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Tonsillectomy for systemic infection in children

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To What Extent Does the Relation of the Tonsils
to Systemic Infection Justify Tonsillectomy in Children

by

Carroll W. Dewey

1932

I. INTRODUCTION

Before setting out to discuss this subject it seems logical that we should first define the limits of the subject. To do this we will attempt an analysis of the subject.

In the first place we are concerned only with tonsillectomies in children. By children we refer to those who have passed the period known as infancy and not yet reached the period known as adolescence. These periods are not clear cut but for the sake of convenience we will assume that infancy ends at the age of two and adolescence begins at the age of twelve. Since we have set these limits we are not concerned in any way with tonsillectomy in the infant, the adolescent, or the adult.

In the second place we are concerned with the tonsils only as they are related to systemic infection. By systemic infection we refer to infection or manifestations of infection in one or more parts of the body remote from the primary focus. We are concerned with the anatomy, physiology, and pathology of the tonsils only as they are concerned with systemic infection and any mention of these aspects of the tonsil will be made incident to this relationship. Obviously we are not concerned with such conditions as sore throat, quinsy, or mechanical obstruction of the pharynx per se.

Finally we are concerned with tonsillectomy only as it affects these systemic infections. Naturally we are interested in any effect of the tonsillectomy on these infections regardless of the age of the individual at which the affect becomes manifest as long as the tonsillectomy was performed in childhood. Since we are discussing the value of tonsillectomy in a given class of cases it may be permissible to touch briefly on the relative value of other treatment

of the tonsils.

Before going any further we wish to say that we do not intend to exhaust the subject and neither do we promise to keep strictly within the confines of the subject although we will try not to wander too far from it.

II. CASES

These cases are presented with the idea of provoking questions rather than answering them. The cases were selected as examples of some of the more serious systemic infections in children in which the tonsil is often considered as an important etiological factor. In the selection of the cases the period over which records of them were available was one of the elements considered. Finding similar cases in each of two families was a temptation we could not resist. In this subject the significance of six or even sixty cases is so small as far as a solution is concerned that if these six cases serve to introduce the subject and provoke a question or two as a good introduction we should be more than gratified.

Case I (11299) white, female, age 11 entered the University Hospital for the first time 7-8-23 complaining of pain and tenderness in the left foot and ankle, fever, and weakness.

The illness began with pain and tenderness in the left knee two weeks before entry. The joint was not swollen or red. The pain and tenderness remained in the knee for two days and then migrated to the left foot and ankle where it persisted to the time of entry.

Prior to this illness the patient had had frequent attacks of tonsillitis.

The girls mother had died of pneumonia. At this time the father and one sister were reported living and well.

On physical examination it was observed that the teeth were in poor condition, the tonsils enlarged and infected, and the cervical nodes enlarged on both sides. There was a slight thrill over the precordium and a systolic and presystolic murmur over Erb's point. The left ankle was slightly swollen.

An X-ray report of 7-13-23 states that the heart was enlarged to the right and that there were parenchymatous changes in the lungs rather suggestive of tuberculosis.

There is no record of any laboratory findings during this sojourn in the hospital which was for ninety one days.

A diagnosis was made of rheumatic fever and myocardial degeneration.

She was on a soft diet from 7-9-23 to 7-19-23 and on a general diet after that. From 7-9-23 to 7-27-23 she was given 10 grains of Sodium Salicylate and 30 grains of Sodium Bicarbonate every three hours and from 7-19-23 to 7-29-23 10 grains of Sodium Iodide three times a day after meals.

On 8-30-23 tonsillectomy and adenoidectomy were done.

Tincture of Aconite was administered twice a day in 2 drop doses from 9-5-23 to 9-13-23, Quinine Sulphate twice a day in 3 grain doses from 9-15-23 to 9-26-23, and Digital twice a day in 5 drop doses after 10-4-23.

The temperature was between 99 and 100 nearly all of the time and was $\frac{1}{2}$ degree lower at dismissal than on admission. The pulse was quite variable and varied between 70 and 120. There was no appreciable difference between the pulse at the beginning and the end of time in the hospital. There are practically no progress notes in the record.

She was sent home on 10-6-23.

She entered the University Hospital for the second time on 6-4-27 complaining of a dull heavy pain in the right side of the abdomen.

Two months before this she had become aware of a dull pain beginning in the region of the heart and shifting to the right side of the abdomen. This pain lasted several days; subsided and after

that recurred at irregular intervals lasting about a week each time. Finally an attack of this pain began about three weeks before she came to the hospital and had persisted since then. There was no associated constipation, gastric disturbance, or dysuria. She was sent to the hospital with a diagnosis of appendicitis.

After leaving the hospital more than three years before she had spent part of the time in bed for several months and the amount of activity she was allowed had been limited over the entire time. She had been very short of breath and had had some palpitation but no edema. She had had head colds less frequently since the tonsillectomy.

At this time her father was in a hospital as a luetic mental case.

Physical examination disclosed that she had three decayed molar teeth, The tonsils were absent, the fossae clean, and there was no inflammation of pillars or pharynx. There were no palpable cervical nodes.

A blood culture of 6-4-27 was negative after 48 hours. A Wassermann taken on the same date was negative. On 6-5-27 an examination of the urine was negative. On 6-4-27 the red cell count was 5,2000,000, the white cell count 10,000 with 81 per cent polymorphs and on 6-16-27 the red cell count was 5,3000,000, the white cell count 9,2000 with 64 per cent polymorphs and 64 per cent lymphocytes and the hemoglobin was 85 per cent.

An X-ray report of 6-20-27 states that there was a probable root abcess of the upper left first molar.

She was studied in the hospital twenty days, the diagnosis of appendicitis was not confirmed, and she was dismissed on 6-24-27.

She entered the University Hospital for the third time on 7-18-27 complaining of precordial pain, pain in the right lower quadrant of

the abdomen, and dyspnoea on exertion.

Four days after leaving the hospital she had palpitation, precordial pain, and dyspnoea on exertion. Later she had pain beginning in the midline of the abdomen and radiating to the right lower quadrant. There was no nausea, edema of the lower extremities, or ascites.

She stated that her menses began in May 1926, that she had flowed every month from then till March 1927, and that she had not menstruated since nor felt like it.

On physical examination it was noted that the apex beat was in the fifth interspace inside the midclavicular line, that the heart rate was 144, that there was a loud systolic murmur, and that the angle of the left scapula seemed to retract with the heart beat.

Everytime the blood pressure was recorded it was within a few points of 110/70.

On 7-18-27 the white cell count was 19,300 with 89 per cent polymorphs, on 7-21-28 the hemoglobin was 77 per cent, the red cell count 4,000,000, the white cell count 6,500 with 60 per cent polymorphs, and on 7-23-27 the white cell count was 7,400 with 61 per cent polymorphs.

On 8-2-27 an appendectomy was performed under ether anesthesia. The preoperation diagnosis was chronic appendicitis and the pathological diagnosis acute appendicitis healed.

The patient made a nice recovery from the operation leaving the hospital fourteen days after the operation and thirty days after admission.

There is no later record of this patient.

This case is interesting because after following it for a period of four years it leaves us about where we started. It is fairly

obvious that the tonsillectomy did not clear up the systemic infection and there is not much reason to believe that the appendectomy did. We do not know how much infection there was in the teeth or why there apparently was no treatment of the teeth. Further - more it would be rather difficult to establish a definite relationship between the infection in the appendix and that in either the tonsils or the teeth. Perhaps if the girl had had her tonsils out several years before she did she would not have had rheumatic fever and carditis. Finally it is possible that there are individuals who for some unknown reason are particularly susceptible to infection and if the infection can not enter by one focus it is likely to enter by another. This case certainly raises more questions than it answers.

Case II. (19551) white, male, age 9 entered the University Hospital for the first time on 4-19-26 complaining of sore throat, general malaise, swollen painful ankles, and precordial pain.

The symptoms began about three weeks before entry with sore throat, fever, and general malaise.

He was sent to bed at this time.

Indefinite pains in the joints were noticed a few days later. There were some skin lesions on the lower extremities at the time which were interpreted as erythema multiforme. At the end of about two weeks he was permitted to get up as he seemed to have recovered. He took to his bed again the next day on account of the pain in both ankles, both knees, and the left hip. These joints were only moderately swollen but very tender on pressure. His temperature varied from 99 to 102.

A few days later he noticed precordial pain at irregular intervals. This pain became quite severe on the night before entry at which time a systolic murmur was heard. An ice bag was put over his heart and he was given 20 grains of Sodium Salicylate. By the time he entered the hospital the next day his joints were no longer painful and the precordial pain was less.

He had previously had measles, an occasional sore throat, and frequent earaches. A tonsillectomy had been performed two years before at age 7.

His father, mother, and three brothers were all living and well.

On physical examination it was noted that the tonsils were absent but the pharynx was quite infected and the uvula quite edematous. The heart was normal in outline and the pulmonic second sound was accentuated but there was a systolic murmur at the apex which did not, however, replace the first sound. There was ^{no} edema or

swollen joints. The left shoulder was the only tender joint and this tenderness was not marked.

On 4-20-26 many pus cells and many red blood cells were found in the urine which was otherwise normal. On the same date the hemoglobin was found to be 80 per cent, the red cell count 4,200,000, the white cell count 17,200 with 56 per cent polymorphs. No other laboratory work was done.

A diagnosis of acute rheumatic fever was made.

He was in the hospital twenty four days and there was practically no joint tenderness during this time. The temperature was normal except on a few occasions when it rose suddenly to 100 to 101 and as suddenly fell to normal again. He was given 10 grains of Sodium Salicylate and 10 grains of Sodium Bicarbonate every 4 hours for 17 days. He also used a hot alkaline gargle for 17 days. On the seventeenth day the heart sounds were normal. On the twenty fourth day he was sent home with instructions to begin exercise gradually, keeping his heart under observation. He was dismissed on the thirty seventh day in apparently normal condition.

On 6-1-31 he appeared at the University Dispensary complaining of pain in the left upper quadrant of the abdomen and less frequently pain in the right side of the abdomen. This pain was aggravated by exercise. The duration of this pain was not definitely established but it had been definitely worse the past two weeks.

The history obtained shows that he apparently had had mumps and whooping cough at some time during the five years since he was dismissed from the hospital. He was sleeping nine hours a night. He weighed 127 pounds and had been gaining.

On physical examination it was noted that his throat was clear

and his tonsils absent. His heart was regular and there was a suggestion of a split second sound over Erb's point. There was tenderness over the left kidney and pressure in the right upper quadrant produced pain at the same point. Slight general muscular twitchings were noticed.

The urine was normal.

A diagnosis of viseroptosis was made and the patient advised to wear a broad belt.

The patient has not been seen since.

There are several interesting features in this case. First there is no record of any manifestation of rheumatic fever or any other systemic infection until about two years after the tonsillectomy. Then there was definite evidence of infection in the pharynx at the time of the attack of rheumatic fever. Also there is evidence that there was infection in both heart and kidneys at the time the boy was in the hospital. Furthermore the fact that the throat was reported clean seven years after the tonsillectomy is evidence that the operation was quite thorough. Finally the findings five years after the boy was in the hospital are not completely reassuring concerning what may be going on in his heart and kidneys. Apparently tonsillectomy did not protect this boy against subsequent systemic infection of which the portal of entry was probably the pharynx.

Case III. (21875) white female age 8 entered the University Hospital for the first time on 1-18-27 complaining of pain in the right elbow.

The illness began ten days before entry at which time the patient complained of pain in the lower abdomen and nausea. Three days later she vomited once. She also complained of sore throat and had a fever of 101 to 102 every day. About this time her knees and toes became swollen, painful, and very tender and were this way four days, at the end of which time pain appeared in the right elbow and persisted there till she entered the hospital.

She had at some time previously had measles, chicken pox, and whooping cough and had had scarlet fever about eight months before she entered the hospital. For three weeks after her birth she would become quite blue whenever she was placed on her back. At the age of seventeen months she had a severe diarrhea and had been constipated since that time.

It was stated that her father was living and well and that her mother was in a hospital convalescing from a radical mastoid operation.

It was observed on physical examination that she had a "washed out" appearance, was fretful, and looked sick. She had several decayed teeth. Her throat was slightly inflamed. The submaxillary glands were enlarged. The heart beat was rapid and irregular. There was a definite systolic murmur heard best at the apex and transmitted to the axilla. There was slight distention of the abdomen. There was slight pain on motion of the right elbow.

Four examinations of the blood were made during the time she was in the hospital. The red cell count varied from 3,600,000 to 4,000,000, the white cell count varies from 13,000 to 9,600, the

per cent of lymphocytes from 34 to 32, and 1 per cent of eosinophiles was found on one examination. Two examinations of the urine were made and both were negative except for a few pus cells found on the first.

A diagnosis of rheumatic fever was made.

She was treated by forcing fluids, by the administration of Salicylates, and by being given a soft diet.

She was in the hospital twenty nine days. The temperature varied from 97 to 100 each day except on the first when it rose to 101.6 and on the second when it rose to 101. The pulse was somewhat variable and varied between 60 and 100. Her symptoms were at no time more than mild at any time and she was dismissed on 2/16/27 after being symptom free for two weeks.

On 2-21-27 she appeared at the Dispensary complaining of pin worms. Rest in bed was advised for her heart and soap suds enema with careful toilet of the hand for her pin worms.

On 3-21-27 she was seen at the Dispensary and 2-28-27 was set as a date for tonsillectomy but for some reason not stated the appointment was later cancelled.

On 8-1-27 she was seen at the Dispensary, the heart and lungs recorded negative, the tonsils infected, and the pharynx and pillars infected.

On 8-4-27 her teeth were examined at the Dispensary and it was recommended that the lower left temporary molar be extracted and that several other teeth be filled. The extraction was done on 8-10-27 and the diagnosis of an abscess confirmed.

On 2-11-28 she was seen in the Dispensary and advised tonsillectomy.

She entered the University Hospital for the second time on 3/14/28

complaining of rheumatism and leakage of the heart

On physical examination she was observed to be well nourished, and to have hypertrophic cryptic tonsils, infected tonsils and pillars, and palpable lymph nodes.

On 3-15-28 the tonsils and adenoids were removed with a snare and adenoitome. There was very little bleeding.

On 3-16-28 she was dismissed from the hospital.

On 10-10-28 she came to the Dispensary complaining of dyspnoea and sore throat of a week's duration. On breathing she had sharp pains which radiated from the precordium to the same level in the back. Two days before she had had a high fever which had gradually receded and when she was seen at the Dispensary her temperature was 99 and she was feeling better. She complained of pain in the left mastoid region for the past five days.

Rest and a vegetable and milk diet were suggested.

On 1-21-31 she came to the Dispensary complaining of blurring of distant vision, eyes which tired easily when reading, frequent headaches, pain above the eyes, and frequent styes.

Her vision was found to be 20/50 for the right eye and 20/40 for the left eye. The correction for 20/20 vision was +0.50 for the right eye and +0.37 for the left eye.

There is no record of this patient since 1-21-31.

The next case is the brother of this girl and the two cases will be discussed together.

Case IV. (25004) white, male, age 8 came to the Dispensary of the University of Nebraska for the first time on 8-1-27 complaining of loss of weight for more than a month and frequent toothache since the previous winter at which time he learned his teeth were in poor condition.

He had previously had measles, whooping cough, chicken pox, mumps, and small pox. He had had running ears from the time he was 2 years old till the time he was 3 years ~~old~~ approximately. He had had sore throat frequently for an undetermined period. A year before he had pneumonia which was followed by what was designated as a meningitis.

He stated that he had palpitation of the heart on exertion but had never had muscle, joint, or growing pains.

His father, mother, and one brother were living and well but his two sisters both were living with heart trouble of rheumatic origin.

At this time his tonsils and their pillars were found to be infected.

On 8-4-27 he was seen in the Dispensary and it was decided that four temporary molars should be extracted and that several other teeth should be filled.

On 8-10-27 in the University Hospital the four lower temporary molars were extracted and found to be abscessed.

On 2-11-28 he was seen at the Dispensary and it was noted that his teeth were in fair condition, his tonsils large, and his anterior cervical nodes enlarged. A diagnosis of hypertrophic infective tonsils was made at this time.

On 3-14-28 he entered the University Hospital complaining of sore throat and rheumatism. He stated that he had had rheumatic

pains in the joints of his lower extremities for the past few months.

On physical examination it was observed that he was well nourished. He had a post nasal discharge, enlarged and cryptic tonsils and infected tonsils and pillars. His anterior cervical nodes were palpable.

On 3-15-28 the tonsils and adenoids were removed with a snare and adenoitome. There was very little bleeding.

On 3-16-28 he was dismissed from the hospital.

Beginning 10-10-28 and ending 10-24-28 he was seen several times by the outcall service of the Dispensary, a diagnosis of acute rheumatic fever was made and he was given 30 grains of Aspirin per day.

On 12-5-28 he was seen by the out call service and a diagnosis of "flu" was made. The treatment at this time consisted of inhalations, a light diet, and Milk of Magnesia.

There is no record of him since.

The fact that these two cases are brother and sister does not detract from their interest. That three out of four children in this family were troubled with manifestations of rheumatic fever suggests that perhaps there was some undiscovered etiological factor at work, nor is this suggestion made less by the fact that the girl had rheumatic fever, the boy pneumonia with meningeal complication, and the mother mastoiditis all within a period of a few months. . In both the boy and the girl an attempt was made to clean out dental infection and both had tonsillectomies. The presence of rheumatic and cardiac disease before the effort was made to eradicate the foci of infection was more obvious in the girl than in the boy. . There is evidence that they both had rheumatic manifestations several months after the operative porcedures and it is of interest that these manifestations occurred in both children at the same

time. The fact that neither of these children have been seen for three years, except one of them for poor vision on one occasion a year ago, may be taken as evidence that they have had no more recurrences but such a conclusion would be more optimistic than scientific.

Case V. (316) white male age 4 entered the University Hospital for the first time on 12-31-17 complaining of inability to walk, inability to speak well, and twitching and jerking of the extremities and body.

The illness began about six weeks before he came to the hospital and with a feeling of numbness and extreme soreness of the legs and thighs. If anyone touched his legs he would cry out with pain. There was no paralysis but he did not move his lower extremities on account of the pain. These symptoms lasted about a week and then he seemed to have recovered. About two weeks later the twitchings began. At the end of another week or two he began to have difficulty in walking and speaking.

Just before this illness began he had a coriza but was not sick with it and there was no evidence that he had a sore throat. He had had pneumonia at the age of 7 months and measles at the age of 2 years.

The father was living and well. The mother was living and well but had had chorea two or three times when she was a child. Three brothers and one sister were living and well and one brother had developed a condition similar to that of the patient during the preceding two weeks.

On physical examination it was observed that he was well nourished but pale. He seemed to be bright mentally, recognizing objects around him, but could not talk and answered questions by nodding yes or no. There were involuntary movements of the hands and feet, and at times of the muscles of the neck. Incoordination of movements increased when voluntary movement was attempted.

The posterior pharynx was inflamed. The tonsils were small,

not visible and the left, and inflamed. The pillars were congested and the cervical nodes palpable. There was a depression of the lower end of the sternum, the distal ends of the radius and ulna were large, and the patient had knock knees.

Four examinations of the urine were done. On 1-1-18 the specific gravity was 1030, a few pus cells and numerous granular and hyaline casts were seen, on 1-2-18 the specific gravity was 1024, there was a trace of albumin, and a few pus cells were seen, on 1-24-18 the specific gravity was 1026 and was otherwise negative, and on 2-1-18 no specific gravity was determined and other observations were negative.

An examination of the blood on 1-2-18 disclosed a white cell count of 9,900 and on 1-3-18 a red cell count of 5,800,000 and a white cell count of 11,200.

On 1-2-18 a spinal fluid examination gave negative results.

On 1-2-18 the blood pressure was 98/30.

A diagnosis of chorea and chronic tonsillitis was made.

The patient was treated with 5 minims of Syrup of Ferrous Iodide 3 times a day and 5 grains of Aspirin every 4 hours.

On 1-7-18 the tonsils and adenoids were removed under general anesthesia with slight hemorrhage. The tonsils were small but ragged and contained crypts filled with pus.

The patient was dismissed on 2-12-28.

There are no progress notes in the record and no record of the patient since dismissal.

This case will be discussed with the next case which is that of a brother.

Case VI. (489) white male age 7 entered the University Hospital for the first time on 2-21-18 complaining of difficulty in walking and involuntary movements.

The illness started about two weeks before when he began to get nervous and cried easily. Not long after this his hand began to twitch and move involuntarily. He had good control of his feet until two days before coming to the hospital when they seemed to get weak and his gait became awkward. His feet had been jerking for six or seven days. He was still able to walk when he entered the hospital but could not stand long without support.

The patient had had measles and mumps. Sore throat had been frequent, particularly in the winter months although it was stated he had had no recent attacks of tonsillitis. He had been troubled with constipation, nocturia, and enuresis for an undetermined period.

The parents were both reported to be living and well although it was stated the mother had always been nervous and had had two or three attacks of chorea when she was a girl. Three brothers and one sister were living and well but one brother had been in the same hospital two weeks before with chorea.

On physical examination it was observed that the boy was well nourished but had a flushed face. The teeth were described as fair. The pharynx was congested and the tonsils were buried and slightly inflamed. The cervical nodes were palpable. A papular vesicular rash was found scattered over the trunk and lower extremities. The skin was slightly flushed. Involuntary choreic movements of the lower extremities were observed and the speech was peculiar. The knee jerks were exaggerated.

On 2-22-18 the urine had a specific gravity of 1022 and showed

a trace of albumin and a few pus cells. On 3-5-18 an examination of the blood showed hemoglobin 85 per cent, red cell count 4,500,000 and white cell count 7,300.

A diagnosis of chorea minor, tonsillitis, and chicken pox was made.

On 3-3-18 a tonsillectomy was performed.

On 3-5-18 it was noted that there was marked improvement and that the twitching movements were practically absent.

He was in the hospital thirty six days being dismissed on 3-27-18.

On 4-12-18 he returned to the hospital with chorea again and was in the hospital fifty eight days, being dismissed on 6-9-18, but there is no record of the progress or treatment this time.

On 7-30-19 he reentered the hospital complaining of nocturia, impediment of speech, and twitching and involuntary movements of the body and extremities.

Since leaving the hospital about a year before he had been quite well until about three weeks before he came to the hospital this time when the symptoms of his previous illness returned apparently out of a clear sky.

He had had nocturia twice a night and occasional nocturnal enuresis but the duration of these symptoms was not determined.

On physical examination it was observed that the tonsils were absent and the teeth apparently in good condition. The knee jerks could not be elicited. The blood pressure was 100/60.

Examination of the blood showed hemoglobin 90 per cent, red cell count 4,500,000, and white cell count 7,300. On 7-31-19 the urine had a specific gravity of 1035 and was otherwise negative.

A diagnosis of chorea was made.

The patient was put on a soft diet on 7-30-19 and this was changed to a general diet on 8-28-19. On 7-31-19 that patient was started on 5 grains of Sodium Salicylate and 10 grains of Sodium Bicarbonate four times a day and 8-22-19 this was changed to 5 grains of Aspirin three times a day. On 8-3-19 tepid bathes three times a day were started. On 8-24-19 the patient was started on 8 minims of Syrup of Ferrous Iodide three times a day.

The patient was in the hospital seventy four days, being dismissed on 10-11-19 but there is no record of his progress and there is no record of him since.

In these two cases we see two brothers both ill with chorea at about the same time and sons of a mother who had had chorea when she was a child. As far as the record goes the younger had no attacks after his tonsillectomy. The elder had a relapse about a month after his tonsillectomy and about two weeks after being dismissed from the hospital. He also had a recurrence more than a year later. The elder gave a history of previous sore throats and the younger did not so it may be that the infection in the tonsils of the elder was of longer standing and tonsillectomy was not as effective in his case as it was in that of the younger. On the other hand if the chorea was the result of chronic infection in the tonsils why did the younger become ill with the disease first and why did it appear in both lads at as nearly the same time as it did? Was the disease due to a specific organism carried by the mother or was it due to a specific susceptibility inherited from the mother or was it coincidence that the mother had had it? On the whole these cases suggest that altho the tonsils may be a factor in chorea they may be only a small part in the whole picture of the etiology of chorea.

By selecting all six of these cases from the rheumatic group of diseases we do not wish to convey the impression that we intend to consider only this group of diseases in its relationship to the tonsil. Six cases with some similarity would seem to form a more comprehensive picture than six widely dissimilar cases. Perhaps we presented these cases with too much detail but our purpose was to give as complete a picture of these cases as possible.

III. Historical Considerations

At the present time the tonsillectomy is and for some time has been one of the most frequent if not the most frequent of all operations in which any part of the body is removed. It may be of some value to try to discover how and why this came about.

The antiquity of the tonsil operation is of little significance in this paper but Heiman¹ in an interesting summary of this part of medical history says, "The first account of the tonsil operation was given by Celsus in AD10, who recommended removal of tonsils if they remained indurated after inflammation. Aetus in AD 490 writes more conservatively of the excision of the tonsils. In AD 1120 Albucasis expressed his fear of hemorrhages after tonsil operations. During the next 500 years the operation was not done. It was revived in 1637 by Servius and criticized later by Dionius, who claimed that the tonsils had definite functions. Meseati and Wiseman were the first to employ it modern times".

In the last quarter of the nineteenth century a tremendous change was wrought in the theory and practice of medicine following the discoveries of Pasteur and Koch. The germ theory of disease came into being and with it the modern conception of infection. It is in this period that our history of the concept of the tonsil in relation to disease really begins. In an effort to discover what this concept was and how it may have changed we shall present samples of the literature not for the ideas contained in these articles but only in the hope that they will give some clue as to the trend of thought of the medical profession of the time on the subject.

In 1886 Fox² in a paper on the relation of tonsillitis to scarletina and diphtheria supports a theory that the tonsils have an ab-

sorbent function and does not mention any surgery of the tonsils whatever. Obviously the idea that the tonsils harbored micro-organisms had not received general acceptance at this time.

In 1888 Spicer ³ wrote, "The functions and affection's of the various tonsils afford the key to the comprehension and scientific treatment - and the prevention - of many of the most intractable and recurrent disorders of the nose and throat." He does not make clear the mechanism of this relationship and while he mentions the excision of the tonsils for hypertrophy the only treatment of the tonsils that he discusses is nonsurgical. From this article we suspect that at this time there is at least a preparation for the later concept of tonsillar infection.

In 1891 Gullard ⁴ writes "Under certain circumstances - for instance, in general debility - the reproduction of leucocytes may be interfered with, and the outward stream of these cells from the tonsils may be arrested. This arrest or other circumstances interfering with the activity of the leucocytes may allow pathogenic organisms from the mouth, etc., to enter the tonsil by the spaces in the epithelium and these microbes may give rise to a local or general infective process." Here we have a rather clear cut conception of infection in the tonsils as a cause of local and even systemic disease. We have no way of knowing what proportion of the medical profession accepted this view at this time but we do know that in time the idea that the tonsils could be invaded by microorganisms became almost universally accepted. Unfortunately, however, the other idea expressed by this writer, that is that the resistance of the individual had something to do with the process, was if not discarded at least pushed into the background.

In 1892 Allen ⁵ states that he believes that the size of a tonsil does not constitute a clinical state as long as it does not impede respiration and that tonsils should never be removed as a whole.

In 1895 Fraenkel ⁶ and Macintyre ⁷ presented papers on the infectious nature of lacunar tonsillitis. In these papers and in the discussion of them some of the points mentioned were peritonsillar abscess as a sequel of tonsillitis, pathological evidence of spread of infection from the tonsils to distant parts of the body, experimental evidence of the pathological properties of organisms found in the tonsils, and the relationship of tonsillitis and rheumatism. Apparently the idea of the relation of the tonsil to focal infection was under way at this time and there had been some scientific investigation of the relation.

In 1900 Poynton ⁸ writes, "It is demonstrated conclusively that these diplococci when present in the throat of a man the subject of rheumatic fever will, if isolated during an attack of angina faucium, cause valvulitis and pericarditis, both non-suppurative, when inoculated intravenously into a rabbit. The presence of the micro-organisms in the cerebro-spinal fluid is very suggestive when the close association of chorea and rheumatic fever is considered from this point of view". In his dozen or more of references from the literature on the etiology of rheumatic fever only one alludes to the tonsils as a factor and that one was published by Buss of Bremer in 1894. From this we assume that altho a relationship between tonsillitis and rheumatic and perhaps carditis and chorea had been suspected for some time it was not until the last few years nineteenth century that experimental evidence was used

to explain this relationship on the basis of focal infection.

The amount of literature written on a subject at any given time should be some measure of the amount of interest in the subject at that time. Altho the Surgeon-General's Catalogue ⁹ probably would not contain all of the literature it should be a representative sample. Table I shows the number of titles dealing with infection of the tonsils in the Surgeon-Generals Catalogue each year from 1893 to 1912. The titles have not been classified under this subject since 1912.

Table I. Tonsillar Infection in the Surgeon-Generals Catalogue.

Year	Infection through the tonsils	Complications and Sequelar of Tonsillar inflammation	Tuberculosis of the tonsils	Total
1893	1	2	0	3
1894	1	6	2	9
1895	1	2	9	12
1896	2	7	5	14
1897	3	2	3	8
1898	8	3	6	17
1899	4	2	4	10
1900	8	4	5	17
1901	4	2	2	8
1902	3	4	7	14
1903	4	6	10	20
1904	1	2	6	9
1905	5	3	7	15
1906	10	5	8	23
1907	8	6	6	20
1908	4	7	9	20
1909	8	3	8	19
1910	3	13	5	21
1911	10	7	5	22
1912	4	4	0	8

This table would seem to show that the interest in tonsillar infection was quite constant over this period of twenty years. Interest in infection through the tonsils apparently increased after the first few years.

Table II shows the number of titles concerned with excision

of the tonsils in the same catalogue and over the same period as

Table I.

Table II. Excision of the Tonsils -in the Surgeons Generals Catalogue.

Year	Partial or complete excision of the tonsils.	Accidents and sequelae of excision of the tonsils.	Instruments and methods for excision of the tonsils.	Total
1893	2	2	1	5
1894	3	7	5	15
1895	3	2	11	16
1896	1	4	4	9
1897	0	3	4	7
1898	4	6	7	17
1899	2	8	4	14
1900	1	9	11	21
1901	3	10	7	20
1902	2	10	8	20
1903	3	10	11	24
1904	2	8	6	16
1905	4	8	9	21
1906	7	4	22	33
1907	7	7	18	32
1908	9	8	21	38
1909	15	9	36	60
1910	23	23	38	84
1911	30	12	37	79
1912	27	12	29	68

This table seems to show that there was a definite increase in the interest taken in tonsil operations in at least the last decade of this period. It is reasonable to suppose that this was because more tonsil operations were being done. The increase in interest in the question of whether the excision of the tonsils should be partial or complete seems to be most marked at the end of the period. We suspect that back of this was an increase of interest in the role of the tonsil in focal infection.

In 1908 Rosenheim¹⁰ listed the infectious diseases, other than arthritis, which he believed to be associated with the tonsils. This list includes anerism, appendicitis, erysipelas, meningitis, iritis, pleuritis, pericarditis, pneumonia, paraplegia, strabismus,

nephritis, osteomyelitis, phlegmon of lower extremities, ovphoritis, architis, septic infection, typhoid fever, and tuberculosis. He concluded that in all infectious diseases the lymphoid tissue of the throat should be carefully examined as a possible focus of infection but he also made the statement that there was no method of pointing out dangerous varieties of tonsils.

In 1910 Loeb ¹¹ wrote that an experience with acute nephritis following tonsillitis in the winter of 1808-1809 brought to mind that acute nephritis is a frequent sequel of tonsillitis and that this is overlooked in practice by the great majority of practitioners.

Now as a rule it is human nature to follow the line of least resistance and the acts of the medical profession are not always an exception to this rule. Literature like the last two samples quoted, and volume of it at this time was not small, furnished an easy explanation of and a possible treatment for a number of diseases which had hitherto been more or less unsatisfactorily solved problems. With this in mind it is not entirely illogical to suspect that many of the medical profession would lose little time in seizing on the tonsils as the cause of a large part of the suffering of the human race and from the increase of interest in tonsil operations at this time we suspect that they did.

We do not mean to infer that the entire medical profession was stampeded by this idea for there were at least a few reactionaries. For example in 1909 Ashhurst ¹² stated that he suspected that the obscure relationship between tonsillitis and rheumatism may be that the tonsil throws off the products of the rheumatism rather than the old belief that the rheumatism might enter thru the tonsil.

This view and other views which defended the tonsil were not generally accepted possibly because they could not be proven but we suspect that the chief obstacle to their acceptance was that they did not suggest some obvious act on the part of the physician to benefit the patient. We do not know how many reactionaries there were at this time but according to Swain¹³ they were not very conspicuous for in 1911 he said "In our annual meeting two years ago, only one man had sufficiently the courage of his convictions to say a word apparently in contradiction of the tremendous weight of the general opinion of the men present".

Thinking that perhaps the increase in tonsillectomies could possibly have some relation to the specialties pertaining to the upper respiratory tract we compiled a table from American Medical Directory¹⁴ between 1906 and 1931. Table III shows the numbers of physicians in the United States, the numbers of societies of ophthalmology, otology, rhinology, and laryngology in the United States and the numbers of members of these societies in the United States as given by the American Medical Directory.

Table III. Physicians, Opto-oto-rhino-laryngologists and their Societies in the United States between 1906 and 1931.

Year	Physicians	Members	Societies
1906	not given	not given	0
1909	not given	not given	3
1912	137,199	1467	30
1914	142,332	1700	33
1916	145,241	2032	35
1918	147,912	2212	35
1921	145,376	2314	35
1923	145,966	2742	38
1925	147,010	3018	37
1927	149,521	2564	10
1931	156,440	3577	12

It can be seen at a glance that the increase in these specialties over this period was about seven or eight times as rapid as

the increase of the profession as a whole. It is true, however, that the interval covered by this table has been an era of specialization and the increase in these specialties may be a part of the general picture. Whether or not the increase in the number of tonsillectomies being done was a factor in the increase in the number of physicians devoting their attention to the upper respiratory tract the increase in this specialty possibly influenced the number of tonsillectomies. These specialists had to live and altho otorhino-laryngologists did not devote their entire attention to the tonsils for many of them the tonsillectomies they performed probably paid their office rent. Not only this but many a physician in general practice has found that a few tonsillectomies aid considerably in keeping the wolf from the door. Now we do not mean to insinuate that any physician would deliberately perform an operation which he believed to be of no value to the patient in order to get his fee but it is human nature not to be quite as critical when our criticism might react to our disadvantage.

By end of the first decade of the tweentieth century the concept of focal infection the position of the tonsil as an important primary focus was quite well established in medical thinking. There was little change in this thinking for about another decade. Billings¹⁵ in 1913 stated the concept prevalent at the time fairly well when he said that the infectious source was usually in the alveoli, focial tonsils, or sinuses and that the treatment should consist of first removal of the cause and second of improvement of general immunity. Among many practitioners, however, the improvement of general immunity was apparently not taken very seriously possibly because general immunity is much less tangible than a pair

of tonsils or a set of teeth. As this period in our history was one in which there was little change we will pass over it rapidly.

It may be interesting to note however that relation of the tonsil to one very important systemic disease, namely tuberculosis, lost much of its significance. Mitchell ¹⁶ in 1917 said that tonsillectomy was essential in all cases of tuberculous cervical adenitis in children but he also stated that experimental studies had shown that primary tuberculosis of the faucial tonsils in children resulted from the drinking of milk from tuberculous cows rather than from the inhalation of tubercle bacilli from consumptive patients. In other words in this particular disease a fairly effective method was found for preventing the tonsils from becoming a focus of infection.

After about ten years of little thought on the tonsil and its relation to focal infection but of an almost universal acceptance of the idea that one could never make a mistake by recommending tonsillectomy if the patient had tonsils, there was apparently a revival of thought on the subject. In 1918 Blum ¹⁷ wrote that the common practice of tonsillectomy as a diagnostic measure was reprehensible and should be discontinued and he gave as one of the reasons that it diverted attention from other diagnostic procedures which not infrequently would have disclosed obvious causes of disease. If this writer was at all correct in his assertion it was high time for the medical profession to consider the subject seriously.

In 1924 Davis ¹⁸ stated that nonpathologic tonsils were removed more frequently and in larger numbers than any other tissue of the body and that the removal of tonsil tissue before the natural maturity period was reached was frequently followed by com-

pensatory replacement in disadvantageous anatomic positions. These statements, regardless of their accuracy, do show that there was some agitation against unnecessary tonsillectomies at this time.

We mentioned earlier the position of the tonsil in relation to tuberculosis and it may be of interest to mention that in 1924 Chadwick¹⁹ in a paper on juvenile tuberculosis states that tuberculosis in children between the ages of five and twelve years is essentially a disease of lymphoid tissue but he does not mention the tonsils in the entire paper.

In 1925 Brennemann²⁰ said, "The burden of proof still lies with the man who asserts that the tonsils can be removed at any age without harm to the owner, though the benefit may be much greater than the harm." This from a leader in the field of pediatrics may be taken as evidence of a healthy feeling of uncertainty.

Medical treatment of the tonsils was largely given up as futile about the time surgical procedures on the tonsils reached their tremendous popularity. Some years later, however, another method of treating the tonsils began to be discussed and this was radiotherapy. Babcock²¹ in reviewing the subject in 1925 arranged the titles in his bibliography under three headings, namely favorable, partly favorable, and unfavorable. Twenty eight titles were under the heading "favorable", ten under "partly favorable", and eleven under "unfavorable". It is just possible that the advent of another procedure as a possible rival of the tonsillectomy may have been ^{a factor} in the revival of interest in the tonsils.

In going over the literature one difference between the clinical evidence offered in the first and third decades of the present century is quite conspicuous. That found in the literature of the first decade consisted chiefly of case reports and the inferences

drawn there from while that of the third decade consisted chiefly statistical studies based on records of from a few to several thousand patients. In a few of these statistical studies an effort was made to introduce an element of control.

In 1927 Tucker²² in discussing tonsil infection wrote that in a mechanism as complex as the human body it was manifestly impossible to detail accurately results from therapeutic measures directed toward one part of the body only. It is perhaps significant that this writer was a specialist in ear, nose, and throat.

In 1931 another nose and throat specialist, Lewis²³, said "Many men, even in our specialty, seem indisposed to think of adenectomy except in connection with tonsillectomy, and for no other good reason than custom and habit. If adenectomy in children, especially in infants, is alone indicated, then poor surgical balance, surely, is shown by doing more." In concluding his remarks on unnecessary tonsil operation he said, "In this wide spread ill-advised surgical activity, it should be a matter of satisfaction that we, as a specialty, are not responsible for its inauguration, and are not now contributing toward its continuance or increase." These statements if they are at all representative of the thought of even a minority of the profession are indicative of a shift toward a more conservative and thoughtful attitude and away from the blind belief prevalent fifteen or twenty years earlier that the only good tonsil was the excised tonsil.

To summarize it may be said that the history of the tonsil and its relation to systemic infection for approximately the past forty years may be divided in four periods each of which lasted about ten years. The first was a period of investigation following the ad-

vent of the germ theory into medicine. In this period the concept of the tonsil as a focus of infection came into being. The second period was more practical and probably less scientific than the first. It was in this period that the tonsillectomy was popularized as a treatment for a very respectable portion of human affliction. The third period was one of blind adherence to previous dicta and one of little advancement. The profession as a whole considered the subject as closed and consequently gave it little real thought. The fourth period was one of disillusionment and skepticism. The subject was again opened for discussion and numerous investigations have been made. At the present time the medical profession is probably in a more healthy state of mind concerning this problem than it has been for thirty years.

IV. Anatomical, Physiological, and Pathological Aspects.

We are told that before we can understand the abnormal we must first understand the normal. When we apply this dictum to the tonsil we reach the conclusion that before we can understand the pathology of this organ we must first know its physiology. Unfortunately, however, the function of the tonsil has never been demonstrated. Bearing this in mind it would seem a bit presumptuous to consider the pathology of the tonsil as established beyond a shadow of a doubt. Nevertheless there may be a few observations, which, altho they may not solve the problem may throw some light upon it.

Barnes ²⁴ states that the tonsils reach their highest development in the higher animals and that in man show great cellular activity throughout the most active period of growth. Now from this it is reasonable to suppose that the tonsils are not vestigial organs but are organs with a function even though we can not demonstrate this function.

If cellular activity is evidence of function it would seem that tonsillar function is greatest in childhood. It perhaps is not out of place to remark that organs with as adequate a blood supply as that of the tonsils are not usually functionless organs. If we admit that the tonsils have a function we can not assume that they are useless organs.

There is one school of thought which holds that the tonsils are merely lymph nodes and that any function they may have is the common function of all lymphoid tissue. This school then very logically concludes that the loss of the tonsils is no very important loss. There is, however, one anatomical feature of the tonsils which this school has apparently overlooked. The tonsillar tissue

of the pharynx and the lymphoid tissue of the intestine are the only accumulations of lymphoid tissue in the body which are in contact with the external environment to any significant extent. It may be that this lymphoid tissue was left exposed as the result of some oversight on the part of nature but we doubt it.

That the structure and location of the tonsil should render it susceptible to infection can not be denied. On this point Barnes²⁵ writes, "In the tonsil of childhood we find a condition which, if it had been specially devised for the purpose of creating infection, could hardly be improved. With the great increase of lymphoid activity after the first year of life the pressure on the walls of the crypts must be considerable; it is likely, also, that it is not uniform but greatest opposite the follicles. The result is that drainage becomes imperfect, retention of cellular debris follows, irregular dilatation of the crypts occurs, and pockets are formed by the backing up of the cryptic contents, which decompose and make perfect nesting places for bacteria of all sorts which may enter from the faucial cavity. Add to this the feeble and degenerated structure of the cryptic epithelium at this age, and the wonder is, not that infection occurs often, but that any tonsils escape it." We can only add that we question whether any tonsil does escape infection during childhood and whether nature intended that any tonsil should escape infection during childhood.

We have seen that it is not surprising that tonsils become infected. We will now discuss briefly a little of the pathological and bacteriological evidence of tonsillar infection. In a series of cases including chronic articular, renal, and cardiac diseases Davis²⁶ found that the crypts of the tonsils generally revealed the hemolytic streptococcus as the predominating organism. These

streptococci were found virulent for rabbits and other animals localizing in or about the joints and producing chronic multiple arthritis. Gloyne²⁷ states that in his series more than half of the children with enlarged or unhealthy tonsils harboured pathogenic organisms in their tonsils, the streptococcus being the predominant organism. Crowe²⁸ states that in some patients suffering with arthritis he found ulcerations in the crypts of the tonsils with thrombosed capillaries around the margins of the ulcers. Some of these patients had no enlargement of the cervical nodes. He assumes that infected emboli were disseminated thru the blood stream from these thrombosed areas. Numerous statements similar to these can be found in the literature but these three are sufficient to show that pathological organisms have been found in the tonsils of patients afflicted with certain diseases and possible may be carried to other parts of the body in certain cases. A few years after coming out with his findings on the presence of streptococci in the tonsils in certain disease conditions Davis²⁹ stated that cultures taken at short intervals sooner or later revealed the presence of hemolytic streptococci in the throats of practically all normal adult persons. In fact we suspect that tonsils usually are infected or at least harbor bacteria. It remains to be proven, however, that the mere presence of organisms in the tonsils is harmful, dangerous, or even undesirable in all cases.

We do not intend to discuss or even mention all of the theories of the function of the tonsil but it may not be out of place at this point to discuss one of them briefly. Anatomical features of the tonsils render them very susceptible to invasion by pathogenic organisms and it is quite probably that this invasion usually takes

place. Now nature does not usually encourage any mechanism that does nothing but harm the individual. Immunity is a subject concerning which there is much to be learned but one of the factors of immunity in many diseases seems to be some form of contact with the causative organism of those diseases. It is conceivable that it may be the function of the tonsils to furnish a means for this proper contact. This hypothesis is not rendered less plausible by the observation that during childhood, the period during which the tonsils seem to show the greatest activity, the individual acquires considerable immunity against many infections.

Altho the theory just mentioned can neither be proven nor be disproven it does have a few points in its favor and if it were to be taken seriously would alter considerably our conception of tonsillar hypertrophy. Even if this function of the tonsils could be proven it does not follow that no tonsils should be removed for infection for obviously if it was the function of the tonsil to become infected it would also be part of their function to keep the infection under control and when an organ becomes diseased to the extent that it can no longer and never again perform its function, regardless of what the function is, the individual is usually better off without the organ. The most a surgeon accomplishes by any operation is to exchange one abnormality for another on the assumption that the patient will receive some benefit by the exchange. If we assume that the tonsils can be physiologically infected we at the same time create the problem of determining when they are pathologically infected. On this point Digby³⁰ says, "One must also be skeptical of a histological report of chronic interstitial tonsillitis or appendicitis as evidence of disease, for these glands

are normally in a condition indistinguishable from chronic lowgrade inflammation."

So far we have attempted to raise a doubt as to whether the presence of microorganisms in the tonsil is always pathological. Now we must face the problem of what determines whether the tonsil will control the microorganisms or whether the microorganisms will overcome the tonsil and use it as a base for an attack on other parts of the body. General resistance to infection may be a factor but this is so large a subject we will not begin a discussion of it. When we consider the manner in which nature takes care of many infections it would seem that in the tonsils the ease with which drainage can take place from the crypts would be an important factor. Murphy ³¹ and Watkins ³² report that Roentgen radiation of the tonsils causes the tonsils to shrink and the crypts to open and drain and that following this the infection soon subsides. We do not know what effect the Roentgen ray has on the tonsil tissue and this is not the place for a discussion of this particular kind of therapy but it may not be out of place to suggest that a more thorough study of the effects of the Roentgen ray on the tonsil might possibly lead to some information on the pathology and physiology of the organ.

Up to the present anatomical, physiological, and pathological investigations of the tonsil have by no means solved the tonsil problem. As we see the problem from this aspect, however, we think we have sufficient grounds for not accepting the view that all tonsils, particularly in children, are dangerous or at least useless. Furthermore we suspect that all the criteria of a pathological tonsil are not known nor will they be known until there is considerably

more understanding of the mechanism of infection than there is at the present time. We suspect that in dealing with focal infection the removal of the foci has been overemphasized and the removal or control ^{of the infection} has not been emphasized enough.

V. Clinical Evidence

There is an abundance of literature dealing with clinical observation of the relation of the tonsils to systemic disease. The quality of this literature on the whole probably is not as impressive as its quantity.

Probably the most extensive investigation of tonsillitis reported in the English language is that of Collins³³ made for the United States Public Health Service. Unfortunately the material for this statistical study was gathered from so many sources and the methods are so involved that the validity and reliability of the findings can not be readily determined. We will, however, quote the summary of the findings which have a bearing on our subject. These are as follows.

"Respiratory diseases other than tonsillitis appear to be somewhat more frequent among children with defect in tonsils than among those with normal or removed tonsils. Among adults there seems to be little difference in the incidence of these respiratory diseases in the different tonsil groups.

The incidence of certain nonrespiratory diseases varies with the condition of the tonsils. The incidence of illness from rheumatism, heart conditions, cervical adenitis, and ear conditions tends to be lowest among children with normal tonsils, higher among those with defective ~~defective~~ tonsils, and highest of all among those with removed tonsils. The incidence of illness from rheumatism and related conditions appears to be higher among adults who have attacks of tonsillitis than among those who are free from tonsillitis.

The incidence of diphtheria among children with defective ton-

sils seems to be much higher than among children with removed tonsils. Among children with normal tonsils it appears to be only slightly higher than among those whose tonsils have been removed.

The incidence of measles, whooping cough, chicken pox, and mumps all appear to be higher among children whose tonsils have been removed than among either of the groups with the tonsils present. Similar differences are indicated by rates based on susceptible children only, eliminating all children who had suffered a recognized attack of the disease prior to the period of observation.

These statements would be of more value if we knew what was considered a normal tonsil and in some of the diseases when the tonsil was removed with reference to the onset of the disease. In any case this study should be given a prominent place in the evidence on this subject at this time.

Hunner ³⁴ reports four cases of chronic urethritis which were ~~of chronic urethritis which were~~ apparently afforded relief by tonsillectomy and is quite enthusiastic about it. No comment should be necessary.

Jones ³⁵ states that routine tests will disclose the presence of albuminuria or other evidence of nephritis in the majority of cases of acute tonsillitis or other tonsillar infections. We suspect that a slight albuminuria is not uncommon in the course of many febrile diseases.

Smith and Bailey ³⁶ report three cases and suggest that in children with acute nephritis and chronically infected tonsils, the tonsils should be immediately removed without waiting for the nephritis to subside. We were unable to find a report of their next three cases.

St. Lawrence ³⁷, after making a study of ninety four children of whom eighty five had presented one or several of the rheumatic manifestations, during an average period of three and one half years after tonsillectomy, states that eighty four per cent showed ~~no recurrence~~ ^{of rheumatic fever and fifty per cent no recurrence} of chorea. He concludes that tonsillectomy would seem to be the most important measure at present available for the prevention of acute rheumatic fever and allied rheumatic manifestations. Unfortunately he gives us no data on what the recurrence would have been in the same period if tonsillectomy had not been performed.

Vercoe ³⁸ in reporting a study of rheumatism in elementary school children gives the following table:

Tonsils of	Enlarged	Removed
105 rheumatic children	10 = 9.5%	12 = 11.4%
483 non-rheumatic children	51 = 10.6%	29 = 6.2%

He does not state whether the tonsils were removed before or after the rheumatism became manifest nor does he state why they were removed except that a considerable number of them had probably been removed routinely when adenoids were removed.

Getchell ³⁹ states that he examines the heart before giving anesthesia and that while he has found definite cardiac lesions in persons who came for tonsillectomies, yet these cases are so few that the complication in his experience is one of great rarity.

Bullowa ⁴⁰ on the basis of a study of one hundred fifty four tabulated cases concludes that in scarlet fever the tonsil is a focus of infection, and that in tonsillectomized children the disease is less severe and the complications more infrequent and less severe.

Comer ⁴¹ after making an analysis of five hundred cases, three

hundred of whom were children, states that a tonsil once infected remains pathologic until it is properly removed. He also states that it is his opinion that pulmonary tuberculosis, both active and arrested, should be regarded as a contra indication to tonsillectomy on the ground that the operation may disturb the equilibrium between illness and health.

After two years observation on approximately seven thousand five hundred school children of whom approximately three hundred were subjected to tonsillectomy Davis ⁴² says that while the number is far too small to justify definite opinions these cases at least suggest that the incidence of heart disease in the great number of children referred for tonsil operations is very small, that the cervical glands enlarge as often after as before tonsil operation, that there is more complete relief from symptoms when removal is done at from seven to ten years of age, in the majority of cases, and that early removal gives mechanical relief for a time; but the original cause of the growths, whatever it may be, is present and active until a much later period.

In a recent editorial in the Journal of the American Medical Association ⁴³ we find the following statement. "Considering the large number of tonsillectomies and adenoidectomies that have been performed, it is unfortunate that the literature reveals a great lack of accurate information on the effect of tonsillectomy. Opinions still differ on this old question. There seems to be a growing tendency to question the value of tonsillectomy as a prophylactic measure against infectious diseases and as a cure for rheumatism, chorea, and carditis."

The most satisfactory contribution on this problem in the English language, at least, is probably a recent one by Kaiser

In 1922 he published the results of a study made of five thousand children one year after tonsillectomy had been performed on them. At that time he said, "The ultimate effects of the operation on a child can not be determined at the end of a year; but at that time 84% of the children were considered in better general health, as indicated by their physical examination and analysis of their complaints."

Two years later he published the results of another study of twelve hundred children three years after tonsillectomy compared with an equal number not operated on. At this time he said, "One is at once impressed with the absence of any spectacular results when a group is studied controlled by a group not operated on."

In 1931 this writer published the results of an investigation of which it is quite safe to say that it is the outstanding piece of work done in this field in this country. This was a study of four thousand four hundred over a ten year period. Two thousand two hundred of these children had been subjected to tonsillectomy between the ages of four and seven years. The other two thousand two hundred were similar children for whom the operation had been recommended but on whom it had not been performed. We will now set down the findings of this study in some detail.

The incidence of head colds was 41% in both groups before operation and did not change in the next three years in the group not operated. In the operated group it was 8% at the end of one year and 7% at the end of three years. At the end of ten years it was 22% in the operated group and 31% in the group not operated. The writer suggests that the removal of adenoids may have been a factor in the improvement.

The incidence of sore throat before operation was 36% in the operated group and 41% in the group not operated. Again the group not operated showed little change in the first three years while in the operated group the incidence was only 5% at the end of one year and 3% at the end of three years. At the end of ten years it was 10% in the operated group and 35% in the group not operated.

The incidence of cervical adenitis was 15% before operation with no change at the end of the first year for both groups. In the operated group it was 5% at the end of three years and 7% at the end of ten years while in the group not operated it was 14% at the end of both these periods.

After the age of five years first attacks of purulent atitis media were as frequent in one group as the other but recurrent attacks were less frequent in the tonsillectomized group.

During the ten year period rheumatic fever developed in 2.3% of the operated group and in 3.5% of the group not operated. At the end of the ten year period 7.8% of the operated group and 9% of the unoperated group had growing pains. Recurrent attacks of rheumatism occurred as frequently in one group as in the other.

Chorea developed in 1% of the operated group and 0.6% of the group not operated during the ten year period.

The incidence of recurrent laryngitis before operation was 3% in the operated group and 5% in group not operated. There was no change in either group at the end of either the one or the three year period. At the end of the ten year period it was 8% in the operated group and 10% in the group not operated.

The incidence of bronchitis before operation was 5% in the operated group and 3% in the group not operated. During both the three and ten year periods bronchitis developed in twice as many

of the operated children as in those not operated.

Before operation the incidence of pneumonia was 6% in the operated group and 5% in the group not operated. During the one and three year periods there were few cases in either group but during the ten year period the incidence was 3% in the operated group and 1.5% in the group not operated.

First attacks of paranasal sinus infection occurred more frequently in the operated group. Of those with this affliction before operation some were apparently relieved by the operation.

Of 34 children in both groups in whom nephritis developed between the ages of five and ten years 9 had had their tonsils removed and 25 had not had their tonsils removed.

Dental infection were twice as frequent in the children not operated as in those operated.

The incidence of diphtheria was 1.3% in the operated group and 1.9% in the controls and the incidence of scarlet fever was 3.3% in the operated group and 4.6% in the controls.

There was no demonstrable difference between the two groups as far as malnutrition was concerned.

Altho this investigation falls far short of solving the tonsil problem the data is quite interesting and it would probably be not without value to follow these same two groups of children for another ten years. A few inferences are suggested by a study of these figures.

The operation seems to have a definite benefit on upper respiratory infections for a few years but this benefit seems to become less marked as time goes on.

The operation seems to have a tendency to prevent enlargement

of cervical nodes but we are not prepared to make a statement on the significance of enlargement per se of these nodes.

It seems strange that the operation should tend to decrease the number of recurrent attacks, of otitis media and not tend to decrease the number of first attacks. The same seems to hold for para nasal sinus infections.

It seems that the operation has little or no value in the rheumatic conditions after they have developed. The incidence of these conditions in these children, all of whom were recommended for tonsillectomy, and apparent value of the operation in preventing first attacks would scarcely seem to justify the indiscriminate use of tonsillectomy as a prophylactic measure against these rheumatic conditions.

If tonsillectomy has any effect on lower respiratory infections the effect would seem to be an undesirable one.

Tonsillectomy seems to be of definite benefit in preventing nephritis in children but fortunate by the incidence of nephritis even children with defective tonsils seems to be much less than some writers would have believe.

The apparent relationship between defective tonsils and defective teeth is intriguing. It is just possible that the parents of the operated children were more vigilant in securing proper care for their childrens' teeth than were the parents of the group not operated. Of course we do not know this but if it were true it could conceivably have a bearing on some of the other conditions studied.

Tonsillectomy does seem to decrease the incidence of diphtheria and scarlet fever but we suspect there are better and more effective

methods of preventing these diseases.

On the whole this investigation by Kaiser would seem to suggest that the wholesale removal of tonsils is not as imperative as we were once led to believe that it was. We should not lose sight of the fact that this investigation covered chiefly the pathological conditions to which the tonsil was thought to have an etiological relationship and that there may be other conditions not suspected of having any relationship to the tonsil but on which the tonsil may have either a desirable or undesirable influence.

On summing up the clinical aspects of the problem we should perhaps first apologize for some of the literature we cited. We perhaps omitted some of the better and more revelent papers on the subject and perhaps used some of the poorer ones. Those we used are, however, what we believe to be more or less representative of the great mass of literature which has appeared in the English language on this subject. Many conflicting opinions are found in the literature and many conclusions have been drawn from insufficient data. Our reaction to the evidence on this phase of the subject is that it is much more difficult to prove the guilt of the tonsil in much that has been charged against it than it is to assume this guilt to be a fact.

VI. Summary and Conclusions.

The history of the tonsil problem for the past forty years seems to show that the value of the tonsillectomy as a common procedure could easily have been overestimated and that not until the last ten years or so has a real effort been made to determine the actual value of this operation.

A consideration of the anatomical, physiological, and pathological aspects of the tonsil in relation to systemic infection is suggestive that very little is known of the real position of the tonsil in the body economy but that there is as much reason to think that the tonsil deserves the respect given a useful organ as there is to think that it does not.

A study of the clinical evidence on this problem seems to reveal that in general the more complete, more thorough, and better controlled investigations on the subject leave less cause for optimism concerning the results of tonsillectomy as far as systemic infection is concerned than do the more uncritical investigations.

Altho the tonsil problem is apparently far from a solution, nevertheless on the basis of existing knowledge the following tentative conclusions seem reasonable.

1. Tonsillectomy is a poor substitute for diagnosis and to use it as such on children is not only unscientific but is unfair to the children.
2. The presence of systemic infection in children is not an indication for the removal of normal tonsils in these children.
3. The presence of apparently infected tonsils in children without the obvious manifestations of systemic infection is not an indication for tonsillectomy as a prophylactic measure against systemic infection.

4. If in a child the presence of both systemic infection and tonsillar infection can be conclusively demonstrated, particularly if manifestations of nephritis are present, tonsillectomy may be indicated, provided no other foci of infection which can not be removed can be found.

5. If in a child the tonsils have become so damaged that they have no longer any capacity for any function there is sufficient justification for their removal as a prophylactic measure against systemic infection.

6. The point at which the tonsil of a child passes from a physiological to a pathological condition has never been satisfactorily determined.

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