Original Articles.

A FUNCTIONAL RELATION OF THE TONSIL TO THE TEETH.*

BY GEORGE H. WRIGHT, D.M.D., BOSTON.

As a preliminary statement I wish to call your attention to four periods in the development of an individual from two years to eighteen years, when the tonsils become slightly enlarged without inflammation and without obstruction or evidence of suppuration, and these four periods are represented practically at the time when four groups of molars are in the process of eruption. That is, the periods with slight variation are from two years for the first group; six years of age, the second group; twelve years, the third group, and from seventeen the fourth group. There may be later tonsilar enlargements due to infection from various sources, particularly the teeth, a subject which concerns us only incidentally at this time.

I propose to show that these enlargements of tonsils coincide definitely with these particular periods of tooth eruption. I hope to show, too, that where there is no infection of the tonsil, by keeping the patient under observation and giving, if necessary, simple prophylactic treatment to the tonsil and waiting for the normal eruption of the tooth, even the slight hyperemia of the tonsil, which is its expression of function, will entirely disappear and the tonsil will return to its normal condition. It is necessary that we have an understanding of the tooth as an organ and of the membrane surrounding the tooth necessary for its production. With that in mind, we follow the processes intelligently, and with a consideration of the normal lymphatic drainage, which I shall show from the work which has been done on the teeth, and the more recent work of G. B. Woods, on the lymphatic glands, that these lymphoid structures play a great part in the removal of this normal waste coincident to tooth development. I shall also offer as evidence some work of Drs. Councilman, Jonathan Wright, Logan Turner, MacBride, Balenger and Stöhr, and take the liberty of commenting upon their findings in such manner as will support my theory.

The teeth begin to develop about the second month of fetal life. The enamel surrounding the crown is produced by cells highly specialized for the purpose; these cells receive through the intermediary of a dental sac, which is analogous to the placenta, all the materials necessary for the production of calcoglobulin, which later calcifies and becomes enamel prisms. Coincident with this enamel formation other cells, odontoblasts, produce the larger body of the tooth, the dentine. So the tooth with its membranes as a whole requires an organ by itself for its elaboration. And it is the final disposition of what remains of this organ, together with such bone and connective tissue immediately outside

the tooth as well as the roots of the first temporary teeth, that are involved in lymphatic absorption. (See Plates I, II and III.)

The histology and anatomy of the tonsil itself we shall leave to Drs. Cobb and Coolidge, who are more competent to describe in detail any points requiring further elucidation.

PLATE I.

Approaching the second period, when the first permanent molar will erupt from its crypt, previous to which the plate of bone next to crown will become absorbed. Observe relation of roots of temporary teeth to crowns of permanent teeth; also status of second permanent molar. [Warren Museum, Harvard Medical School.]

We offer for consideration 19 patients whose tonsils were slightly enlarged, and in each case the enlargement coincided with the second, third or fourth periods of tooth eruption. Some teeth showed the point of the cusp had cut through the gum; others would not appear for three or more months. In no instance did we find excessive enlargement of the tonsil or suppuration. Yet all these patients were sent to us by physicians and social service workers, or they came on their own initiative for treatment and operation. None have been operated on for removal of the tonsils. Some have had carious teeth extracted, filled or cleaned. All have been advised to return at once should the tonsils give increasing disturbance. In two patients under observation since last May, the tonsils have returned to normal and the teeth are fully erupted. One represented the second period, or six-year molars; the other, the third period, or twelve-year molars.

Another aspect of the problem is illustrated by a boy, age eleven, who had his tonsils extirpated three years ago; he comes to us for treatment for glandular enlargements in the neck. The tonsilar gland is markedly enlarged and other glands enlarged and distributed down to

* Read at a clinical meeting of the Throat Department, Massachusetts General Hospital, Jan. 30, 1909.

the border of the clavicle. No history of tuberculosis in family. The teeth of the third period, or twelve-year molars, are in process of eruption.

Another boy, age twelve and one-half years, whose four molars have just erupted, had his tonsils removed, which were only slightly enlarged, according to his history card. I did

PLATE II.

Later development than Plate I, approaching the third period, when the second permanent molar will erupt from its crypt. The space surrounding unerupted molar, result of dissection and removal of membranous dental sac. [Warren Museum, Harvard Medical School.]

not see him before operation. We were obliged to keep him in the hospital ward for four days on account of post-operative hemorrhage.

We exhibited another patient, girl, age seventeen. Tonsil slightly enlarged on right. Left tonsil normal. Right tonsil later removed. Three months later patient returned and shows enlarged tonsillar gland the size of a hen's egg. Examination of mouth reveals lower third molar cutting through the gums—the fourth period. Also remnant of root of lower six-year molar. The root was extracted and operation on glands deferred. One month later patient reported for examination. We found the gland reduced to normal, no pain or swelling of any kind and tooth erupted.*

With the enormous structural upbuilding where nature is elaborating the materials for 48 teeth, and the jaws, there is much waste tissue to be disposed of. In close proximity to the erupting second lower temporary molar there is a thick plate of alveolar bone. That bone and fibrous tissue in contact must be absorbed before the tooth comes through. Sometimes there will be a swelling in the region of the submaxillary and lymphoid enlargements; intense pain, excessive salivation, followed by

*Since reporting these cases, Jan. 30, 1909, we now have a record of forty-nine patients where operations on tonsils have been deferred, awaiting eruption of the molars in the several periods.

a hot and feverish condition of the oral mucous membrane, and occasionally a slight cough. The disturbance may continue until we find a slightly enlarged tonsil, or even acute otitis media with a sinus and profuse suppurative discharge through the external ear. Usually within a few hours or days, at least, the offending molar will make its appearance through the gum, disturbance will cease, and tonsil return to its normal condition. So, too, in the adjacent region of the upper first and second temporary molars we may find lymphatic enlargements involving the parotid gland, lachrymal gland and tonsil. The faucial tonsil and normal adenoid upon the side nearest to the erupting tooth may become considerably enlarged through the influence of the lymphatically absorbed waste. Nature has undoubtedly developed and placed these lymphoid organs for a useful purpose during this structural upbuilding, and it is conceivable that if we have present a number of decayed and abscessed temporary teeth, whose surrounding membranes are in close

PLATE III.

Approaching the fourth period. The twelve-year or second molar fully erupted, its roots not entirely developed. Crown of third molar within its crypt not yet complete. Observe absorbed condition of roots of temporary teeth as the bicuspids are about to succeed them. [Warren Museum, Harvard Medical School.]

proximity to the underlying membranes of the developing permanent teeth, we shall get micro-organic infection through continuity of tissue; particularly so when the temporary roots are in process of active absorption, and in consequence we might readily find an infection of the subjacent lymphoid glands even to the tonsil. In this latter event we may find a considerable tonsillar enlargement and possibly resolving itself into a peritonsillar abscess. (Plate IV.)

Some years ago we made experiments by sealing a coloring of prussian blue into teeth pulps of dogs to determine the lymphatic drain-

age, and it was shown conclusively that the blue particles passed directly through the pulps to the lymphatic glands and endothelial spaces.

The suprahyoid, which lies between the bellies of the digastric muscle, drains the anterior part of the lower gums and teeth, whence the lymph is passed on to the submaxillary group. These are found in the digastric triangle along the lower border of the jaw.

PLATE IV.

FIG. 1. A. Broad flattened surface of gum, below which is found the bony crypt and crown of the molar.

B. Diseased and abscessed six-year molar, whose underlying structures are in intimate relation with the membranes of the adjoining developing teeth and lymphatic vessels and spaces.

The superficial cervical glands which are distributed along the course of the external jugular vein receive some lymph from the posterior region of the dental ridge and gums, and particularly that region where the several groups of molars are developed and erupted—at two years, six years, twelve years and seventeen to eighteen years. The deep cervical glands lie along the internal jugular vein and indirectly receive their lymph through the submaxillary group from the structures already mentioned.

The lymph from the upper gums and teeth corresponding to the lower structures is taken care of by the deep facial glands. These are located by the side of the pharynx behind the buccinator muscles close to and behind the faucial tonsil.

G. B. Woods offers the suggestion that an infection which inoculates a lymph gland may come through its efferent lymphatics by a retrograde thrombosis, and more frequently it follows the current of the lymph stream and enters through the afferent vessels.¹ Careful dissections of children from birth up to six years of

¹ Brit. Dental Asso. Jour., 1903. Am. Jour. Med. Sci., August, 1905.

age show the superficial and deep lymphatic drainage to be divided into two main groups:

(1) Superficial or *collecting* glands, and (2) deep or terminal glands.

The first group is subdivided as follows:

1. Suboccipital group.
2. Mastoid group.
3. Parotid and subparotid groups.
4. Submaxillary group with facial glands as offshoots.
5. Submental glands.
6. Retropharyngeal glands.

The deep glands of the neck form a perpendicular chain beneath the sternocleidomastoid muscle, with several secondary or lesser chains, subdivided into external, posteriorly, and an internal jugular chain. The superficial glands receive their afferents from those parts of the external and internal head that lie nearest to the individual portions, and are named accordingly.

The efferents of all these collecting glands of the superficial group empty into or by the afferents of the deep or terminal glands. One or two large glands are *constant* beneath the posterior belly of the digastric muscle. (Plate V.)

PLATE V.

Showing distribution of superficial lymphatic drainage in region of upper and lower teeth and neck.

The internal and external chain are united by many anastomoses.

The internal receive their afferents from anterior part of neck, head, nose, pharynx, larynx and thyroid body.

An important observation from the dissection showed that whereas the majority of the

afferents of the deep glands of the neck are the efferents from the superficial glands, quite a number of lymph vessels pass directly from the lymph radicals of the nose and throat to the deep glands. An example of this is seen in the majority of the lymph vessels from vault of pharynx, which drain into the retropharyngeal glands ordinarily, yet some of them pass directly into the upper glands of the deep set without interruption.

In a child one week old the tonsilar gland is the same size as any other gland in that region. "In a child of six or more months of age, which coincides with the eruption of the temporary incisors, this gland was generally twice or three or four times larger than any other, and in every injection of the tonsil it is this enlarged gland

PLATE VI.

Showing the deep cervical lymphatic glands. A, tonsil; B, faucial tonsillar gland; C, retropharyngeal gland; D, parotid gland.

that primarily received the injecting fluid." I believe that this gland is the antechamber to the tonsil in its relation to the disposition of waste consequent upon the eruption and absorption of the surrounding material of the 52 teeth placentas already referred to, and at this constant gland we would find retrograde thrombosis from the lymphatic vessels through this gland back to the tonsil; or even directly from lymph spaces to lymph vessels, thence through endothelial channels into the tonsil. (See Plate VI.)

Wood further states: "Clinically the gland which becomes enlarged during tonsillar infection appears to be superficial and has led to the belief that the posterior gland of the sub-

maxillary groups is infected through the tonsils." This may rightly be so under some conditions, yet I incline to the belief that this particular gland which may become enlarged at the periodic time of teeth eruption and coincident enlargement of the tonsil is enlarged not because of infection through the tonsil *per se*, but through normal waste or combined with bacteria from the diseased membranes adjacent to erupting teeth, and that the enlargement of the gland is due to this latter process, and the tonsilar enlargement without infection is a normal expression of the active function of the tonsilar gland, and when the tonsil becomes infected, it does so because of its lack of power of resistance to the invasion of micro-organisms. This latter view is held by Jonathan Wright, Balenger and MacBride. This invasion could be easily accelerated whenever the tonsil becomes overworked in its function of caring for normal physiological waste.

Dr. Councilman:² "There is one thing which comes out strongly in the study of lymphoid tissues, and that is their preponderance in the child. There is a steady atrophy with age."

He finds nuclear detritus within the body of the lymphoid structure not enclosed in phagocytic cells. And the most marked changes are found in the large germinal centers of the tonsil. He says the necrosis here is massive. . . . The phagocytic cells become involved in the common necrosis, and their activity, so prominent a feature in the nodes elsewhere, is not manifest. Then he describes in minute detail the appearance of the cells such as he has never found outside of the lymph nodes, except in the efferent lymphatics, where they are numerous immediately adjacent to these nodes, and frankly states that he knows of no explanation for their appearance.

I venture to suggest that these remnants of cells are the remains of the waste which was necessary in the final elaboration and eruption of a tooth, and also such bone and membranes of the alveolar crypt surrounding the tooth, which must be disposed of by lymphatic absorption when the tooth is completed.

Jonathan Wright³ has made a careful study of normal tonsils in relation to behavior of the epithelial cell in the crypts toward bacteria and their relation toward dust, with conclusions which demonstrate that pathogenic bacteria inhabit the tonsilar crypts in great numbers, and do not enter the tonsilar tissue proper so long as the tonsils are in a normal and healthy condition and consequently remain harmless.

His experiments further demonstrate that after shock of injury, wound or cold to surface there was evidence of bacterial invasion in great numbers, whereas examination of tonsilar tissue uninfected and uninjured showed no trace of bacterial debris within its cellular structure, even though the crypts were plugged with bacteria.

² Jour. Am. Med. Asso., March 30, 1907.

³ N. Y. Med. Jour., Jan. 6, 1906.

In experiment of dusting carmine over tonsil, in fifteen minutes all particles of color had passed into the deeper layers through the epithelium and were easily demonstrated in section under microscope, and the bacteria located at same points of entrance of the dust did not penetrate and remain unabsorbed.

Bordet believes this phenomenon due to the existence of a positive and negative chemotaxis, and J. Wright accepts his explanation to account for the state of equilibrium which is maintained between the epithelium of the crypts and the included bacteria.

Would not this equilibrium be disturbed if the body structure of the tonsil was filled with normal debris of organic cells, which would render the organ less able to resist the micro-organic invasion? In other words, would not its condition be equivalent to or analogous to that produced experimentally through shock, injury, cold or wound? Where he found a marked invasion of bacteria and, to carry our interrogation farther, if added to this normal physiological debris we included such pathogenic micro-organisms as are found in abscessed roots, should we not logically expect a disturbed equilibrium within that tonsil?

The author of the latest textbook on the "Diseases of the Nose and Throat," has removed, within a short period, over 2,000 tonsils. What per cent were examined in connection with carious teeth? What per cent came in the four periods of tooth development? What per cent would have been unnecessary when function of tooth eruption had ceased? What per cent were slightly enlarged, with no mechanical obstruction or abscess? What per cent might have responded to prophylactic treatment and given no subsequent trouble? What per cent have or will develop deeper troubles beyond these barriers of the lymphoid ring of Waldeyer because it is presumable that the adenoid tissue was removed at the same time from the vault of the pharynx?

What per cent of cases of temporary paresis, of the palatopharyngeus muscles, cervical cellulitis and hemorrhages? What per cent of lymphoid enlargements both superficial and deep will recur later in life?

As to what the tonsil may yield as a by-product after the metamorphosis of this normal waste, and what influence the by-product as a secretion through the crypts to the digestive tract may have upon the body as a whole, either mental or physical, is a question for the future to determine.

In conclusion, gentlemen, we offer these six observations:

1. When a tonsil is normal, infection from the external surface is rare.
2. Secondary infection through the lymph channels the usual source.
3. There are four periods of molar eruptions, with some variations in time when the tonsils may enlarge without infection or inflammation, at two years, six years, twelve years and seventeen years.

4. Tonsils though slightly enlarged when not infected return to normal with complete eruption of the teeth.

5. Diseased teeth are prolific source of enlargement of the glands through proximity of membranes, either directly, by infection, or by toxins.

6. In the treatment of the tonsil by the specialist, may we not include as a routine the observation as to carious teeth and a recognition of these four periods of eruption coincident with slight enlargement?

DISCUSSION BY DR. C. F. COBB.

Gentlemen: I do not know whether from your standpoint you can appreciate the full significance of this paper.

For years no one has understood the importance of the tonsil, and, being considered useless, it has been removed freely. But in recent years studies in tonsillar absorption have resulted in the conclusion by many persons that the tonsil is an easy point of entry for bacilli and disease. This theory has led to attempts to more completely extirpate the tonsil than has ever been done before. In former years removal was done by cutting off the portion projecting into the throat and necessarily leaving a large or small submerged portion behind the pillars. The tonsil lies between the pillars attached to the fascia of the superior pharyngeal muscle and protected in front and rear by the pillars to one half or more of its extent. From the pillars anterior and posterior a reflexion of mucous membrane comes to the tonsil, making it, when at rest, resemble a telescope one half closed. Were it not for this reflexion of mucous membrane, the contraction and expansion of the organ would be checked by the mucous membrane about it and great pain would result on any enlargement of the gland. This arrangement seems to show that nature intended the tonsil to be free to change its shape in accordance with alterations in size due to some functional activity. And this agrees with clinical facts, for we find tonsils now large, now small, at one time recommended for operation, and a few weeks later, when the date arrives, of such reasonable proportions that no operation seemed wise.

This functional activity, this enlargement and decrease, was laid to cold, to irritants like dust and to some cause or causes unknown. Of late years, as I have said, theories of absorption from tonsils have come in and tonsils have been condemned on slight evidence and removed. Dr. Wright has gone into these theories and I will not repeat them, but will try and put before you a picture of the reasoning used so that its wisdom or fallacy may be submitted to your judgment.

Let us take two hypotheses: first, that the tonsil is an organ for infection or absorption; second, that it is a protective organ. First, then, acute tonsillitis affects the tonsil and gives rise to toxic symptoms. Tuberculosis enters by the tonsil at times and tubercle bacilli have been found in the follicles of the tonsil. Rheumatism

is said to be a result of conditions of tonsilar absorption.

Of course it is claimed by many advocates of this theory that the tonsils causing such troubles are diseased tonsils, but practically as disease can only be determined in most cases by removal of the tonsils and examination under the microscope, the result has been the removal of healthy tonsils, the working theory being that the tonsil might form the source of infection; and in any case no harm could be done.

Now let us discuss the probabilities, as seen from an anatomical and pathological standpoint, of the question whether the tonsil is an absorptive or protective organ.

If the tonsil were intended to absorb poisonous substances, why should nature give them to young and tender children and allow them to atrophy as the person grows older?

Why should nature surround the tonsil with chains of lymphatic glands which resist infection into the general system?

How is it that millions of staphylococci, the poison of which to a mild extent reaches the general system, causing a fever for a day or two, can be cared for by this maligned organ, when a very, very few, in a wound may result fatally?

But it will be said, Does not tuberculosis sometimes get in in this way?

It is true, probably, that it does, but it is also true that because a sentinel is sometimes overpowered by an enemy a wise commander does not abolish all sentinels. There are other channels for tuberculosis. We find them in Peyer's patches in the intestine and in the glands which drain the bronchi of the lung. Who suggests the wisdom of destroying such organs because they have failed in their efforts to protect us?

Now Dr. Wright tells us that the tonsil serves as a sentinel for the protection of the system from the products of dental infection, and this idea is borne out by common sense, by clinical experience and by theory.

I have myself watched the improvement in size of tonsils after the removal of bad, rotting teeth. This function is, perhaps, one and not the only function, but it is enough to justify the tonsil's presence; and our gratitude is due to him for clearing up this point.

Do not misunderstand these remarks. Removal of obstructing tonsils, where breathing, swallowing or disease is present, is justifiable and wise, but radical extirpation should only be done where disease of the tonsils, chronic tonsillitis or peritonsillar abscess make it necessary, and this rule is especially true in early youth.

DR. A. COOLIDGE, JR.: We know really very little about the tonsils. We not only do not know what their function is, but we are not even sure that they have a function at all. What we know is that surrounding the combined respiratory and digestive passages is a ring of lymphoid tissue, developed in the pharyngeal mucous membrane. Different parts of this ring are especially developed into the so-called tonsils. Of these masses of lymphoid tissue, four are of especial importance: the single pharyngeal tonsil at the apex

of the ring in the pharyngeal vault, the two faucial tonsils, one on each side between the pillars of the fauces, and the single lingual tonsil at the base of the tongue. Other parts of the ring are represented by lymphoid tissue about the Eustachian tubes, in the fossæ of Rosenmueller, along the lateral fold of the pharynx, and often in small islands irregularly scattered on the posterior pharyngeal wall. The development of the tonsilar ring begins in fetal life and reaches its stage of greatest development in childhood. This is especially true of the upper part of the ring, which tends largely to disappear in the second decade of life, leaving the lower portion for slower involution.

The physiology of the tonsilar ring has long been the subject of speculation and of varying theories. Its constant presence, its development and involution at fixed periods of life suggest a function, either distinct in itself or contributory to that of the lymphoid tissue in the intestinal tract. On the other hand, removal of a large proportion of the ring, as is often done in adenoid and tonsil operations, has not been shown to produce any decided effect upon the body.

Some diseases affect the ring as a whole, although the faucial tonsils are often spoken of as alone affected. This is especially true of acute tonsillitis. The various tonsils may become acutely swollen during the course of different infectious diseases involving the nose and throat.

The amount of lymphoid tissue in the different parts of the tonsilar ring varies at different ages and in different individuals. *A considerable variation in the size of the pharyngeal or faucial tonsil must be looked upon as within normal limits*, unless pathological symptoms are present. As a rule, a pharyngeal tonsil of considerable size can be found in the vault up to the age of puberty, and remnants can be seen up to the age of twenty or twenty-five, after which it should no longer be seen in the rhinoscopic picture. The faucial tonsils also vary both in size and in their relations to the palate and the faucial pillars. They commonly project somewhat between the pillars, but their absolute size cannot be judged from the extent of the projection alone, as a large part of the mass may be concealed behind the anterior pillar. They develop somewhat later than the pharyngeal tonsil. Although they recede after puberty, they do so slowly, and often remain large during life.

The lymphoid tissue may become increased in amount to an extent to be considered pathological, either as a whole or in one or more of the tonsillar masses. This increase over the normal amount takes place almost exclusively in children, although once established it may persist into later life. It is of especial importance in the naso-pharyngeal space, where it is commonly called "adenoids," and in the faucial tonsils, when the patient is said to have enlarged or hypertrophied tonsils. These frequently occur together. The increase in size is due to an increase in the amount of lymphoid tissue; there is nothing necessarily pathological about the tissue itself. The cause of overgrowth of the pharyngeal and faucial tonsils has been ascribed to heredity, unhealthy surroundings, irritations from definite infections such as measles or recurrent colds, and other general and local conditions.

Among the causes to which we must look for tonsilar enlargement, Dr. Wright now adds certain conditions of the teeth. It will be noticed from his diagram that the teeth and the tonsils both drain into common glands in the neck. A path from the teeth to the gland and then back to the tonsil is interesting. It is perhaps conceivable that the tonsils may act as the local outlet of matter absorbed from the teeth, as has been suggested by Fraenkel in regard to the nose.

In operations for the removal of adenoids and tonsils the question has been discussed whether it is better to remove as much of the lymphoid tissue as possible, or only so much as to reduce the amount to what might be called normal proportions. The argument in favor of complete removal is that if any is left behind it may be the source of further trouble, and that experience does not show that any obvious function is interfered with when a thorough operation has been done.

A SHORT DESCRIPTION OF WERTHEIM'S RADICAL ABDOMINAL OPERATION FOR CANCER OF THE CERVIX OF THE UTERUS, WITH A REPORT OF EIGHT CASES.

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LATE in 1906, Prof. E. Wertheim, of Vienna, operated upon a case of cancer of the cervix in the Gynecological Clinic of the Johns Hopkins Hospital, and demonstrated his radical operation for the cure of that disease. All who saw the operation were impressed with its thoroughness as offering the greatest chance of cure, and as being a sound surgical procedure.

During the year following his demonstration I operated upon eight cases of cancer of the cervix after his method. Early in 1908 a visit to Professor Wertheim's clinic in Vienna only strengthened my confidence in this operation, and increased my enthusiasm for its possibilities.

A short description of the essentials of Professor Wertheim's operation may serve to add to its already increasing popularity.

About fifty per cent of the cases of carcinoma of the cervix which apply for treatment at Professor Wertheim's clinic, he finds operable. For the inoperable cases but little is done. For the operable cases, and in this group are included the so-called border-line cases, the following procedures are carried out.

The patient receives but little preparation before operation, seldom more than an enema the night preceding, provided the patient's bowels have been moving regularly.

Without anesthesia, and without great pain, the cervix is thoroughly curetted and then cauterized with the actual cautery, irrigated with boracic solution followed by bichloride solution 1-1000. Three sponges sopping with the bichloride solution are then packed firmly in the vagina against the cervix and left there. This preliminary curettage and cauterization of the necrotic cervix is done for two reasons: First, to get rid of the necrotic growth, and, second, to destroy, as far as possible, all infection, usually streptococcus, the sopping sponges aiding greatly in the latter. This preliminary treatment is *always* carried out *immediately preceding* the giving of the anesthesia for the operation, never at a longer interval before, thereby leaving the least possible chance of spreading cancer by opening new channels for infection.

The patient is then anesthetized and placed

in a high Trendelenberg position, legs widely separated, and each enveloped in a separate sterile sheet. A second assistant then stands between the patient's legs out of the operator's way.

A thorough scrubbing reaching from the ribs nearly to the knees with soap and water and bichloride complete the preparation. A long median incision is made extending from symphysis to umbilicus. The peritoneum is sewn to the skin by interrupted sutures in order to protect the abdominal wall from bruising and infection. All sutures and ties used throughout the operation are silk, and no running sutures are placed. No retractors are used in the abdominal wound, only the assistant's fingers. No gauze is placed in the abdomen to pack off the intestines, the high Trendelenberg position allowing the intestines to drop back well out of sight and danger. The pelvic exposure is perfect.

The resection of the uterus with tubes and ovaries is then begun in the usual way. The left infundibulo-pelvic ligament is tied and cut, a clamp being placed on the uterine side; the left round ligament is cut in like manner; then the right side is dealt with, an assistant keeping strong traction on the fundus uteri by means of traction forceps.

The loose cellular space between the bladder and uterus is now opened and the peritoneum divided laterally to join the cut round ligaments. By actual dissection with scissors, *not with gauze*, the bladder is now freed from the anterior vaginal wall without bleeding and this dissection is carried as far down the anterior vaginal wall as is necessary to clear the growth. Laterally the dissection is carried to the point of entrance of the ureters into the bladder. No bleeding is encountered when dissection is carried on between the proper layers of pelvic fasciæ.

The ureters are now found on each side by carefully cutting the parietal peritoneum just back of the uterus and exposing the ureter lying on the peritoneum a short distance after it has crossed the pelvic brim. Care is taken not to separate the ureter from its peritoneal covering any more than is necessary. The bare finger lying above the ureter and following its course is now gently pushed through the broad ligament till it appears anteriorly. All the uterine vessels now lie on top of the finger and the ureter lies just below the finger and out of the way of any possible injury. Being sure of the position of the ureter, the isolated uterine vessels are rapidly tied and cut, a clamp being placed on the uterine side.

The rectum is then separated posteriorly as was the bladder anteriorly, bleeding from the utero-sacral ligaments and paravaginal tissues being controlled by the use of special long heavy right-angled clamps. Two traction sutures are placed low on the vaginal wall. The bichloride sponges which have been in the vagina are now removed and vagina wiped dry. The vagina is clamped across by large right-angled clamps and cut. Bleeding is controlled by suture of the