carefully carried out intranasal work fails to relieve the patient from annoying headache and in cases in which there is a threatened intracranial complication. Such cases will arise only exceptionally in one's experience.

DR. JAMES J. PATTEE, Pueblo, Colo.: Frontal sinusitis, requiring operation, is a troublesome affection, and the operation of choice should be determined with care. From a general survey of the published opinions there is, in my judgment, a progressive increase in the number of intranasal operations with a corresponding lessening of the external. I am in accord with this order of things. I agree with Dr. Shambaugh that it is applicable in the vast majority of cases. In rare cases we must resort to external measures.

The Killian operation fails occasionally, even in the hands of our best operators. It frequently produces much disfigurement and in some cases fails to afford ample permanent drainage, the feature on which its greatest claims are based. Dr. Ingals' statement is very true. The intranasal operation requires intimate anatomic knowledge and much experience. The narrowest part of the nose is on a plane with the canthi. The Lothrop operation has the advantage of opening the sinus very near this point, a great advantage. The Lothrop operation permits of thorough work; establishes adequate drainage; affords the best vision, and offers the most direct route to the site of greatest difficulty and danger. It permits healing in the shortest time and minimizes untoward after-effects.

Military Medicine and Surgery

THE TONSILS AS FOCI OF INFECTION IN STREPTOCOCCUS HEMOLYTICUS CARRIERS *

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The study of hemolytic streptococcus infections, which has been stimulated by the Army experiences of last winter, naturally includes the subject of carriers. We have done some work in this field and are convinced that the tonsils play a part that should be emphasized. It has already been shown that throat swab cultures demonstrate the presence of hemolytic streptococci in various percentages of individuals and that hemolytic streptococcus complications, for example, in measles, occur only in those with positive throats.¹ Throat swab cultures for hemolytic streptococci, therefore, have a practical value in the maintenance of clean and infected wards which has been confirmed by experience at this hospital.

INFECTION OF THE TONSILS

With the established importance of positive throat cultures as a starting point, our attention was directed toward localizing the focus of infection if there is one. For this purpose we made swab cultures in positive throat cases from each side of the nose, from the pharynx, from each tonsil and from the saliva. In making the nasal cultures, the swabs were passed into

the nasopharynx. The results, which are shown in Table 1, were striking. The cultures of nasal swabs were either negative or showed a few hemolytic streptococcus colonies; the pharynx cultures were moderately positive; those of the saliva were slightly so, but the tonsil cultures showed in every case a rich growth of hemolytic streptococci. In the isolation and identification of hemolytic streptococci the methods adopted by the Medical Department of the United States Army were followed.²

TABLE 1.—RESULTS OF SWAB CULTURES IN POSITIVE THROAT CASES *

Case	Right Tonsil	Left Tonsil	Pharynx	Saliva	Right Nostril	Left Nostril
1	+	+++	—	—	—	—
2	++	+++	+	—	—	—
3	++	++	++	+	—	—
4	++	++	++	—	—	+
5	++	++	+	—	+	+
6	+++	+++	++	+	+	—
7	++	++	+++	+	+	—
8	+++	+	+++	—	+	+
9	++	++	+++	—	+	+

* Positive findings are thus indicated: +, few colonies; ++, many colonies; +++, innumerable colonies.

These results pointed to the tonsils as possible foci of infection. One hundred pairs of excised tonsils were then examined by means of crypt cultures made with a platinum loop. Seventy-five pairs were found positive. The degree of infection in one or both tonsils of each pair was found to be as given in Table 2.

TABLE 2.—DEGREE OF INFECTION OF DISEASED TONSILS BY HEMOLYTIC STREPTOCOCCI

Pure hemolytic streptococci.....	31
Predominating hemolytic streptococci.....	23
Many hemolytic streptococci.....	16
Few hemolytic streptococci.....	5
No hemolytic streptococci.....	25

These tonsils were removed on clinical grounds on account of size, presence of discharge from the crypts, cervical glandular enlargement and possibility of focal infection and not on account of the carrier state except in a few instances. The results of this series of examinations made it clear that diseased tonsils harbor hemolytic streptococci in a large proportion of cases.

The condition of the surface of tonsils was then compared with that of crypt contents in regard to streptococci, and it was clearly shown that the ordinary throat swab cultures may be negative while loop cultures from the crypts may be positive. The findings were:

Normal cases, 50; percentage of throat swab cultures positive, 28; percentage of tonsil crypt cultures positive, 50; percentage of error in throat swab cultures, 44.

Additional evidence of the importance of the tonsils in carriers is found in the results of throat cultures taken after tonsillectomy, which will be referred to later.

Out of twenty-five cases of typical acute follicular tonsillitis, only one failed to show a rich culture of hemolytic streptococci. We believe that the ordinary case of tonsillitis is most frequently caused by hemolytic streptococci, and that the organisms in many cases persist and reinfect the individual or spread to others.

In persistent carriers of any infectious disease, some focus seems necessary, as pathogenic organisms do not seem able to live indefinitely on healthy tissue. In typhoid and cholera carriers the gallbladder, liver or kidneys are recognized foci rather than the intestine or

* From the Laboratory Service and the Ear, Nose and Throat Section of the Surgical Service of the Walter Reed General Hospital, Washington, D. C. In this work the writers were assisted by: Capt. C. O. Stimmel, Capt. William H. Huntington, Lieut. S. A. Alexander and Lieut. E. Sturm.

1. Cole, Rufus, and MacCallum, W. G.: Pneumonia at a Base Hospital, *THE JOURNAL A. M. A.*, April 20, 1918, p. 1146. Levy, R. L., and Alexander, H. L.: The Predisposition of Streptococcus Carriers to the Complications of Measles, *ibid.*, June 15, 1918, p. 1827.

2. Methods for the Isolation and Identification of Streptococcus Hemolyticus, Adopted by the Medical Department, U. S. Army, June 1, 1918.

urinary tract as a whole. In diphtheria carriers the tonsils are being recognized as the principal focus.³ We believe the same is true in streptococcus carriers. The possibilities, of course, include the nose, the sinuses, the gums and the adenoids; but in our experience the tonsils are by far the most frequent foci. Sections made of positive tonsils have usually shown erosion of the epithelium of the crypts with exudate.

IDENTIFICATION OF CULTURES

One hundred strains of streptococci have been studied by Captain Stimmel for cultural reactions in His sugar mediums with results shown in Table 3. In this work each tube was checked for purity and growth by smears and by transfers to blood agar plates. In case of contamination of any tube or lack of growth in negative tubes, the work was repeated. Fresh serum was found necessary for good growth, and serum water controls were used without sugar, as some serums naturally contain over 0.5 per cent. of glucose. Tests were also made for bile solubility, hemolysis in blood broth and morphology. The results were clean cut and uniform.

TABLE 3.—CULTURAL REACTIONS OF STREPTOCOCCI

Source of Strain	Num-ber	Glucose	Lac-tose	Saccha-rose	Man-nite	Mal-tose	Dex-trin	Inulin	Saline
Tonsil.....	43	+	+	+	—	+	+	—	+
Throat.....	26	+	+	+	—	+	+	—	+
Empyema.....	18	+	+	+	—	+	+	—	+
Miscellaneous.....	11	+	+	+	—	+	+	—	+
(middle ear, etc.)									

In other words, no differences were found in strains from empyema fluids and surgical conditions, as compared with those from throats and tonsils. Of course, there may be differences in immunity reactions; but for the present in the prophylaxis of pneumonia and empyema, no differentiation is available. Several tonsil strains tested for virulence were low, requiring 0.5 c.c. to kill a mouse; but by mouse passage they became more virulent.

THE CURE OF CARRIERS

In our experience the only radical method of curing carriers is excision of the tonsil, which is successful except in a few cases in which other foci are present in the gums or elsewhere. The problem of chemical or mechanical disinfection has been attacked at this hospital as well as elsewhere with some enthusiasm, but a short experience has shown the futility of most measures. It has been found that a certain number of carriers on no treatment give two successive negative cultures in about three weeks. With dichloramin-T, Dobell's solution and hot alcohol, a few carriers cleared up in about the same time.

Under daily use of 25 per cent. silver nitrate, several cases became negative in about one week; but in some of these cases the crypts were still positive after negative throat cultures. In order to test the disinfecting power of silver nitrate, several excised streptococcus tonsils were submerged in 25 per cent. silver nitrate for five minutes. They were then washed in salt solution and incised, and cultures were made from the crypts. All these cultures were positive. In cases with a few open crypts, the silver nitrate treatment may be effective; but in most tonsils it is impossible to sterilize the crypts by this means.

The difficulty in sterilizing the tonsil may be realized by attempting to inject all the crypts with lampblack in paraffin; after all visible openings have been injected and the paraffin allowed to cool, incision of the tonsil will show a number of perfectly good crypts that have escaped the injection. If this is so with excised tonsils, the impossibility of mechanically or chemically disinfecting this tissue in vivo is easily understood.

The change noted in throat cultures after tonsillectomy was striking as compared with any other method. Twenty-seven out of thirty-one cases showed a second consecutive negative culture in eleven days. In the cases that did not clear up under tonsillectomy, there were foci in the nose or gums, and the cases became negative when these were attended to. No case of a carrier has been found in men who had previously had their tonsils properly removed.

COMMENT

It is evident that the removal of diseased tonsils is indicated not only for the good of the individual but also for the good of others, because it reduces the number of carriers of *Streptococcus hemolyticus*. Whether a carrier with healthy tonsils should be operated on simply because he is a carrier may be a debatable point; but in view of the lack of standards for "healthy" tonsils, it is justifiable to operate in our opinion, provided the case does not clear up in a few weeks spontaneously or under silver nitrate.

The practicability of materially reducing the number of carriers by this means is also a debatable point, as the number of carriers may be large, running at times from one third to one half of the military population. It is at least possible, however, to examine the tonsils of chronic carriers and to remove those tonsils which are manifestly diseased.

CONCLUSIONS

1. The tonsils are the principal foci of infection in throat carriers of *Streptococcus hemolyticus*.

(a) Cultures taken from different parts of the nose, mouth and throat show more streptococci in the tonsils than elsewhere.

(b) Cultures from excised tonsils show streptococci in 75 per cent. of cases.

(c) Crypt cultures show a higher percentage of positive results than surface cultures.

(d) Excision of the tonsils renders the throat negative in nearly all cases.

2. The streptococci isolated from tonsils and throats show no cultural difference on sugar mediums from those obtained from empyema fluids.

3. Excision is the only radical method of curing carriers of the infection.

(a) Dobell's solution, dichloramin-T and hot alcohol had little better effect than no treatment.

(b) Silver nitrate, 25 per cent., gave the better results in negative throat cultures, but the crypts frequently remained positive.

4. The presence of hemolytic streptococci in pathologic tonsils is an additional reason for their removal.

Obligation of Physician to Report Births.—The state protects the physician in his practice, and on ethical ground has a right to expect him to comply with the laws affecting his practice, and on legal grounds to demand the registrations of births as a matter of public welfare. Court decisions have held this many times.—W. J. V. Deacon, M.D., State Registrar, Kansas.

3. Keefer, F. R.; Friedberg, S. A., and Aronson, J. D.: A Study of Diphtheria Carriers in a Military Camp, *THE JOURNAL A. M. A.*, Oct. 12, 1918, p. 1206.