the forceps still remaining in the nose, the other blade is applied to the external surface of the jaw, and a horizontal section is

FIG. 3.

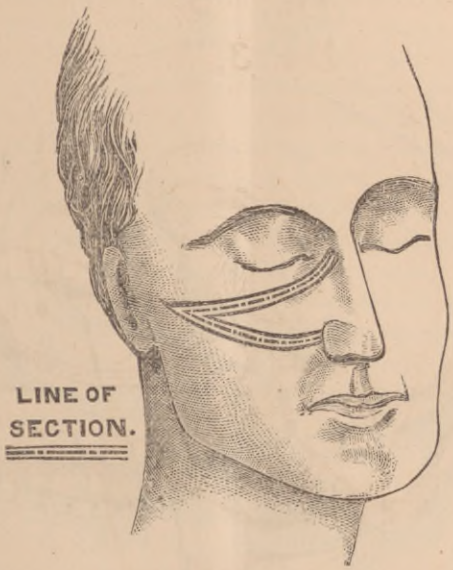


made of the latter, beneath the malar tuberosity. Simple depression now suffices to remove the bony fragment, which contains the palatine processes, the alveolar process, and nearly the entire pterygoid process." The subsequent steps of the operation consist in extirpating the polypus by one of the methods already mentioned. Maisonneuve's operation was successful, and has frequently been performed by himself and others.

Five osteo-plastic methods deserve a brief description, namely, two devised by Langenbeck, one by Huguier, one by Roux, and one by Dr. Cheever, of Boston.

One of Langenbeck's methods (Fig. 3) aims at reaching the pedicle through an opening made in the nose. After suitable incisions through the soft parts, the nasal bone and the nasal process of the affected side are turned upward and outward, but are not detached, being left connected with the frontal bone by bands of periosteum and mucous membrane. The polypus having been removed, the displaced bones are restored to their proper position, and the external wound is closed by sutures. This operation has been done with success both by Langenbeck and others.

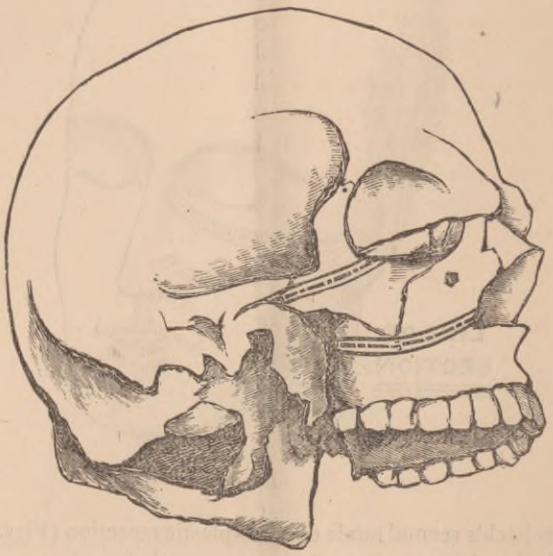
FIG. 4.



Langenbeck's second mode of osteo-plastic resection (Figs. 4 and 5) was devised and first performed for the removal of a polypus originating in the pterygo-maxillary fossa; but was afterward done with success by the same operator for a naso-pharyngeal polypus. It was executed as follows:—"A curved incision, with its convexity downward, was made from the ala nasi to the middle of the zygomatic arch; another incision extended from the nasal process of the os frontis, along the inferior margin of the orbit, until it met the outer extremity of the first one. Without raising the skin from the subjacent soft parts, the periosteum of the upper jaw was divided in the line of the lower incision, and the masseter muscle separated from the inferior edge of the zygoma. The mouth having been widely opened, a straight, narrow, probe-pointed saw was passed into the pharynx

through the spheno-palatine foramen, and the jaw divided completely by a horizontal cut from behind forward, while the forefinger, introduced into the pharynx through the mouth, protected the septum nasi from injury with the tip of the saw. The upper incision was now carried down to the bone and into the orbit, and the soft parts divided in the angle between the frontal and temporal processes of the malar bone. A second cut was next made with the saw from below upwards, through the zygomatic process of the temporal and the frontal process of the malar bone, into the spheno-maxillary fissure; and thence through the orbital plate of the superior maxilla as far as its line of junction with the lachrymal bone. The resected por-

FIG. 5.



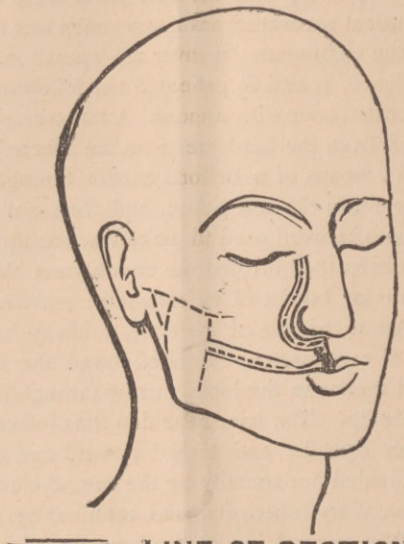
tion of the superior maxilla was then left connected only with the nasal bone, and the nasal process of the frontal bone, by means of its nasal process. Over this bridge of bone, intended for the nutrition of the resected portion, the soft parts, including the skin, were left intact, and likewise the hard palate and alveola process were left uninjured. The resected piece was now raised upward and inward by an elevator, and was made to move like a hinge upon its attachments to the nasal bone and nasal process of the frontal." This manœuvre at once rendered accessible the pterygo-maxillary fossa, and gave

sufficient space for the extraction of the polypus. The resected bone was then replaced, and the soft parts were united by wire sutures. The patient recovered, and bony union was thought to have taken place on the eighteenth day after the operation.

Huguier* (Figs. 6, 7, and 8) proposed the following osteo-plastic method, and operated once with success. A transverse incision having separated the soft from the hard palate on the affected side, a ligature was introduced by means of a Belloc's canula through the nose, and next through the slit in the soft palate, and then out of the mouth. This ligature was afterward used to make traction upon the resected maxilla. An incision then divided the cheek from the angle of the mouth to the anterior border of the masseter muscle. Another incision commenced at the side of the nose, midway between the ala nasi and the inner canthus, and extended round the ala nasi to the median line, and thence in the labial furrow through the entire thickness of the upper lip. The triangular flap thus indicated was raised from the superior maxilla, and turned upward and outward. The bone was then divided horizontally by the saw, the cut commencing just above the maxillary tuberosity, and terminating above the floor of the nares. The central incisor tooth on the affected side having been drawn, the hard palate was grooved, but not divided, with the saw, in the longitudinal direction, close to the septum. Next, the base of the pterygoid process was severed by strong bone forceps, thereby leaving the under part of the superior maxilla separated from the rest of the facial bones, and held only by the mucous membrane of the soft palate and alveolar process. By employing a chisel as a lever, and by making traction with the ligature at first introduced, the jaw was luxated downward and toward the median line. Through the opening thus afforded, the pharynx was exposed, and a large polypus, attached to the basilar process, the posterior surface of the pharynx, and the base of the pterygoid process, was removed. Its removal was effected partly with a sharp-edged metallic spoon, and partly with a curved scissors. The hemorrhage was alarming, and occasioned syncope. It was arrested with the actual cautery. The jaw was then replaced, and the external wound closed. Considerable difficulty was experienced in keeping the resected bone in position, and eight months after the operation, when the patient was exhibited before the Paris Academy of Medicine, the fragment was still movable, bony union not having taken place. Meanwhile, necrosis had occurred, and a sequestrum was removed 2½ ctms. long and 1½ ctm. wide.

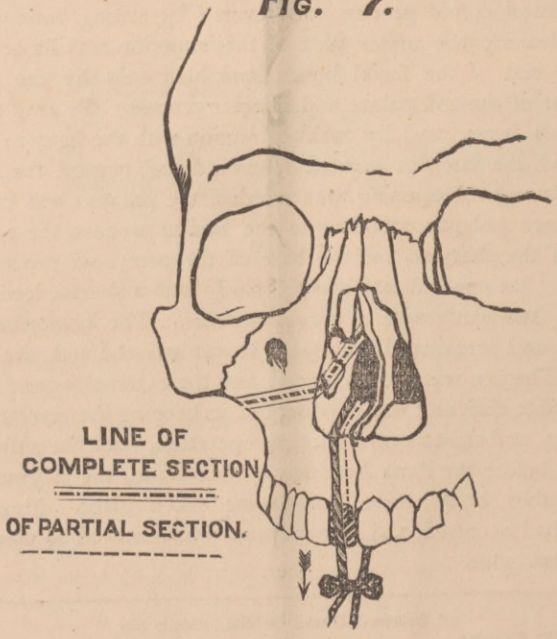
* Bulletin de l'Acad. de Méd., 1860, p. 783.

FIG. 6.



LINE OF SECTION.

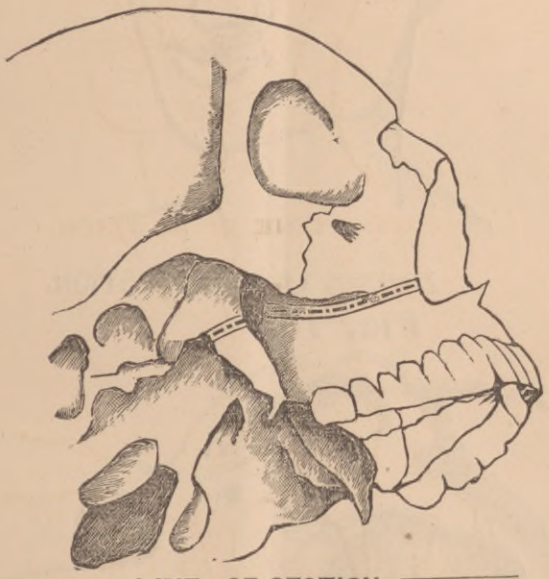
FIG. 7.



An operation essentially the same as Huguier's, was performed in the Boston City Hospital, in 1867, by Prof. Cheever.* In this case, however, the pterygoid process was not divided, and but one external incision was made, extending downward along the side of the nose to the angle of the mouth. The patient made a prompt recovery, but the tumor recurred ; and, eleven months later, a second operation was performed, the steps of which were identical with those of the first. After both operations, bony union of the resected maxilla took place.

Roux's † operation (Figs. 9 and 10) involves the resection of the

FIG. 8.



superior maxillary and malar bones in a single piece, which is displaced upwards and outwards. It is described by Roux as consisting of five steps, as follows :

1. A transverse incision, 1 ctm. long, is carried through the soft parts covering the frontal process of the malar bone. With a chisel and hammer, or chain-saw, the bone is divided in the line of the temporo-malar suture.

2. A vertical incision, 1 ctm. long, is made over the zygomatic arch, and the bone is divided either with the saw or the chisel.

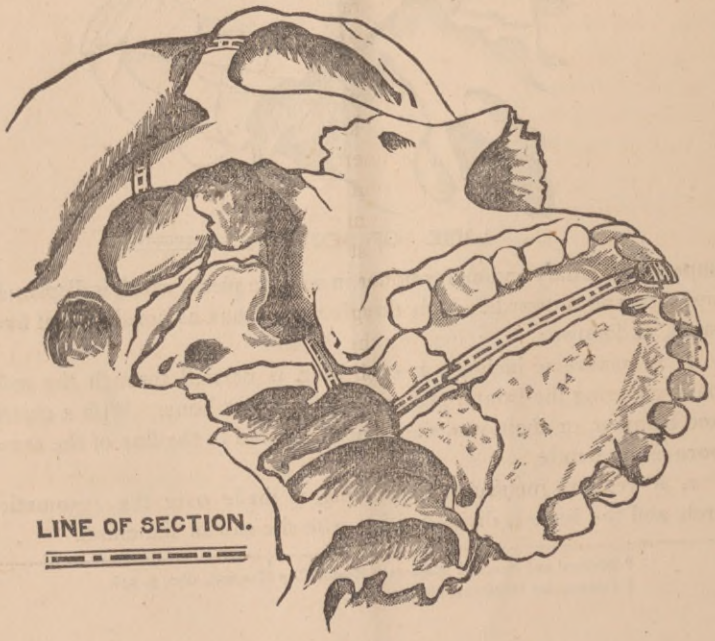
* Medical and Surgical Reports of Boston City Hospital, 1870, p. 156.

† Gazette des Hôpitaux, 1861, p. 354.

FIG. 9.

LINE OF SECTION.

FIG. 10.



3. An incision is commenced below the inner canthus, and carried down along the ala nasi into the nostril, and thence to the median line, and downward through the entire thickness of the upper lip. The nasal process of the superior maxilla, and the inner wall of the orbit, are divided with the chain-saw or chisel at the level of the inner canthus.

4. The connection of the maxilla with the pterygoid process is destroyed by the chisel and hammer, the former being introduced just behind the last molar tooth, where the superior maxillary, sphenoid, and palate bones meet.

5. The soft palate having been separated from the hard palate on the affected side, and the central incisor of the same side having been removed, the hard palate and alveolar process are divided with a chain-saw close to the median line.

The maxillary and malar bones, covered by their soft parts, are now forced upward and outward, until the interval between the two superior maxillary bones is wide enough to permit access to the pharynx. Should the space be found insufficient, Roux recommends that the operation be done on both sides. The tumor having been removed, the parts are to be brought together and maintained in apposition in the usual manner. I am not aware that Roux's operation has ever been performed upon the living subject.

Lastly, Dr. Cheever, of Boston,* performed an osteo-plastic resection of both superior maxillæ, for the removal of a naso-pharyngeal tumor of unusual size. The operation is thus described :—"The primary incision through the soft parts was on either side of the nose, along the natural wrinkle from near the inner canthus, around the alæ, and through the commissure of the myrtiform fossa of the lips. The flaps were freely reflected, so as to expose the bone beneath as far upward as the malar prominences. With a narrow saw the body of the bone was divided from the tuberosity, forward, beneath the zygoma, on each side with the middle meatus. The septum nasi and the vomer were divided with strong scissors. Nothing but the posterior attachments of the upper maxillæ now prevented their depression ; and, hinging on the pterygoid processes, the upper jaw was brought down so as to expose the tumor. Its attachments were found to be to the body of the sphenoid bone, and to the ethmoid. These attachments, except the first, were divided by the finger, and a section of the growth was made by means of scissors as near the sphenoid bone as possible, the mass being too large to deliver altogether. With a gouge chisel the remaining portion was scraped

* Medical and Surgical Reports of Boston City Hospital, 1870, p. 164.

away and removed. The whole growth was in size and shape like a large lemon. The depressed jaw was returned to its position, and retained firmly by silver wire passed on each side through the malar bones. The soft parts were opposed by silk sutures : and the whole physiognomy perfectly reinstated."

Dr. Cheever's patient never fairly rallied from the shock of the operation, and died on the fifth day. Several other osteo-plastic operations have been devised and executed, but I have referred to all that possess any special interest or importance.

In discussing the relative value of the various preliminary operations which have been recommended for the extirpation of naso-pharyngeal polypi, it may be assumed that, in the great majority of cases, some such procedure is necessary. That one will also be the best which enables the operator to gain access to the tumor with the least amount of mutilation, and of danger to the patient. It is highly important, however, that the exposure of the pedicle should be satisfactory, otherwise the tumor cannot be entirely removed.

Operations through the mouth have the advantage of avoiding mutilation of the face, the features being left untouched. Nor can it be denied that such operations have sometimes been done with gratifying success. If the pedicle is narrow, and its situation of attachment central, it may be dealt with thoroughly after simple section of the soft palate ; and its attachment having been destroyed the wound in the palate may be closed at once by sutures, with every probability of securing primary union. But it must be confessed that the operation can rarely be conducted in the manner described ; and the published cases prove that it has generally been found impracticable to destroy the pedicle so completely as to warrant the immediate closure of the wound in the palate. Accordingly, it is the practice of many surgeons to leave the wound open until the pedicle has been removed by some subsequent procedure, and afterwards to restore the palate by staphyloraphy. These facts alone prove that the method now under consideration does not afford the space requisite for the removal of a tumor having extensive attachments, and that in this respect it must be rejected as defective. Moreover, it is by no means easy to destroy the pedicle afterward, and for similar reasons. The actual cautery, and various caustic applications, have been employed for this purpose. In many instances the pedicle has continued to increase in size in spite of the treatment, and the surgeon has been finally driven to the alternative of excision of the jaw to gain the desired end. Furthermore, the irritation and suppuration induced by the repeated application of caustics are exceedingly annoying, and often dangerous, to the patient. Indeed, it has been ascertained that fatal

results have more frequently followed operations through the mouth than those of apparently greater magnitude, so that the former operations cannot, as a rule, be recommended either for their safety or certainty. They avoid disfigurement, but do not guarantee success. Osteo-plastic resections may next be briefly considered as causing less deformity than ordinary excisions. Langenbeck's first method, namely, that which consists in resection of the nasal bones, has been done several times with success, and is adapted especially to those cases in which the tumor occupies the nasal cavity rather than the pharynx, and in which the attachments are situated pretty well forward. It certainly would not afford the facilities for reaching tumors which occupy the usual situation, as an examination of the cadaver alone will show. I have found that after the nasal bone and nasal process of the superior maxillary have been resected in the manner recommended, the distance of the basilar process of the occipital bone from the anterior opening is nearly three inches; and although the boundaries of the nasal fossæ would, in any given case, probably be dilated by the pressure of the tumor, the space thus afforded would rarely be found sufficient for the satisfactory manipulation of its pedicle. Langenbeck's second operation, in which portions of the malar and superior maxillary bones are temporarily displaced, is admirably adapted for the removal of those polypi which originate in the pterygo-maxillary fossa, and it is for this purpose that it was originally designed. I once performed the operation in such a case, and had no trouble in detaching the tumor. But although it has been also successfully done for naso-pharyngeal polypi, I think it is inferior to several other procedures for this purpose. The operation itself is difficult of execution, unless the spheno-palatine foramen is abnormally dilated; and the pharynx is very imperfectly exposed, owing to the presence of the pterygoid process. These objections will be found, I think, to prevent the operation from being extensively adopted.

Huguier's operation has been performed by its inventor, and, with slight modifications, by Dr. Cheever, of Boston. Both patients recovered; but one circumstance in each case deserves to be mentioned. In Huguier's case necrosis occurred, and a portion of the resected bone exfoliated, the remainder failing to unite by osseous union. In the patient treated by Dr. Cheever, the tumor recurred within a year after its removal, and resection had to be performed a second time in order to expose it. These facts constitute objections to the operation; and the liability to recurrence of the disease after removal offers a strong argument against osteo-plastic operations generally.

I have tried Roux's operation on the cadaver, but do not feel disposed to perform it on the living subject. It involves great mutilation of the facial bones, and does not afford satisfactory access to the pharynx. To expose a tumor having a broad attachment, it would be necessary to displace the maxillary and malar bones on both sides of the face, thereby greatly increasing the risks of the operation.

Cheever's operation is ingenious, and is not, I should judge, very difficult of execution. Although it terminated fatally in the single instance in which it has been performed, I agree with Dr. Cheever in thinking that there is no danger inherent in the operation that ought to prevent its repetition.

Finally, let us endeavor to determine the value of ordinary excision of the upper jaw, either partial or total, as a preliminary operation. It may be remarked, in passing, that excisions of the upper jaw are, as a class, remarkably successful operations. The objections that apply to them are mainly owing to the disfigurement which they produce. We shall have occasion presently to see that this objection is almost groundless, so far as the operation of partial excision is concerned. In the next place, it may be stated that excision of the jaw affords easier access to the pharynx than any of the other methods, and thus enables the operator to attack the pedicle with the maximum chances of success. Accordingly, the probability of a recurrence will be correspondingly diminished. Neither the operations through the mouth, nor any of the osteo-plastic procedures which have been described, permit that satisfactory exposure of the base of the skull which is afforded either by partial or total resection of the superior maxilla; and it must be evident, from what I have already said, that ample space is necessary, both for the thorough extirpation of the tumor, and for the prompt arrest of the hemorrhage that so often accompanies its removal.

Another advantage of ordinary excision is, that a wide gap is left after the operation, through which the disease, when it recurs, can be readily recognized and treated. After an osteo-plastic operation, on the contrary, the recurrence is not so easily detected; and, when it does take place, the entire operation must be repeated. This latter fact establishes an objection to osteo-plastic operations, which is not outweighed, in my opinion, by any of their alleged advantages.

It remains to be ascertained, whether partial excision of the jaw, according to the plan devised by Maisonneuve, will not fulfil all the indications presented; and I believe that, in most cases, this question may be answered affirmatively. In the patient now exhibited to the Society, I removed, after partial excision, a polypus of large size and extensive attachments. Partial excision affords an excellent view

of the pharynx, and leaves the patient with very slight external disfigurement. The orbital plate and malar tuberosity being left intact, the eyeball does not descend from its normal position, and there is not that absence of the natural prominence of the cheek, which is noticed after complete excision. The skill of the dentist can readily imitate the lost portion of bone, and the gap in the palate can be closed partly by staphyloraphy, and partly by an obturator made of hard rubber. Of all the operations mentioned then, which are applicable to grave cases, I give the preference to partial excision of the upper jaw, as the one which is calculated to favor the complete removal of the tumor with the least practicable disfigurement.

The conclusions to which I have arrived are based chiefly on the experience I have obtained in the treatment of the following case; and I may remark, finally, that operations for the removal of naso-pharyngeal polypi, although formidable in character, are remarkably successful in their results. This fact is especially gratifying, as they are undertaken for the cure of a disease which, if left to itself, leads inevitably to a fatal termination.

CASE.—Josiah Dutcher, a farmer, aged 20, entered the Roosevelt Hospital in October, 1872. He began to suffer from obstruction of the nose about a year previously to admission; and, six months later, noticed a swelling in the roof of the mouth. Ten months before admission he commenced to have attacks of hemorrhage. Lately he had grown weak, and had lost flesh. When admitted, he was pale and anæmic. On examination, a large tumor was discovered, distending the pharynx, and extending downward so as to be visible below the free edge of the soft palate. The latter was crowded downward and forward, so that the plane of its surfaces was nearly vertical. The tumor was firm and elastic, and its pedicle could be traced to the base of the skull, where it had a broad attachment, extending somewhat further to the right than to the left of the median line. The left nasal cavity readily admitted a flexible catheter backward into the pharynx; the right cavity was nearly impassable.

An operation through the mouth was performed on Oct. 17th, 1872. A longitudinal incision was made through the soft palate, just to the right of the uvula, extending from its free edge to a point about half an inch anterior to its line of attachment to the palate bone. A second incision, beginning where the first ended, was carried outward to the right alveolar border, and the flap thus mapped out, which included the horizontal plate of the palate bone, was reflected downward. The hard palate was found in part absorbed from the pressure of the tumor. The latter was free from secondary adhesions, and no difficulty was encountered in surrounding the pedicle with the chain of a large écraseur. The chain broke, and I then divided the pedicle, which was thick and firm, with a pair of stout scissors, making the section as close to the skull as possible. Copious hemorrhage immediately followed, and much time was consumed in unsuccessful attempts to secure a large artery which had retracted to the deepest part of the wound, and which was inaccessible to the ligature. The bleeding finally ceased, in consequence of the prostration of the patient, who had several alarming attacks of syncope. It became

evident that the pedicle could not be satisfactorily detached at the time of the operation, consequently the wound in the palate was left open.

The tumor removed was firm, and distinctly fibrous. It was oval in shape and measured as follows; length, 2¾ inches; breadth, 2½ inches; thickness, 1½ inches. The surface of section of the pedicle was nearly circular, and its diameter an inch and a quarter.

The patient rallied after the operation, under the influence of stimulants, and recovered without any bad symptoms, although he regained strength slowly, and remained, for several months, very pale and anæmic. Meanwhile, it was observed that the tumor had begun to grow again. I now decided to operate a second time, by making a partial excision of the jaw, and to remove the principal mass of the tumor with the galvano-caustic ligature. The recurrent growth had descended so low as to interfere considerably with respiration, and the patient was very anxious to get rid of it. In the mouth it presented a fungus-looking mass, extending forward and laterally nearly as far as the dental arch. The right nasal cavity was completely obstructed, and the tumor had grown firmly adherent to the posterior border of the septum narium.

On May 10th the patient was etherized, and I operated as follows: With a scalpel, the tissues of the face were divided down to the bone, along a line extending from just below the right inner canthus downward beside the nose and around its right ala into the opening of the nostril; thence along the junction of skin and mucous membrane to the middle line, and along the latter to the free margin of the upper lip, the latter being completely divided.

The flap thus marked out was reflected upward and outward sufficiently to admit of the next step of the operation, as follows:—

With a straight, narrow, button-pointed saw, known as Langenbeck's, the malar process of the upper jaw-bone was divided upward and inward (the right central incisor having first been drawn), and into the upper end of the saw-cut a trephine centre-pin was entered, and a circular hole made into the antrum, to admit one blade of a large cutting bone-forceps, the other blade being passed into the inferior meatus of the nose.

With this instrument, thus entered, the section of the front and inner walls of the antrum was completed. With the same instrument the hard palate was divided on the right side, close to the septum. The soft palate was then separated with scissors curved on the flat, from the hard palate, and the detachment of the lower part of the upper jaw completed by grasping it with Fergusson's lion-toothed forceps, and wrenching it away, the lower part of the pterygoid process coming with it. The inferior turbinated bone, which projected into the cavity thus left, was pulled away, and ready access to the tumor was then obtained.

The tumor was found, like its predecessor, to be attached to the basilar process of the occipital, and the body of the sphenoid bone, and was adherent to the posterior free margin of the septum and hard palate, and to the right pterygoid process.

The palatal and pterygoid processes, and the vomer, were all thinned, and in parts absorbed.

The connections of the tumor with the septum, hard palate, and pterygoid plate were first divided, partly with the scissors and partly with the finger, a very large part of the septum, and nearly all the remains of the hard palate, being removed by the process.

The pedicle, which was very broad, was then surrounded, near the base of the

skull, with a loop of platinum wire, and the latter connected with from two to three cells of a Grove's battery, the larynx and pharynx being protected by wet sponges from the leakage of heated fluids. The tumor was divided by the galvano-caustic wire in six minutes, without the least hemorrhage.

Examination now showed a considerable portion of the pedicle still remaining, and to this the galvano-caustic loop was again applied. Other smaller portions were removed with the fingers, aided by a large rugine, and the last piece left, in part, with scissors. The use of the latter was followed by a certain amount of bleeding, soon checked by the application to the stump of the galvano-cautery, and the persulphate of iron, aided by pressure, and by the ligation of an artery in the pterygoid fossa.

After all had been removed of the tumor that could be, a small prolongation of it was discovered running into the sphenoidal cells; and this I deemed it imprudent to attack.

The flap of soft tissues was now replaced in position, and secured by one twisted and a number of interrupted sutures of silver and fine silk.

Very little blood was lost during the operation, which lasted at least two hours, nor did what was lost penetrate the glottis to any dangerous degree.

The patient's pulse continued good throughout the operation, and at its end was less than 100. He bore etherization perfectly, and had no asphyxial symptoms from any cause. The great comparative ease and safety of operation resulting from the use of the galvano-caustic wire is thus forcibly illustrated.

The tumor removed by this second operation consisted of one larger and one smaller piece, and of a number of fragments. The larger piece was $2\frac{5}{8}$ inches long by $1\frac{3}{4}$ broad; the smaller, $1\frac{1}{4}$ inches by $1\frac{1}{2}$. The surface of section left on the larger piece after the use of the hot wire was $1\frac{3}{8}$ inches across.

Microscopic examination showed the tumor to be essentially fibrous, the bundles of fibrous tissue being mingled with a certain amount of young cells, which were especially numerous beneath that point on the free surface of the growth from which the first tumor had been removed.

The patient recovered rapidly after the operation, and was allowed to sit up on the ninth day, union by adhesion having taken place throughout the entire extent of the external wound. He is now exhibited before the Society, to show how little disfigurement has resulted from the operation.

At the present date, Feb. 1st, 1873, the patient remains quite well, no recurrence having taken place.

NOTE.—I am indebted to my friend Dr. J. G. Curtis for the woodcuts accompanying this paper. With the exception of Fig. 3, they are all original.

The accompanying photograph in which the parts are seen reversed, was taken two months after the second operation. No artificial contrivance had yet been made to replace the lost bone and teeth.

ARCHIVES

OF

Scientific and Practical Medicine.

This Journal, edited by Dr. BROWN-SEQUARD, with the assistance of Dr. E. C. SEGUIN, and of several New York, Boston, Philadelphia, and Cincinnati Physicians and Surgeons—will appear on the 15th of every month, in numbers of about one hundred pages, similar to the first one.

This periodical will chiefly contain original papers on subjects belonging to every branch of the medical sciences. It will also contain: 1. An *Exposé* of the State of our Knowledge on some great Medical Question; 2. Translations of Short Foreign Papers; 3. Report on the Results of Experimental Researches made in Dr. BROWN-SEQUARD'S Laboratory by himself, or by his pupils; 4. Short Clinical Reports; 5. Reviews and Bibliographical Notices; 6. Reports on the Progress of Medicine, Surgery, and Obstetrics; 7. Miscellany.

Most of the numbers will contain illustrations or plates.

Books for review, and exchanges, should be addressed to Dr. C. E. BROWN-SEQUARD, No. 18 East 29th St., New York City. Communications intended for publication in the Journal must be addressed to Dr. E. C. SEGUIN, Sub Editor, No. 17 East 21st Street, New York City.

Subscriptions received by Messrs. G. P. Putnam's Sons, Association Building, Fourth Avenue and 23d Street, New York City.

The annual subscription price will be Four Dollars, to be paid in full, in advance. It is designed soon to confine the circulation to yearly subscribers only; the first numbers, however, will be sold separately at fifty cents a copy.

Papers by the Editor, on the following subjects, will appear in rapid succession:

On Asphyxia, Syncope, and Collapse.
Ear Affections, and their Relations with Brain Disease.
Mechanism of Production of Symptoms in Diseases of the Brain.
Morbid Influences of the Nervous System on Organic Functions.
Physiological and Pathological Proofs of Attraction of Blood by Tissues.
Amaurosis and Deafness in Diseases of the Brain.
Rational Treatment of Poisoning by Organic Substances.
On the Various Kinds of Hemiplegia.
On Counter-Irritation: Its Importance and Rational Use.
Physiology and Pathology of Epileptiform Affections.
On Pneumonia and other Lung Affections in Diseases of the Brain.
On Reflex Paralysis and other Affections produced by a Reflex Influence.
Analogies and Differences between several Remedies (Belladonna, Digitalis, the Ergot of Rye, and the various Bromides).
Artificial Epilepsy in Animals, and what it Teaches for the Treatment of Epilepsy in Man.
On Transfusion of Blood: New Methods and Proper Conditions for its Use.
On Differences between Americans and Europeans, as regards Diseases and Power of Resisting Injuries.