THE BIOLOGICAL SIGNIFICANCE OF THE TONSILS AND ADENOIDS AND OTHER EXTERNAL LYMPHOID MASSES

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In the wall of the pharyngeal cavity and intestinal canal numerous masses of lymphoid tissue are situated; they are not wholly enclosed in the tissues of the body, and for that reason may for descriptive purposes be termed "external lymphoid masses." Some of the larger masses have received names—the tonsils, the adenoid mass, and Peyer's patches; each is so situated that one of its surfaces is in contact with food or air, the remainder being buried in the tissues. Like other organs an external mass has an arterial and a venous blood supply through which it receives the material necessary for its special metabolism and from which by osmosis and filtration its lymph supply is derived. It possesses an efferent vessel through which lymph is conveyed to an adjacent node, but, unlike lymph nodes, it has no afferent lymph vessel. This anatomical peculiarity is of some importance, and will be referred to later.

The lymphoid tissue of the larger external masses is arranged so that folds alternate with fissures like the gyri and sulci of the cerebral cortex, or so that deep crypts lead inwards from its surface. Between the folds or in the crypts living micro-organisms are always found, except of course in the case of the newly born infant. It will thus be seen that an external mass has three salient features: (1) one surface is in contact with food or air; (2) it only possesses an efferent lymphatic channel which leads to the adjacent nodes; (3) the crypts contain living micro-organisms.

The Function of the External Lymphoid Mass

The external mass selects its inhabitants from food or air, and these flourish there to a greater or lesser extent. During its growth a micro-organism produces its specific toxin, which must be removed if growth is to continue. There are three routes by which this removal can be accomplished. The toxin may pass either (1) into the pharynx or intestine; (2) through the efferent lymph vessels into the lymphatic system; (3) direct into the blood stream. The following clinical evidence shows that the toxin is able to pass through the efferent lymph vessel into the lymph system and thence eventually into the blood stream.

It is well known that in the common air-borne infection called acute tonsillitis and in the food-borne infection typhoid fever, the external mass involved, be it tonsil or Peyer's patch, becomes inflamed, increases in size, and on it an exuberant growth of micro-organisms ensues. After a short interval the temperature of the body is raised, indicating that the toxins have passed into the blood stream. In addition, the lymph nodes in the vicinity of the external mass have become enlarged and sometimes tender. Since, as we have seen, an efferent lymph vessel passes from the external mass to the nodes we may conclude that the toxin has chosen this pathway into the lymphatic system and thence into the blood stream. It is not uncommon for nodes to suppurate, and when this occurs the specific organism in the external mass can be recovered from the abscess. Similarly the *B. typhosus* has been recovered from a Brodie's abscess and even from the "rose" spots in the acute stages of that disease. It is

clear, therefore, that when inflamed an external mass admits not only toxins but also micro-organisms into the lymphatic system which may form colonies in lymph nodes. But living micro-organisms are also to be found in all healthy external masses, consequently their toxins too are being formed and removed unceasingly. It is obvious that the amount of toxin passed into the lymphatic system both in health and in disease bears a direct relation to that formed in the external mass at any given time.

Granted that an external mass is performing a positive function, we may define an external mass as one whose function is to cultivate micro-organisms deposited on its surface with the object of admitting some of them or their toxins, or both, into the lymphatic system and thus into the blood stream. The biological application of this definition will be clear from a consideration of the following facts.

It will readily be conceded that the common air-borne and food-borne infections are of more frequent occurrence in childhood than in adult life, that the child as he advances to the adult state contracts fewer and fewer infections, in spite of the fact that he is living generally under the same conditions as to food and air. He has by means of repeated infections and recoveries established an immunity, partial or complete, to many of the infections that still attack more particularly the younger members of the community in which he happens to live. The process by which this result is achieved may be termed "auto-immunization," the biological importance of which is evident, for by this means the adult population becomes relatively immune to infection current among the younger members of the community.

Particular stress is laid upon the fact that although any organism may be deposited upon an external mass, that external mass will only cultivate those to which the immunity of the individual is low or absent. In the case where immunity is complete, sufficient concentration of antibodies is present in the blood stream to prevent growth of organisms in the external mass. On the other hand, when immunity is low, growth takes place, toxin is absorbed, metabolic disturbance ensues, and the necessary antibodies are produced. It is clear, therefore, that external masses are extremely valuable organs and have a highly important biological function to perform in the establishment of a healthy adult population by auto-immunization of the growing child.

The Clinical Significance of Enlarged Tonsils and Adenoids

The removal of tonsils and adenoids is perhaps the commonest of all surgical procedures. Let us therefore review the situation with regard to the removal of tonsils and adenoids, bearing in mind clearly the function as defined above, its biological significance, and its medical implications.

At the present time children are often referred for removal of tonsils and adenoids for one or more of the following reasons: (1) enlarged tonsils alone; (2) enlargement with recurrent colds and mouth-breathing; (3) recurrent attacks of tonsillitis; (4) enlarged adenoids with chronic catarrh or suppurative otitis media. The operation is often performed when any one of these conditions is present, without a thought being given to the biological value of the tonsil and adenoid or to the ill effect which early removal may have on auto-immunization. In the first class of case, enlargement alone, there are frequently no other symptoms. The child is often sturdy and well nourished: his tonsils are enlarged because an organism is

present to which immunity is required in the interests of his future health. Auto-immunization is progressing satisfactorily, and when complete the tonsil will shrink in size from an enlarged, soft, succulent functioning organ to the fibrosed and atrophied organ of the adult.

In the second class of case the position is more complicated. Two additional conditions are present: these are frequent colds and nasal obstruction. It is generally taught, and believed, that both conditions are caused by an adenoid mass obstructing the post-nasal space—so much so that the term “adenoid facies” has crept into the literature. An adenoid mass large enough to obstruct an airway is certainly sometimes found, but, on the other hand, it is not unusual for almost complete nasal obstruction to exist although there is only a very small adenoid mass present, or for nasal obstruction to persist after its surgical removal.

What is nasal obstruction due to in these cases? Thorough investigation reveals (1) that nasal obstruction is due to rhinitis with congested and hypertrophied turbinates; (2) that on transillumination the sinuses are duller than normal on one or both sides. This has been confirmed repeatedly both radiologically and by exploratory puncture. The latter physical sign is invaluable, and is invariably present in such cases, being diagnostic of catarrhal sinusitis, and accounting for the rhinitis and the congested and hypertrophied turbinates so often seen in these children. This, therefore, would appear to be an adequate explanation of such cases of nasal obstruction. It is true that removal of adenoids in such cases sometimes restores nasal breathing and allows the catarrhal sinusitis to clear up; but this happy result is by no means common—failures are often experienced. It is doubtful, even in the apparently successful cases, whether permanent benefit has been secured. In any event an organ of biological value has been removed.

That catarrhal sinusitis should be diagnosed is important, for, apart from the symptomatic relief its cure affords, this condition is the precursor of many other medical conditions which lead to chronic ill-health, such as bronchial asthma, bronchitis, and bronchiectasis. It is also a direct cause of discharging ears and middle-ear deafness. It has been found that the conservative methods adopted at the Royal Liverpool Children's Hospital in preference to the radical removal of adenoids have yielded excellent results during the last few years.

A Plea for the Conservative Treatment

The treatment referred to is the administration of small doses of potassium iodide over a period of three months—1 to 3 grains once a day, according to the age of the child. Potassium iodide causes an increased secretion from the mucous membrane of all the nasal sinuses, as is evidenced by the greater amount of watery discharge seen in cases of catarrhal sinusitis so treated. Given over a period of at least three months it is an excellent “nasal aperient.” As will be seen from the accompanying table there are failures, but the results as a whole compare favourably with those treated in a more radical manner. In 70 per cent. of those so treated it was seen that cases of enlarged tonsils and adenoids with nasal obstruction were transformed to cases of enlarged tonsils and adenoids only. Where no improvement was observed operation was considered.

In the third type of case, in which there are recurrent attacks of tonsillitis, it is difficult to make a decision for or against operation. It should always be borne in mind that the child is acquiring auto-immunization through

repeated mild infections. Of course it is impossible to say how many attacks of tonsillitis will produce such an immunity. In the routine examination transillumination should never be omitted, and if this should reveal a concurrent sinusitis this condition should be treated as outlined above, before any operative measure is warranted. In the case of recurrent tonsillitis without a sinusitis, more especially in the adolescent and the adult, we must come to the conclusion that the tonsil is now harbouring an organism to which that individual cannot acquire an immunity. Here operation is advisable.

In the above category two other classes of case fall—namely, rheumatic fever and nephritis which are not responding to treatment. Here again auto-immunization has given place to auto-intoxication, and, such being the case, removal of tonsils is urgently indicated. It will be noted that both conditions usually begin as a tonsillitis; that when the case is examined either the initial tonsillitis is not apparent or the acute stage has passed off and consequently the tonsillitis cannot be detected by inspection only. However, enlarged and/or tender glands can invariably be detected in the anterior triangle, showing that the micro-organisms or their toxins (or both) responsible for those conditions are still being absorbed and damaging the kidney or the heart. It is clear that in such cases removal of the tonsils which are harbouring these organisms is now a necessity.

The remaining indication for removal of adenoids is in those cases of chronic catarrhal otitis media and persistent otorrhoea where it is claimed by some clinicians that the enlarged and infected adenoid mass is retarding the improvement of the middle-ear infection.

Cases Operated on after Potassium Iodide Treatment

Period Under Review	No. of Cases Under Observation	No. of Cases where Operation was Primarily Indicated	No. of Cases Operated on After Potassium Iodide Treatment
1928	426	9	170
1929	369	19	141
1930	300	11	83
1931	376	9	105
1932	358	22	76
5 years	1,829	70	575

The cases operated on after treatment with potassium iodide, excluding those in which operation was primarily indicated, amount to 30 per cent. The number successfully treated by potassium iodide is 70 per cent.

Conclusions

1. That the function of an external lymphoid mass is to collect micro-organisms from food or air and to grow those to which an immunity is needed.
2. That the condition “enlarged tonsils” alone is definitely an indication against their removal.
3. That the adenoid facies is more commonly caused by catarrhal sinusitis than by an adenoid mass.
4. That catarrhal sinusitis can be treated successfully in a large number of cases without operation, by giving a “nasal aperient.”
5. That tonsils and adenoids at the present time are removed too frequently and without due consideration of their important biological function.
6. That many cases of rheumatic fever and acute nephritis that are going downhill can be cured or greatly benefited by removal of the “carrier organ.”