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**THE SIGNIFICANCE OF THE TONSILS AND THE SUPRA-
TONSILLAR FOSSA.**

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RECENT discussion has brought up afresh the position of the tonsil in the animal organism, and we have once more in a larger form the old problem of what is best to be done for its simple hypertrophy. One result of medical inspection of schools has been to demand its more active treatment, if not complete removal. This renaissance of the tonsil question has not been confined, however, to this country, for the movement has been general, and there are few lands where laryngologists are not engaged in discussing the most effective procedure for getting rid of the gland, whilst conservative measures, which served their day in preserving some part of it, have been pushed into the background. Such being the case, it seems worth while to draw attention to certain points which throw light on the meaning of these organs with a view to inquiring if the place they fill in the economy is such as to justify a recourse to conservative measures which may enable them to retain it. For this purpose it will be necessary to refer to some points in their development, comparative anatomy and physiology, and as the palatal tonsil is the best known of the group and has in relation to it a space of some importance, the

supratonsillar fossa, with which I propose to deal, it will be convenient to begin with it.

The palatal tonsil arises in the second branchial cleft, the dorsal prolongation of which forms below the palate a groove—tonsillar sinus—and in this it is laid down. The sinus is clothed with a continuation of the mucous membrane of the mouth-cavity, consisting of stratified epithelium and young connective tissue. Into the latter there dip down processes of epithelium which develop a tree-like branching. These solid buds continue not only during the embryonic period but also in the first year of life. In the course of time they become hollow by the core softening and being expelled and the system of branching canals or crypts characteristic of the tonsil is established.

About the third month leucocytes appear in the connective tissue of the mucous membrane, changing the young fibrillary structure into adenoid tissue, and up to the time of birth this still preserves the form of a diffuse infiltration. Only later in the course of the first year of life does it proceed in close formation to the separation of true follicles with germ centres (Stöhr).

W. His was the first to trace back variability in the form of the adult tonsil to embryonic conditions, and it is only by a close study of those that a true appreciation of the organ can be arrived at. In this relation our knowledge has been considerably extended by Hammar. He has shown that in early embryonic life a projection—tonsillar tubercle—arises from the floor of the mouth and projects over the groove—sinus tonsillaris—converting it more or less into a sac. This tubercle soon flattens, becoming a fold—plica triangularis (His). This takes no part in the tonsil formation in man, though in the adult it may often be observed blending with the anterior palatal arch, its apex above becoming lost in the velum, its base disappearing in the root of the tongue.

Early in the middle of the third month the tonsillar sinus becomes divided by an ingrowing fold—intratonsillar fold—into two compartments. These, the tonsil recesses, lie the one above and in front, the other below and behind. Each recess becomes the starting-point of a tonsil lobe, anterior superior and posterior inferior, and it is noteworthy that the former lobe is laid down somewhat earlier than the latter, and is during the greater part of embryonic life the larger of the two. In later foetal life, the intratonsillar fold retrogresses, the lobes amalgamate and an undivided sinus again results, the fold disappearing without taking any part in the lymphoid formation. The tonsillar tissue is con-

fined to the floor and outer wall of each recess, rarely involving the inner wall formed by the plica. This latter fold disappears completely or in part, and according as this takes place, it gives rise to variation in the naked-eye appearance of the tonsil. The whole plica may disappear and with it the tonsillar sinus as a space, leaving only as a remains the supratonsillar fossa. Where the plica persists in a more or less reduced state the sinus may be represented during life by a groove running along the anterior edge of the tonsil as well as by the supratonsillar fossa.

To appreciate the significance of these somewhat complicated changes it is necessary to look at the development of certain lower animal tonsils. That of the rabbit is essentially simple (Fig. 1, A). The tonsillar sinus formed by the remains of the second cleft is transformed into a sac by the growth of the tonsillar tubercle—*plica triangularis*. The lymphoid tissue is laid down all round this

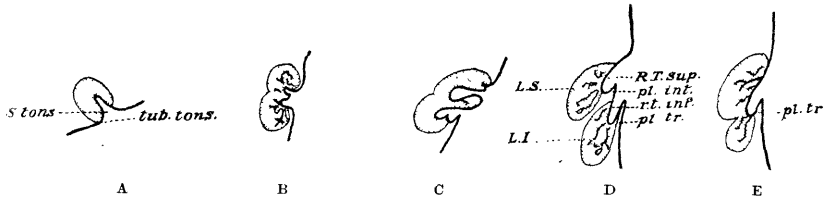


FIG. 1.—Schemes of tonsil formation in frontal section (after Hammar).
A. Rabbit. B. Ox. C. Sheep. D. The more original condition in man.
E. Fully developed tonsil in man. A is the primary form; the others
the secondary showing also branching processes. *S.tons*. Tonsillar sinus.
tub.tons. Tonsillar tubercle. *L.S.* Superior lobe. *L.I.* Inferior lobe.
R.T.sup. Superior tonsil recess. *r.t.inf.* Inferior tonsil recess. *pl.int.*
Intratonsillar fold. *pl.tr.* Plica triangularis.

pocket—that is, the tubercle or plica takes part in the formation of the tonsil. It is similar in the cat and the dog where the tubercle is well marked. In the pig there is a difference: the tubercle disappears early without taking part. In the ox and the sheep the tubercle also disappears, and an intratonsillar fold appearing later divides the sinus into two recesses and persists during life as a septum between the two lobes. In the sheep each recess opens separately on the surface. There are thus two forms, a *primary* where the tubercle comes into the development of the adenoid tissue (rabbit, cat, dog), and a *secondary* where a tubercle is formed, but disappears more or less early. The simplest variety of the secondary form is in the pig, where the sinus undergoes no modification beyond the growth down of epithelial processes to become the centre of the tonsil. In the others (ox, sheep, man) (Fig. 1, B, C, D) an intratonsillar fold appears as a new formation; in the first two species it is persistent through life, whilst in man

it is present only for a certain period in the embryo, and then completely disappears.

A further important difference between the primary and secondary form is an extensive development of epithelial prolongations in the latter. In the former they are entirely absent. Whilst the rabbit has a simple layer of lymphoid tissue lining the sinus, the cat and the dog show folds which suggests a transition stage, but it is only in the secondary that true prolongations are found, and they are especially marked in the ox, where they attain a tree-like branching.

This short account of the development of the tonsil shows an evolution from a simple to a more highly specialised form, and the changes which take place in man, following a well-known biological law, indicate what has occurred in the phylogeny. The simple lining of the sinus with lymphoid tissue is its primitive form, and in this form, as I shall show, it is associated with spaces and organs in process of retrogression. In man and the higher vertebrates it assumes later a more specialised *rôle*, and we shall see that in the fully developed organ these two forms exist side by side.

Lymphoid tissue shows a wide diffusion throughout the body, more especially in connection with the alimentary tract, where it is apparently associated with nutritive processes or the removal of tissue remnants. Examples of this may be found in the fore kidney of lower vertebrates, where lymphoid tissue appears around that disappearing organ. To take an instance from the amphibia lymphoid tissue laid down round rudimentary structures may be seen in the gills of the frog. Associated with the disappearance of the gills towards the end of the tadpole period of existence, large numbers of lymph-follicles form on the inner surface of the opercular membrane. The gills with the branchial cartilages become absorbed and the opercular cavity blocked up. Portions of the ventral ends of the gills persist even in the adult frog as a pair of soft lymphoid bodies lying at the side of the larynx, whilst remnants of the dorsal ends also stay for a time as a pair of soft lymphoid bodies immediately beneath the skin behind the ear (Milnes Marshall). According to Gaupp, the former, which persists in the adult, is to be regarded as a lymphoid organ producing lymph-cells, and as representing in certain relations the lymph glands of the mammalia which have no analogue in the frog. Thus lymphoid tissue, originally laid down in relation to a retrogressing structure, develops in the adult into a specialised organ.

We have again the almost constant presence of lymphoid tissue

in certain congenital cervical fistulæ formed by incomplete closure of branchial clefts. Kostanecki and Mielecki, after discussing those fistulæ in which an internal opening had been located, say: "The common factor in all these cases is that the inner opening is always either in the region of the tonsil, in the tonsillar sinus or in the palato-pharyngeal arch. . . . In each case the internal fistula opening falls in the region of the second branchial cleft." This statement is confirmed by Leegaard, who quotes five cases of his own in which the fistula opened in the region having its origin

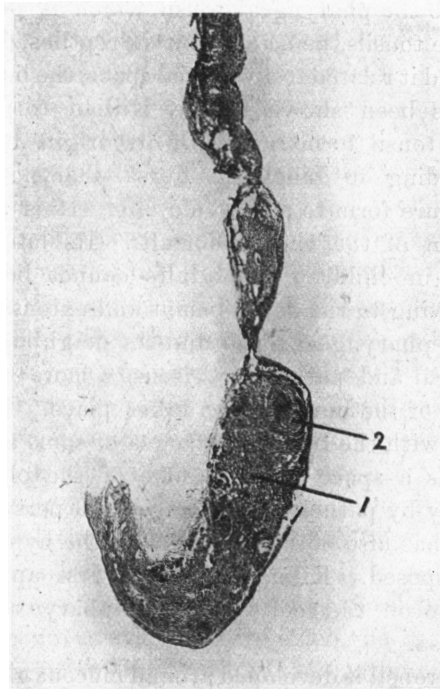


FIG. 2.—Photograph, $\times 10$. Section of wall of branchial cyst showing the lymphoid structure. 1. General lymphoid tissue. 2. Imperfect follicle.

in the second cleft. Levinstein recently recorded a case of incomplete internal branchial fistula where the opening was just in front of the anterior palatal arch. We owe to Leegaard a careful examination of twenty-three cases and a complete account of the microscopic structure of the fistula wall. In all a layer of lymphoid tissue was present under the mucosa, containing in many cases distinct lymph-nodules similar to those met in the tonsil, and this lymphoid layer was found practically throughout the length of the fistula track. In some cases of branchial cyst I found the wall infiltrated in places with lymphoid tissue having imperfect follicles

(Fig. 2), a condition which had been met by Hildebrandt in certain congenital branchial cysts.

The relationship is further illustrated by the presence of islands of cartilage in the tonsil area. Rückert found them in seventeen out of forty-eight tonsils examined in newly born and older children. They were confined to the fibrous tissue round the tonsil. Their occurrence may be explained by inclusion of parts of the second branchial cartilage, which had only partially retrogressed in the tonsillar structure.

If we turn to the pharyngeal tonsil, which is phylogenetically the oldest of the tonsils, being present in reptiles, birds and most mammals, we find it related to a vestigial space, the bursa pharyngea. This space has been shown by G. Killian to come into the region of the tonsil formation. Of its origin little definite is known. According to Linck the bursa pharyngea embryonalis belongs in its pure form to embryonic life. It is associated with the development of the chorda dorsalis. Its later fate in post-embryonic life in children and adults cannot be followed with certainty, as, owing to the development and extensive transformation which the pharyngeal tonsil and its neighbourhood undergo in a physiological and pathological sense a more or less comprehensive change of the bursa region takes place. It ought not to be confounded with the bursa pharyngea of some authors (Schwabach), which is a space in the centre of the pharyngeal tonsil produced chiefly by pathological changes and persisting often into adult life. It has also nothing to do with the hypophysis as was at one time supposed. Killian figures the first appearance of the lymphoid tissue on the roof of the naso-pharynx infiltrating the wall of the bursa.

The lingual tonsil is developed around mucous glands at the base of the tongue which appear in man in the fourth foetal month. It is only after complete development of these glands in the eighth foetal month that in connective tissue in the neighbourhood of the ducts a laying-down of round-cells takes place. A diffuse infiltration follows and the connective tissue assumes a reticular character. Later it leads to the formation of definite follicles, but even at five years of age these are not found in all the glands. As to the significance of this tonsil, it must be born in mind that the tongue in man has undergone complex changes before it emerged as the present muscular organ differing widely from the lower vertebrate tongue, which is largely glandular.

The appendix of the ventricle of the larynx represents the

vestigial remains of an air-sac, which is found in certain anthropomorphoid apes, and which sometimes persists in man as an extra-ventricular sac. Its formation indicates an organ differing from the main cavity of the ventricle. Whilst the latter forms a single space, the appendix has a complete system of small recesses and canals having at most a common opening. Adenoid tissue with actual nodules is found in many places in it. Citelli has shown that in normal conditions this adenoid tissue—laryngeal tonsil—is non-existent in the foetus, and only begins to appear in the first years of life, becoming evident towards the third or fourth year. After this it develops more and is maintained until the thirtieth year when retrogression sets in, which is marked by the fiftieth year. Like other tonsils it may present more or less hypertrophy. It is interesting to note that in this appendix, which represents a structure occurring late in the phylogeny, tonsillar tissue is not laid down until after embryonic life.

The vermiform process contains so large an amount of lymphoid tissue that Clado called it the *glandula appendicularis*, and recently Berry has put forward the view that the process is a specialised lymphoid organ. Like other retrogressing structures it is relatively larger in the embryo and newly born child. Its mucous membrane contains numerous lymphoid follicles. This tissue is developed in an organ in retrogression in man and undergoes changes similar to tonsillar tissue in other regions.

A noteworthy piece of what may be termed negative evidence showing the relation between the formation of a tonsil and a vestigial space is furnished by the rat. It is said that this animal as well as certain allied species has no palatal tonsil, and my own observations confirm this. I have examined carefully the mouth-cavity and pharynx of the brown rat in continuous serial sections, and no lymphoid tissue was noted until the region of the larynx was reached. The fauces was quite devoid of this tissue though well-developed mucous glands were present in large number. An explanation is furnished by Hammar, who examined rat embryos of various lengths. In none of the stages was any rudiment of tonsil present. The tonsillar sinus was altogether absent and no tubercle appeared. The non-appearance of the tonsil coincided with the absence of the vestigial space.

The palatal and pharyngeal tonsils may be regarded as the most highly developed form of lymphoid tissue. Only those two fulfil the conditions to which Bickel would apply the term "tonsil," viz.: (a) A circumscribed form; (b) thick diffuse infiltration of the

connective tissue with lymph-cells together with a collection of special lymphoid follicles within those diffusely infiltrated areas ; (c) presence of crypts, *i. e.* branching depressions lined by epithelium of the surface into the lymphoid tissue, which is grouped round them ; (d) a large number of acinous mucous glands whose outlets pass through the lymphoid tissue and open mostly into the crypts. In the human subject, especially the child, a large number of mucous cavities do not separately open on the surface. In the interior are large single spaces into which several cavities open, whilst the common outlet is on the surface by a round or slit-like opening. The presence of these spaces or crypts has raised considerable controversy as to their meaning, but general opinion inclines to associate them with the mucous glands with which the parts about are richly supplied. Collections of peripheral lymphoid tissue are frequently met in the company of glands, and as Schaffer has pointed out, on the posterior pharyngeal wall in man every lymphoid collection is associated with a gland outlet. Lymphoid tissue is one of the most mobile in the body, having a predilection for places with favourable nutritional and space conditions. The difference between the palatal and the pharyngeal tonsil is incidental to their position. In the former are crypts, more or less closed branching canals ; in the latter clefts and folds. The site of the former, whilst exposing it to injury, enables it to bury itself in structures which protect it, and hence the necessity of closed spaces ; the latter, with no such need, is placed on a bony sub-structure where its development takes place surfacewards. The essential structure of both is, however, the same.

The developmental changes in the palatal tonsil, viz. the appearance of an intratonsillar fold which soon disappears after dividing for a time the tonsillar sinus into an upper and lower lobe, a condition persistent in the ox and sheep, afford strong presumption of a specialised structure. The upper part of the tonsil is the more primitive, the part in relation to the supratonsillar fossa, the remains of the second cleft. Hammar noted that the adenoid tissue of the upper lobe is laid down before the lower, and in his reconstruction model of the adult tonsil the upper lobe is confined to the upper pole of the tonsil and lies almost entirely within the soft palate. After birth growth takes place in the middle and lower parts, the upper showing very little development in comparison. This is more particularly noticeable in a hypertrophied tonsil at the end of the first year, when the enlarged mass is made up almost entirely of the middle and lower parts of the tonsil. As

pointed out by J. Killian, the portion of the tonsil which determines its characteristic form in the newborn is to be found in later life in the upper pole. All below that is secondary growth of the lower part of the original rudiment ("Anlage").

A similar change is seen in the pharyngeal tonsil, where a notable development of the lower part of the gland takes place after birth. About the end of the first decade the upper part of the gland is firm and crateriform, the lower soft and thrown into folds. The later development of this lower part explains the fact that the pharyngeal tonsil of man from the sixth embryonic month to the second decade moves out of the basisphenoidal into the basi-occipital region.

It will be noted that these tonsils may be arranged in the order of appearance in the embryo as follows: pharyngeal, palatal, lingual, and laryngeal. Their specialised development and their disappearance take place in the same order.

Each of these collections of lymphoid tissue is in the first instance laid down in relation to the vestigial space, and although it may undergo specialisation later part of it retains its primitive character. At a certain period of life the lymphoid tissue begins to disappear and the organ to undergo atrophy, the essential change consisting in the follicles and tissue as they disappear being replaced by connective tissue. A similar change takes place in the lymphatic glands, what Bezançon calls a "sclerose physiologique," in which the reticulum becomes thickened and fibrous, the follicles no longer contain germ centres and are less distinct, until in old age they disappear altogether, leaving little more than a mass of fibrous tissue. In the palatal tonsil of middle age this change is already well advanced, the tonsillar sinus is largely occupied by layers of fibrous tissue with a few islets of lymphoid structure (Fig. 3), and still later the supratonsillar fossa may be reduced to a groove or dimple. The oldest of the tonsils, the pharyngeal, shows the same change, only at a much earlier period, leaving a few grooves or a more or less definite depression surrounded by fibrous tissue at the top of the pharynx. Still later than either of those the same change is undergone by the tonsilla laryngis, which develops later. It is of interest to note that the onset of the change bears some relation to the appearance of the tonsil in the phylogeny. The earlier phylogenetically the tonsil appears, the earlier do atrophy and sclerosis set in. The sclerosis leads to what may be termed a normal involution of the space in which the lymphoid tissue is laid down, and it may be regarded as a means of protection from outward infection.

A similar change leads to the obliteration of the vermiform appendix. Ribbert regards this obliteration, so far as it occurs in the definite typical form, not as a pathological occurrence, but as a process of involution which corresponds to the significance of the appendix as an organ undergoing retrogression. The process of obliteration may be summed up according to Ribbert, as, simultaneously with or preceded by the disappearance of the lymphoid nodules and tissue, an overgrowth of connective tissue occurs.

In every such space there lies a disposition to disease due to its rudimentary character which favours bacterial growth and stag-

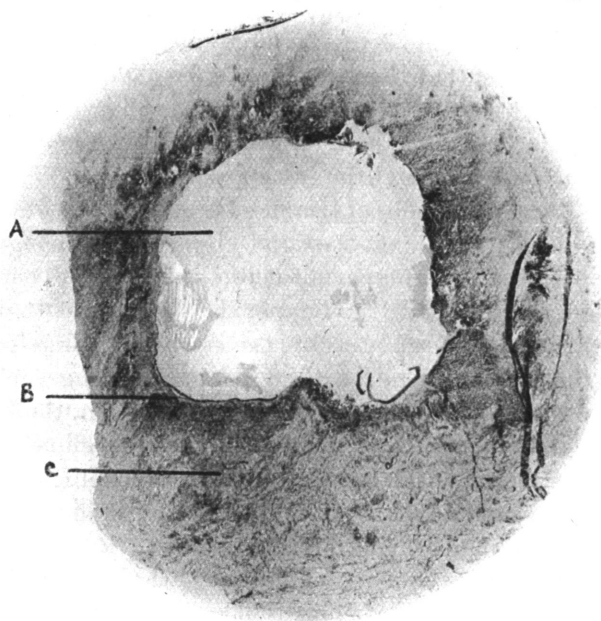


FIG. 3.—Photograph, $\times 10$.—Transverse section through the supratonsillar fossa of a man of fifty to show the changes in age. The ill-defined lymphoid tissue is confined to a small area around the lumen of the space, the main part of the section being made up of fibrous tissue. A. Cavity of the fossa. B. Remains of tonsillar tissue which is ill-defined; follicles have disappeared. C. Thick connective tissue which has replaced the lymphoid structure.

nation of contents, and it is a protective arrangement by which, in the first instance, the space is enveloped by lymphoid tissue, to be replaced later by a firm fibrous structure.

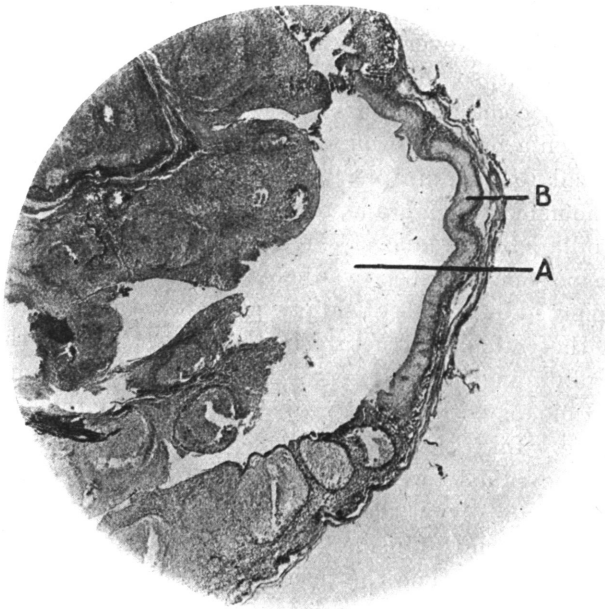
Before discussing the supratonsillar fossa and its relation to the palatal tonsil it will be convenient to say a few words about a structure which has received some attention of late, *viz.* the capsule of the tonsil, and for this purpose it will be necessary to refer to some points in its anatomy about which some misconception

exists. The tonsil on its outer aspect comes into relation with the intra-pharyngeal aponeurosis or fascia. This fibrous layer, very thick at the base of the skull to which it is attached, becomes thinner as it descends and is continued into the cellular tissue of the œsophagus. As pointed out by Descomps, it is this aponeurosis which forms in the faucial region the fibrous wall, concave internally, which lodges the tonsil, and is sometimes called the tonsillar capsule. It is at this point quite thick. On its internal aspect it may be strengthened by muscular fibres from the pillars of the fauces, whilst its external surface may receive fibres from the superior constrictor of the pharynx so that it may be fibro-muscular. Not infrequently, however, the constrictor is very thin or even deficient at this point, so that the peripharyngeal aponeurosis, lying outside it, may come into contact with the intrapharyngeal and the capsule is then a purely fibrous arrangement. It is worthy of note that, internal to the intrapharyngeal aponeurosis in this region, there lie the mucous membrane, tonsil and submucous muscles which form the pillars of the fauces. If the tonsil is pulled inwards its external aspect may be seen to adhere to the fibro-muscular capsule, which is pierced by vessels of supply fixing it to the tonsil. As age advances the reticular structure in the deeper part of the gland, owing to physiological sclerosis, becomes transformed into fibrous tissue and blends with the aponeurosis to form the thicker capsule of later life. Like the larva, which spins its own cocoon, the tonsil may be said to weave or at least add to its own capsule. Though anatomically in the first instance it does not belong to the tonsil the term "tonsillar capsule" is surgically convenient, inasmuch as after a time the fusion of the deep connective tissue of the gland with the aponeurosis is so intimate that it is impossible to separate them, and any operation for the complete removal of the tonsil must not only go outside the intrapharyngeal fascia, but sometimes take the peripharyngeal aponeurosis as well.

SUPRATONSILLAR FOSSA.

This space, the remains of the tonsillar sinus of the second branchial cleft, is, like all vestigial structures, somewhat variable, although its presence is very constant. I have already in papers published in 1898 dealt fully with its anatomical arrangement, and shown that its variation is due to the degree in which lymphoid tissue infiltrates it. An essential difference between the upper and lower parts of the tonsillar sinus is that the lymphoid tissue of the

latter is much more developed, more compact and fills out the sinus completely. In the former, part of the sinus persists as the supratonsillar fossa, the lymphoid formation being at once looser and more open, even taking the form of a network with separate strands distinct and well defined. In some specimens it is easy to evert the plica and palatal fold and expose the interior of the fossa, which may extend well over the upper part of the tonsil; large crypts open into it, and its soft lymphoid tissue differs from the firmer structure of the lower part. Most of the large crypts drain into this part, and it is a tendency to act as a cesspool which gives it



10. 4.—Photograph, $\times 25$.—Transverse section through supratonsillar fossa, which was lightly packed with cotton-wool before hardening. A. Fossa. B. Its anterior wall, in the greater part of which tonsillar tissue is entirely absent. The epithelium is well developed and lies directly on the connective tissue of the palate.

importance in inflammatory affections. Where its wall is thickly infiltrated with lymphoid tissue it has received the name of Tortual's sinus. On the other hand, the infiltration may be more thinly laid down and even in places deficient, so that gaps exist, the significance of which I shall allude to directly.

This latter form of fossa is, as J. Killian well puts it, a persistence of the uppermost part of the tonsillar sinus in its condition at birth where the mucous membrane itself, and especially the lateral fold of the plica, remain free from much lymphoid infiltration. To

determine the disposition of the lymphoid tissue in the fossa wall I have examined a large number of tonsils. Specimens taken by operation and from the post-mortem room were hardened, the fossa in some being lightly filled with cotton-wool so as to show the outline better. Horizontal and vertical sections were made through the upper part. Great variability in the amount of adenoid tissue in the anterior and upper section of the wall of the fossa was noted. Some specimens showed considerable lymphoid infiltration, others only a more or less thin lining, and this latter form received special attention. Even when the lymphoid tissue generally was much developed the anterior part of the wall exhibited a striking resemblance to the condition met in branchial fistulæ, where, under the mucous membrane, a lymphoid layer of variable thickness is always present. This points to the primitive character of the fossa wall, a comparison with a fistula being further borne out by specimens in which the lymphoid lining is very thin and in places absent. In these, at certain points the mucous membrane lies in direct contact with the cellular tissue beneath and the gap extends over a not inconsiderable area. These gaps are always in relation to the upper and anterior part of the space, directly behind the anterior pillar and the adjacent part of the palate. Over the greater part of the fossa the epithelium is well developed and remains free from infiltration—a condition more marked on the anterior wall.

In Fig. 4 a transverse section displays a considerable area of the wall quite free from tonsillar tissue, the mucous membrane being in contact with the cellular tissue of the anterior aspect of the palate. The other illustrations (Figs. 5, 6, 7, 8) exemplify similar points, and I am indebted to Dr. Barton White for the photographs.

On the other hand, Fig. 3 shows the changes produced by age, the section exhibiting atrophy of the lymphoid tissue with a thick fibrous ring round. I have seen a specimen where the lymphoid tissue had entirely vanished, leaving a well-marked space filled with calcareous and other particles.

In a former paper I pointed out that the disposition of the plica triangularis affects the fossa at its anterior part, and I have already mentioned Hammar's view that whilst in some of the lower vertebrates this fold takes part in the tonsil formation, in man it does not, but is a retrogressing structure. This supplies a key to its great variation and in part explains the variability of the anterior wall of the fossa just noted.

Let us now see how those dispositions help to explain the origin of certain tonsillar affections. Even when much tonsil hypertrophy

is present the lymphoid tissue around the anterior aspect of the fossa takes little or no part in the enlargement. The specialised part of the gland is then mainly affected, the crypts of which, opening into the fossa and shedding their products into it, render it a starting-point of infection. The significance of this is manifest when it is recalled that lymphoid tissue in the palatal tonsil begins to retrogress about the fifteenth year. Up to then it is in full activity, able to resist the entrance into the deeper tissues of infection which may lurk in the fossa. Up to that time

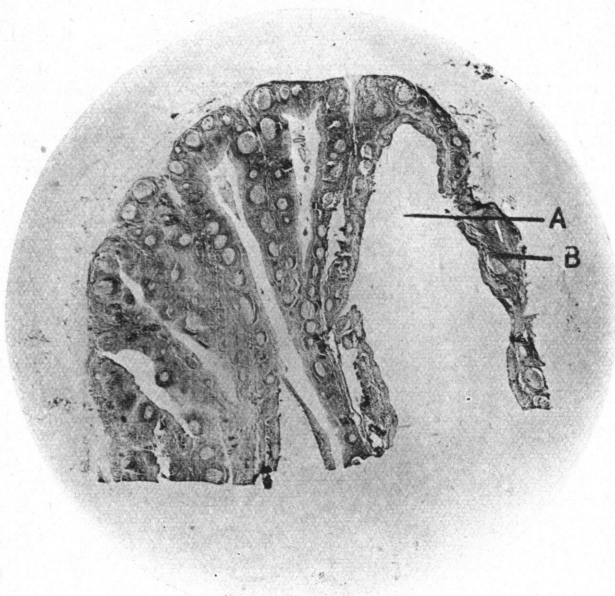


FIG. 5.—Photograph, $\times 7$. Sagittal section of upper part of tonsil, the supratonsillar fossa of which was lightly filled with cotton-wool before hardening. A. Supra-tonsillar fossa. B. Its anterior wall.

from the fifth year, tonsillar affections are mainly those of the gland proper, the crypts and lacunæ being the seat of disease, the infective agents entering the gland tissues by way of the crypts. After that, infection of the peritonsillar tissue begins to manifest itself. The age of incidence of simple hypertrophy, 5–15, is not the age of peritonsillitis, 15–35. What is the reason? By fifteen the activity of the gland begins to wane, physiological sclerosis sets, hardening the tissues and throwing up a barrier to further infection. The thicker the adenoid tissue the stronger the fibrous barrier which replaces it. Where it has been thin or absent as in the fossa little or no fibrous layer is produced, and septic secretions

from the crypts collected in the cesspool find a gap in the anterior wall through which they infect the peritonsillar tissue. In 98 per cent. of cases, peritonsillitis starts at this point around the upper and outer aspect of the tonsil, the infective agent going through the wall into the areolar tissue of the soft palate and spreading through it, limited only by the intra-pharyngeal aponeurosis. In other infections, such as scarlet fever, necrotic changes may affect the thin anterior wall of the fossa, leading to perforation in the neighbourhood of the anterior pillar and not infrequently permanent

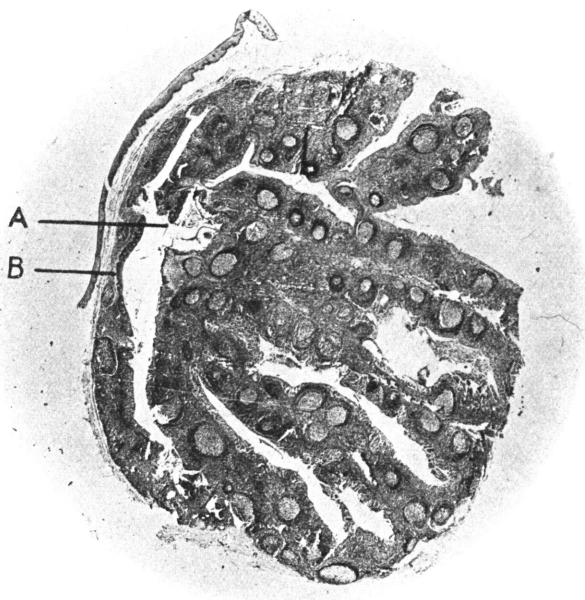


FIG. 6.—Photograph, $\times 7$. Section in transverse plane of the same specimen as Fig. 5. A. Supratonsillar fossa. B. Its anterior wall showing lymphoid tissue in varying thickness.

fenestration. Examining such cases it may be seen that the fenestrated anterior wall is often extremely thin and practically devoid of adenoid tissue. Similar changes I have seen in cases of tertiary syphilis of the pharynx. Recently, in two patients showing syphilitic scarring in the pharynx one could inspect through a fenestration the fossa with perfectly smooth wall, having no trace of lymphoid tissue, and below it an apparently healthy tonsil.

Winckler holds that peritonsillar infection is due to defect in the capsule through which adenoid tissue pushes itself, and in this way carries infection to the deeper tissue. It is difficult, however,

to realise how this occurs at a time when the capsule is already becoming thick and more fibrous.

With regard to the treatment of affections of the tonsil it is essential to bear in mind the composition of that structure, made up as it is of two parts, fossa and gland proper, each associated with affections which usually occur at different periods of life. Though distinct those parts are closely associated from the fact that a large number of the crypts drain their contents by way of the fossa. Experience has shown that improving this drainage by

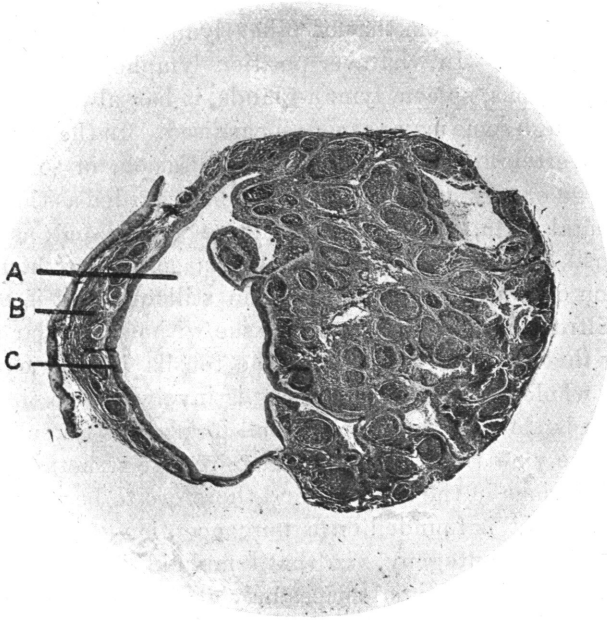


FIG. 7.—Photograph, $\times 7$. Transverse section through supratonsillar fossa.
A. Cavity of fossa. B. Its anterior wall, showing irregularity in amount of lymphoid tissue.

opening out the fossa leads to cessation of the crypt infection and return of the gland to a healthy condition. The comparative freedom from such affections of the neighbouring lingual tonsil, though it occupies an exposed situation, is in great part explained by the absence of such a space as the fossa, and the same may be said of the pharyngeal tonsil. Affection of one part of the palatal tonsil may take place independently of the other, and its appropriate treatment may be carried out without sacrificing the whole gland. The palatal tonsil is too often regarded as a homogeneous organ, a view which seems to be the basis of the drastic treatment which aims at sweeping it away, not always with due

regard to its place in the animal economy. That it has a very definite function is evidenced by the changes it passes through in development. These cannot be dismissed as without meaning and useless. Rather do they speak against its sacrifice unless for very good reason, and surely it is more rational to aim at the restoration of an organ to a healthy state than its complete removal.

In a former paper I pointed out that in treatment of the fossa the primary consideration is to open out the space and drain it, and that the removal of the upper pole of the tonsil fulfils this

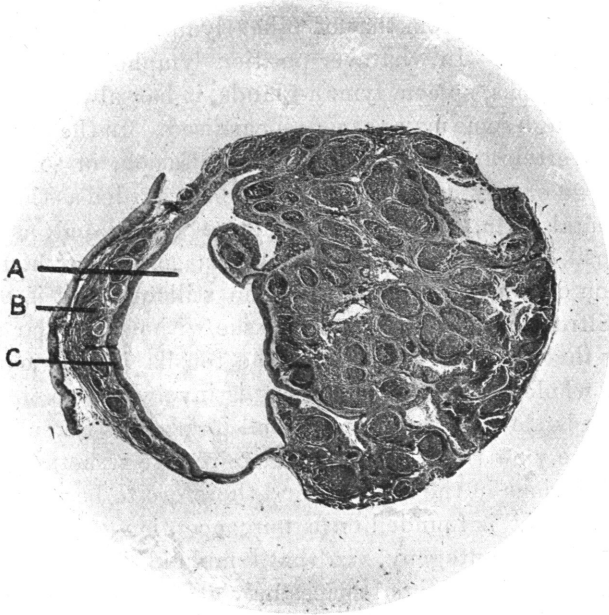


FIG. 8.—Photograph, $\times 7$. Transverse section of supratonsillar fossa a short distance above the outlet to show the well-developed mucous membrane lining it. A. Cavity of fossa. B. Anterior wall. C. Well-developed mucous lining.

indication. This has been confirmed by subsequent experience, for the lower part of the tonsil usually becomes healthy and resumes its function. Even removal of the upper pole is not always necessary. Rosenberg has called attention to a procedure which has been carried out in Hinsberg's clinic for over two years—that of slitting up the fossa by passing a bistoury along it and cutting across the anterior pillar. By treating it in this manner like a fistula an admirable view is obtained of the interior as the edges spring widely apart. Limited disease can be dealt with, and where necessary removal of the gland can be more readily carried out. The injury to the anterior pillar causes little or no inconvenience

as the parts soon granulate up and leave very little scar. Finally, there is the still more conservative treatment of brushing or washing out the fossa and crypts—an old method which is now being largely used on the Continent.

The palatal tonsil, which I have taken as the best example of the group, has, as we have seen, lymphoid tissue appearing at two different periods, an upper part retaining more or less its primitive character, and a lower, which may be regarded as the gland proper. With regard to the latter no one has yet given any cogent reason why its function should be regarded as different from that of other lymphoid structures, viz. to form leucocytes. In whatever position lymphoid tissue is met, *e. g.* tonsils, thymus, spleen, lymph-glands, it has always the same structure, though some may be more specialised. In the pharyngeal cavities of vertebrates it shows a wide diffusion, in some places forming large organs, tonsils, which may be regarded as the highest developmental form, in others it is more spread out, as in the lingual tonsil, possessing interspersed germ centres without close aggregation of mucous glands, whilst in still others it is a simple diffuse infiltration of the connective tissue without nodular masses. We know that the chief activity of the tonsils falls in early age when the whole lymphatic apparatus is involved, at a time when the thymus is slowly disappearing, and its place is taken by their activity. The view that tonsils are retrogressive structures, useless and even injurious in the economy and therefore to be pursued with "fire and sword," is founded on a misconception of what we have seen occurs in the ontogeny, viz. that lymphoid tissue laid down in the first instance in vestigial spaces may at a later period be called upon to assume another and important function—the formation of leucocytes for the use of the organism—and to this end is specialised to form distinct organs. The contention of Berry that the appendix is a special lymph organ does not exclude, as he assumes, the view that its lymphoid tissue is primarily laid down in a retrogressing structure; on the contrary, as we have seen, the association of the two is not uncommon. The appearance of tonsils in connection with retrogressing structures at different periods in the ontogeny coincides with the general scheme of the hæmopoietic system, in which all parts are not in full activity at the same time, but replace each other in the course of development, as may be seen from the different periods at which the tonsils come into full activity. It is probable that most leucocytes are agents of absorption either in the service of nutrition, or destined for the removal of tissue remains

which are in part or complete retrogression. It is also probable that this process, originally serving only such removal, develops a further use, so that eventually by a change of function it subserves other purposes than the original, and by so doing preserves itself longer.

It is not within the scope of this paper to notice various theories which have been advanced to explain the meaning of the tonsils. We have dealt only with considerations which show that they have an essential function in the body, and that treatment, designed to preserve them whole or in part so as to enable them again to fulfil it, is based on rational lines.

BIBLIOGRAPHY.

- BERRY.—*Journ. Anat. and Physiol.*, vol. xl.
 BEZANCON.—Cornil and Ranvier's "Manuel d'Histologie Pathologique," vol. iii, 1907.
 BICKEL.—*Virchow's Archiv*, 97, 1884.
 CLADO.—*Comptes Rendus*, 1892.
 CITELLI, S.—*Anat. Anzeig.*, Bd. xxix, 1906.
 DESCOMPS.—*Thèse de Paris*, 1908.
 GAUPP.—Ecker u. Wiedersheim's "Anat. des Frosches."
 HAMMAR, J. AUG.—*Arch. f. Mikroskop. Anat.*, Bd. lxi.
 HILDEBRANDT.—*Langenbeck's Arch.*, Bd. xlix.
 HIS, W.—"Anat. Menschlichen Embryonen": iii, "Zur Geschichte der Organe."
 KILLIAN, G.—*Morph. Jahrb.*, Bd. xiv, 1898.
 KILLIAN, J.—*Arch. f. Laryngol. u. Rhinol.*, Bd. vii, 1898.
 KOSTANECKI AND MIELECKI.—*Virchow's Arch.*, 120 and 121, 1890.
 LEEGAARD.—*Arch. f. Laryngol.*, Bd. xxvi, Heft 1.
 LEVINSTEIN.—*Arch. f. Laryngol.*, Bd. xxiii.
 LINCK.—*Zeitschr. f. Ohrenheilk.*, Bd. lxii.
 MARSHALL, MILNES.—"Vertebrate Embryology."
 PATERSON, D. R.—*Proc. Laryng. Soc. London*, February, 1898; *Journ. of Laryngology*, April, 1898; *The Laryngoscope*, July, 1898.
 RIBBERT.—*Virchow's Arch.*, 132, 1893.
 ROSENBERG, W.—*Zeit. f. Ohrenheilk.*, Bd. lxvii, Heft 1 and 2.
 RUCKERT, A.—*Virchow's Arch.*, 177, 1904.
 STÖHR, P.—*Anat. Anzeig.*, 1891.
 WINCKLER.—*Verhandlung, III, Inter. Laryngo. Rhinol. Congress.* 1911.