

## CHAPTER LI.

### CARIES OF THE MAXILLÆ.

CARIES of bone, practically viewed, is a disease very analogous to ulceration in the soft parts, and is possessed of the threefold expression of simple, strumous, and specific. As the jaws are concerned, the condition is confined almost exclusively to the superior bones. The causes which act as provocatives are, of course, various; yet dead teeth and roots of teeth are found far to preponderate.

Caries of the jaw presents commonly, yet it may be in aggravated form, the external features which characterize the ordinary alveolar abscess, whether in its acute or chronic state. This, however, would be inferred, such lesion being so commonly its origin. When the attack is acute in its nature, ulitis or periostitis will always be found associated with it. If the disease originate as a pure ostitis, then the gum in turn quickly sympathizes; if, on the contrary, the inflammation arise from a tooth, periodontitis will distinguish the offending agent. In all inflammations about these parts, whatever their character and cause, the abortive treatment cannot too quickly be attempted. From failure to attack with sufficient vigor such perversions, the whole bone is sometimes destroyed.

Caries once established, a diagnosis is made easy through the instrumentality of touch. One or more fistulous openings will be found to exist in the gum, or it may be in some neighboring part, the orifices of which are surrounded usually by fungous granulations; it is only necessary to carry a probe through these sinuses when the bone is found riddled, honeycomb-like, and easy to break down, either as the surface is implicated, or as, in the strumous expression of the disease, the deeper parts are involved. In such examinations it is always found advantageous to replace the ordinary probe with the common dental excavator, as otherwise, from the less accurate touch attained through the first instrument, it is possible to mistake the denuded bone of ordinary alveolar abscess for the more formidable and extensive disease, thus being misled as to treatment. In carrying the instrument through the opening of an alveolar abscess, it is remarked that the bone is bared; but the touch differs from that peculiar to caries, in the fact of this uncovered bone being hard and resisting. Not always, however; for it has just been remarked that periodontitis and dental abscesses are the most common causes of ostitis and caries, reference being had only to the pure, uncomplicated cases of alveolar abscess. As a rule, when a sharp instrument can be made

to pass readily into the substance of the bone, and to break it down, caries is present. If, on the contrary, the bone be solid and resisting, even although denuded, caries does not exist. Carious bone is frequently, however, found associated with exuberant granulations, which deceive when the probe used is not of sufficient sharpness readily to penetrate the fungus. As a rule, no harm is seen to result in boldly thrusting knife or probe through soft parts inferred to mark benign maxillary disease.

An ostitis, however provoked, does not by any means necessarily run into osseous ulceration, any more than ulceration is necessarily a result of an inflammation in the soft parts. There are, however, certain conditions which markedly predispose to such degenerations: of these the strumous is without doubt the most common. The bones of scrofulous subjects break down easily, also those of persons who have received the mercurial impression. Cancerous caries of the upper jaw is not infrequently met with; while, aside from such lesions, it seems to be true that, in persons of the most robust and vigorous health, a slight cause has been sufficient to develop the disease. A case this moment recalled (a very expressive one) will serve to illustrate the probability.

In the autumn of 1867 a gentleman from a distant State visited Philadelphia for the purpose of having an opinion concerning a fistule that existed over the apex of the right upper lateral incisor tooth, and which had long resisted the ordinary applications and injections used by his professional adviser at home. This fistule had originated from the tooth named, a dead one, and was considered simply an alveolar abscess, the only question thought to be involved being the loss of an organ, which the patient was most desirous to save. The gentleman coming first under the care of a personal friend, opportunity was afforded the writer to see him in consultation, when examination revealed a softened, honeycomb-like condition not only of the right but also, partially, of the left jaw, necessitating an operation of very extensive character as the removal of bone was concerned.

In this case nothing wrong was recognized with the general health of the patient, he being young, and of more than commonly vigorous habits.

The primary lesion here was, without doubt, the dead lateral incisor. Why this should have provoked such extensive trouble one is at a loss to say. In this particular instance, as in other cases, the disease was developed and advanced without any very marked acute manifestations, a not uncommon feature in caries, and one which is of much importance to be borne in mind. A whole jaw may be softened and destroyed, while the patient rests under the impression that he has no lesion beyond cure through the loss of a tooth. Cases of this kind are occasionally met with, where the adviser and advised have been alike deceived.

The slowness or the rapidity with which caries of the jaw progresses is influenced by individual conditions. Thus, in the periods of dentition, the disease will commonly be found to make rapid progress, unless, indeed, the

vital forces are very resistive; while in the mercurially weakened bone, caries seems sometimes analogous to simple disintegration, as if, indeed, the particles had lost the power of cohesion.

The peculiar affinity existing between this disease and the cellular tissue of the bones leads to the inference that it is more common to persons whose skeletons are loose and spongy in character than to the reverse class; and this is markedly true: hence strumous children are very subject to caries, as is so often witnessed in their articular complaints.

In many subjects the condition seems to be that of a semi-fatty decomposition, the animal portion of the bone becoming quite soft and greasy; indeed, even the osseous particles thrown off present the same aspect. The relationship of the disease with tubercular deposits is so fully established in the minds of many that they incline to the conviction that such tubercle is present at all points of the manifestation of caries. That this is not fully true, is proven by examples such as have been presented. That constitutional causes have, however, quite as much to do with the development of caries as have local injuries, is made sufficiently evident in the immunity of the numberless persons who have been brought, without ill result, under the influences of similar local sources of irritation.

It has been suggested that caries may exhibit itself in various ways. Yet, however and whatever the manifestation, an *ostitis*—chronic or acute—must precede the ulceration. About the jaws the great majority of cases have, in their incipency, nothing to distinguish them from ordinary *periodontitis*; and it is by far most frequently the case that the acute attack has been long past before this peculiar ulceration is developed, it seeming to be that the resistive power of the bone is gradually worn out by the presence of chronicity; the inflamed tooth has died, and its devitalization is the source of offence. Nearly every case of caries of the jaws met with could have been aborted by the timely removal of a certain tooth or teeth,—not, of course, all, but that great majority which have dental irritation as the exciting cause.

A carious bone presents clinical peculiarities according to the duration of the disease and the several phases of the cause inducing it. If seen early, there is to be observed simply the increased vascularity and congestion of the inflammation. A little later, and a *cacoplastic* exudate occupies the cells, which cells, in their turn, have become enlarged, and their walls decalcified; these, still later, commence gradually to break down, together with the semi-organized lymph exuded into them; in proportion as such exudation has been, and is, extensive, and the breaking down is rapid, the caries may be said to be dry or moist. Such exudation and degeneration are markedly exhibited in many cases of hip disease, or in white swelling of the knee-joint, where the discharge may amount to quite as much as a pint a day. On now looking at the bone, we find it riddled with irregular cavities, many or all of which are lined by a sort of imperfect secretory surface, or perhaps it would be more

correct to say, a glazing of semi-organized exudate corpuscles.\* If the disease is to involve the whole bone, such will be its general condition. If, however, there reside in the part the vital force capable of resisting the lesion, then from the central point of the disease outward will be observed a change in the character of the lymph exuded. The farther we get from the centre, the more bland and healthy is the exudate; while the complete filling up of the cells (structural consolidation) exhibits the wall of protection present in circumscribed healthy inflammation of the soft parts. It is to be observed, however, that this protecting wall is most apt to give way before the advance

\* "The whole essence of caries consists in this: the bone breaks up in its territories, the individual corpuscles undergo new developmental changes (granulation and suppuration), and remnants composed of the oldest basis-substance remain in the form of small, thin shreds in the midst of the soft substance. In ossification (in cartilage) there is a portion of the original intercellular substance of the cartilage cells (secondary cells) which, though it belongs to the group as a whole, yet when these, in the course of ossification, are transformed into a number of isolated bone-cells, becomes, comparatively speaking, almost entirely independent of those cells individually (which have their own immediate intercellular substance to attend to, and from most of which it must be separated by a considerable interval), and therefore escapes the changes which befall them. It is this portion which remains behind in caries, while the secondary intercellular substance perishes. In other processes, however, which run a more chronic course (in cancer, for example), everything is destroyed.

"At the moment a periosteal tissue quits the surface of a bone, and the vessels are drawn out from the cortex in inflammatory condition, we see, not as in normal bone, mere threads, but little plugs, thicker masses of substance; and if they have been entirely drawn out, there remains a disproportionately large hole, much more extensive than it would be under normal circumstances. On examining one of these plugs, you will find that around the vessel a certain quantity of soft tissue lies, the cellular elements which are in a state of fatty degeneration. At the spot where the vessel has been drawn out the surface does not appear even, as in normal bone, but rough and porous, and when placed under the microscope, you remark those excavations, those peculiar holes, which correspond to the liquefying bone-territories. If it be asked, therefore, in what way bone becomes porous in the early stage of caries, it may be said that the porosity is certainly not due to the formation of exudation, seeing that for these there is no room, inasmuch as the vessels within the medullary canals are in immediate contact with the osseous tissue. On the contrary, the substance of the bone in the cellular territories liquefies, vacuities form, which are first filled with a soft substance, composed of a slightly streaky connective tissue with fattily degenerated cells. If round about a medullary canal the territory of one bone-corpuscle after another liquefies, you will, after a time, find the canal bounded on all sides by a lacunar structure. In the middle of it, the vessel conveying the blood still remains, but the substance around about it is not bone or exudation, but degenerate tissue. The whole process is a degenerative *ostitis*, in which the osseous tissue changes its structure, loses its chemical and morphological characters, and so becomes a soft tissue which no longer contains lime. The tissue which fills the resulting vacuity in the bone may vary extremely according to circumstances, consisting in one case of a fattily degenerating and disintegrating substance (the bone-corpuscles perishing), and in another of a substance rich in cells, and containing numerous young cells; this latter is formed by the division and proliferation of the bone-corpuscles, and the newly-produced substance is very analogous to marrow. Under certain circumstances this substance may grow to such an extent that—if we may again borrow our illustration from the surface of the bone where a vessel sinks in—the young medullary matter sprouts out by the side of the vessel, and appears as a little knob filling one of the pits in the surface. This we call granulation."—VIRCHOW.

of the trouble,—seeming to retard but not to check it. In other words, nature seems seldom able, unassisted, to complete a line of demarkation, as witnessed in necrosis.

**Treatment.**—To do all that can be done in these cases is not at all difficult. If inflammation of the bone exist in an acute stage, it is to be treated on general principles: cathartics, diaphoretics, counter-irritants, hot pediluvia, leeches, dry or wet cups, the general abstraction of blood, any or all of these means being brought into requisition, the practitioner being influenced alone by the resistance of his case. If a tooth, irritated in its enveloping membrane, be the cause of the inflammation, as is most frequently the case, such tooth is to be removed, or treated. Generally, in such an inflammation, it is found sufficient to scarify the gums, give a hot foot-bath, apply a blister to the back of the neck, and administer a saline cathartic. If such a course should not abort the trouble, then three or four Swedish leeches are to be applied directly to the inflamed part, this being easily accomplished by introducing a napkin back of the middle of the roof of the mouth. If even this should not succeed, and the patient be plethoric, blood is to be taken from the arm. Dry cups are invaluable.

It is, however, frequently the case that even what may be viewed as the acute stage will be found of an asthenic type. In these cases, conjoined with the local depletion, tonics are demanded: iron, quinia, beef-essence, cod-liver oil, etc., being indicated. If, when a case be first seen, the caries has become established, the acute action having ended, as recognized by the existence of fistulæ, the honeycomb-bone, etc., vigorous tonic medication, conjoined with stimulating injections, is to be used. Of such injections, the tincture of iodine, carbolic acid, compound tincture of capsicum, and chloride of zinc, will be found as promising as any. Of the tonics, a common experience gives to the chalybeates a preference. It is not, however, from the medication alone that a cure is to be expected. In caries nature seems unable to throw off the incubus of the disease; and the cases are rare indeed where relief by operative means is not found imperatively demanded. Such operative means, however, to be of profit, are to be well considered.\*

\* "Prevention is obviously the paramount indication. With this view, if symptoms of interstitial absorption be present, our attention will be directed to the arrest of this by counter-irritation and constitutional care. If a simple abscess or ulcer occurs on the surface of bone, it will be our object to effect the healing of this as rapidly as possible, in order to prevent degeneration. When mere osteitis is present and demands our aid, we shall treat it actively yet warily: actively, in order to arrest the inflammatory process ere yet the untoward results of suppuration or ulceration have occurred: warily, avoiding exhaustion of the system, and still more the poisoning of it by excess of mercurial and other active antiphlogistics; careful not to induce a state favorable to the occurrence of destruction in bone. And seeing that caries is usually so much connected with taint of system, our attention will be directed throughout toward constitutional care in connection with both prevention and cure.

"When caries has occurred, the indications of local treatment are abundantly simple. We are to take away the two portions which are incapable of healthy effort,—the intersti-

To operate for caries of the jaws the author now employs universally the surgical engine and stoned rose drills. The rapidity and painlessness with which such operations can be performed must be witnessed to be appreciated. One not possessed of an engine gets along very well, however, with two or three delicate chisels, a scalpel, and a syringe. Taking the fistula for a guide in an operation, the bone is exposed by a simple incision. Next, with rose drill or chisel, the softened structure is, little by little, cut away.

The extent to which caries is occasionally found to have progressed is a matter of surprise. One can do no better than follow the softened bone, wherever it leads. The author very frequently, in this way, has been led from an apparent simple beginning, to remove nearly or quite all of the upper jaw. Danger from hemorrhage affords no special occasion of anxiety; indeed, cases are few in which the injection of alum-water or phénol sodique is not found all-sufficient for its control. When healthy bone is reached in an operation, it is distinguished from the carious by both touch and sight. Under

tially absorbed as well as the truly ulcerous; leaving a solid foundation of normal texture, not only capable of, but already engaged in, the business of efficient repair. Afterward, the part is to be treated as a simple ulcer; our anxious care being directed to speedy yet efficient and certain closure, lest renewed degeneration supervene; not resting satisfied with a blue, elevated, soft, and spongy cicatrix, but insisting on the establishment of one which is firm, white, depressed,—plainly incorporated with the bone.

"For effecting the removal, cutting instruments are infinitely preferable to escharotics, in all situations where excision is practicable. But as a general rule, no operation of any kind should be performed on the bone unless the adjacent and superimposed soft parts are in a quiet state. They may be undergoing the acute inflammatory process; they may be the seat of acute suppuration, of acute ulceration, or of both; and removal of a portion of bone, imbedded in such soft parts, is almost certain not only to prove futile as a means of cure, but actually to aggravate and extend disease. The then carious portion of bone may be taken away, but ulceration instead of reparation is certain to ensue; and by rapid degeneration the carious condition is renewed; or a more general and intense osteitis is kindled, and the partial caries is merged in general necrosis. And even supposing none of these untoward events to occur, still the time of operation were inexpedient, as causing an unnecessary and therefore unwarrantable amount of secondary inflammation.

"The soft parts being already quiet, or having become so under suitable treatment, free incision is made through them, so as effectually to expose the diseased portion of bone,—previously tolerably well explored by judicious use of the probe. The extent of the doomed parts having been satisfactorily ascertained, their thorough removal is then to be accomplished.

"Escharotics in some cases are employed; as, for example, when a patient resolutely objects to any other mode of removal. Or when cutting instruments have been used, and yet a border of suspicious character remains, the extinction of such a suspected part may sometimes be conveniently enough intrusted to cauterization. The actual cautery may be applied, but unwisely. It effects too much. The carious part is at once and satisfactorily killed; but, as in all severe burns, the texture immediately surrounding the eschar, though escaping with life, has its vitality very much impaired, and is more prone to disintegration than to repair. The potential cautery is infinitely preferable. It destroys the diseased part just as effectually, though, perhaps, with less rapidity, and at the same time the immediately adjoining parts do not in any wise suffer, but at once institute a healthful line of demarkation for removal of the dead part, and are well able to commence, at the same time, a sthenic action of repair."—MILLER.

the steel the first is hard and springy, the latter soft and brittle; passing, with the instrument, from the diseased to the healthy tissue, one could not fail to remark a difference. To the sight, healthy bone is white and vascular; carious bone is dark and non-vascular, or it is a deadish white, or oleaginous. A very observable difference between caries and necrosis consists in the absence, in the former, of the odor associated with the latter, caries running its whole course without necessarily giving the slightest annoyance from this cause; at least, where proper cleanliness is observed.

The use of the syringe, after an operation for caries, is of the greatest moment; the capacity is not to be less than of one gill, and every particle of detritus is to be carefully washed away. In the after-treatment, this instrument will also be found to perform good service,—repeated washings with proper medicaments being very conducive to a cure.

The use of sulphuric acid in the treatment of caries, designed to unite with the base of the phosphatic salts of the bone, and thus remove it, introduced into practice by George Pollock, F.R.C.S., surgeon to St. George's Hospital, has justly attracted much attention. Used in that state, in which nature, possessed of the requisite resistive force, has compelled the line of demarkation, and needs only the assistance of relief from the dead tissue, sulphuric acid employed in a required strength will undoubtedly dissolve such dead bone and thus allow a cure. Again, employed as a local stimulant, it exerts most excellent influence, exciting into action, and seeming to afford support to all the abeyant force of the parts. Still again, used as an antiseptic, its effects are very beneficial, assisting in keeping the parts fresh and clean.

In using sulphuric acid with a view to the solution of dead bone, one part of the officinal is to be diluted with eight of water; or, if preferred, the aromatic acid may be used pure. Mr. Pollock himself uses this latter, at first diluted with equal parts of water, and then more and more nearly pure, pencilling the surface which he exposes by turning aside the soft parts. When the acid is employed simply as a stimulant or antiseptic, the circumstances of each case will govern the strength of the application.

Aromatic sulphuric acid is used undiluted by the writer, being applied and retained against the part to be dissolved on tufts of cotton wool fully saturated. No harm results to the soft parts.

The employment of caustic potash for destroying quickly disintegrating bone has the recommendation of no less eminent authority than Dr. Fitzgerald, of Dublin. When tested, however, by the side of sulphuric acid, it is to be agreed that there is no comparison. With the former agent, secondary injuries may associate; with the latter, nothing but good is to be anticipated.\*

\* "Acid does not affect or injure the soft tissues when used in the diluted form: acting chemically on the *diseased bone alone*. It does not affect the living bone, and its application is seldom followed by any great degree of pain.

"That, in the diluted form, it will only act on dead or diseased bone, and not on healthy bone, is a point of very considerable practical importance, and is the great advantage sul-

**Illustrations in Practice.**—Mary B., girl of weakly constitution with caries of inferior maxilla involving the body of the bone from the second bicuspid of one side to the first molar of the other, the teeth being in place, but very loose, three sinuses existing in the gum overlying the disease, which sinuses were in constant discharge. Examination with a sharp-pointed steel probe exhibited the bone as so honeycomb-like that the instrument could be pushed through it without difficulty.

**TREATMENT AND RESULT.**—Patient kept on a chalybeate tonic for three weeks, then operated upon before hospital class. Desirous of testing the reparative powers, a cut, uniting several sinuses, was made below the apices of the roots of the teeth, and with delicate gouges the softened bone was scraped away, allowing the teeth to remain supported almost exclusively by the gum. After the operation the parts suppurred from the superficies of the bone more or less for three months, the left cuspis being thrown off by a slough of the immediately overlying gum. At the end of this period, an osteophytic sequestrum was exfoliated, after which the wound closed, the teeth gradually became firm, and a cure, with the teeth preserved, was happily secured. Locally, sulphuric acid alternated with the chloride of zinc was used. Systemically, advantage was endeavored to be taken of all tonic influences: exercise in the open air and sunshine, salt-water sheet-baths, juicy undercooked meat, the compound tincture of gentian as an appetizer, etc.

The use of sulphuric acid in caries, acting to the chemical decomposition of bone, may readily be conceived as possessed of much good import; indeed,

phuric acid possesses as an application, under the circumstances quoted, over the use of the gouge, or of the actual cautery, or of caustic potash. The following experiments, conducted at my request by Mr. Henry M. Noad, lately my clinical clerk, satisfactorily prove the correctness of this statement.

"Portions of dead, diseased, and healthy bone were selected and subjected to the action of sulphuric acid, viz.:

- "1. Dead bone, 10 grains.
- "2. Diseased bone, 10 grains.
- "3. Healthy bone, middle age, 10 grains.
- "4. Healthy bone, old age, 10 grains.

Exposed to the action of a mixture of sulphuric acid and water, one part in four, for three days, at a temperature of 100°, the following were the results:

- "1. Dead bone: Phosphate of lime, 2 gr.; carbonate of lime, 3.30 gr.; dissolved in the mixture.
- "2. Diseased bone: Phosphate of lime, 2 gr.; carbonate of lime, 1.3 gr.; dissolved in the mixture.
- "3 and 4. In both specimens of healthy bone, *no action took place*.

"The process of disintegration or dissolution, with the commencement of healthy granulation from the surface of the living bone, may be observed simultaneously progressing, in any exposed surface of dead or dying bone to which the acid may have been applied. When its action and effects are compared with those of the gouge, the bruising which is necessarily produced by the use of the latter, the pain and frequent subsequent inflammation, and, even under the most favorable circumstances, the time required for the rough lacerated surface to recover itself, throw off its small bruised fragments, and become covered with granulations, the treatment by sulphuric acid will be found far preferable."—POLLOCK.