

there is no advantage in adding epinephrin, strychnin, glucose, gelatin or similar substances in the anesthetic solution. The repeated production of spinal anesthesia in the same person is apparently no more harmful than a single injection. My experience indicates that if spinal anesthesia is not properly employed by one possessing sufficient clinical skill, it may have a large mortality. It should not be employed by those who have not developed trustworthy aseptic technic or who have not carefully mastered the physiology of the method.*

CONCLUSIONS

Spinal anesthesia is not a universal anesthetic, although it produces the greatest degree of muscle relaxation with the least protoplasmic disturbance. Even if skilfully administered it is probably more dangerous than a transient and light narcosis under ether or nitrous oxid-oxygen, but safer than a prolonged narcosis with complete relaxation under ether or nitrous oxid-oxygen.

Spinal anesthesia causes an earlier and more marked fall in blood-pressure than other anesthetics, with a slowing and weakening of the heart action, and should therefore be used with caution or avoided in conditions of marked hypotension of the circulatory system.

In certain cases in which alarming symptoms follow the inhalation of ether, spinal anesthesia may be used with success. Spinal anesthesia requires a more highly developed technic and a greater degree of watchful supervision than does the use of ether.

Certain sequelae such as headache and abducens palsy indicate that faulty solutions have been injected; late spinal cord degenerations probably do not occur in man; but various cord and nerve lesions may be simulated in the neurotic or hysterical and attributed to the injection.

In abdominal surgery it may be selected when there is an acute pulmonary, severe cardiac, vascular or renal disease, especially when associated with a high blood-pressure. In conditions of acute peritoneal sepsis it is valuable. Against spastic or paralytic ileus it is a most potent agent and its use will often render operative intervention needless.

In malignant disease and for operations on large tumors, although not free from danger, it is at times safer than ether. It does not eliminate the danger of cardiac failure in operations for uterine fibroids.

In obstetrics it facilitates operative delivery, lessens hemorrhage and reduces cardiac and pulmonary strain. In pulmonary tuberculosis it largely relieves the patient of the great danger of labor, the accentuation of the disease. In heart disease it relieves the patient of any strain on the heart tending to decompensation. For operative delivery, during eclampsia it is especially desirable, giving relaxation and lowered blood-pressure without interference with elimination. In extra-uterine pregnancy it is efficient. Spinal anesthesia is relatively safer in the young and robust than in the enfeebled and toxic.

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ABSTRACT OF DISCUSSION

ON PAPERS OF DRs. GELLHORN AND BABCOCK

DR. A. E. HERTZLER, Kansas City, Mo.: First, I wish to criticize Dr. Gellhorn's method of preparation of the patient. My experience is that the less you say to the patient the better. I should think that plugging the ears with cotton would excite rather than allay apprehension. My practice

is to ask the patient whether local or general anesthesia is desired. When local anesthesia is selected I take the patient into my confidence and state the stages of the operation offering the greatest difficulties, and keep her informed as to the progress of the operation. The question of local anesthesia is largely one of industry on the part of the operator. Every operation can be done under local anesthesia if the operator has sufficient industry to carry out the procedure.

I desire to emphasize the point made by Dr. Babcock on the need of differentiation between the kinds of sensation that the patient has. It may be a sensation of touch and the operator may think it is a complaint of pain. Only by keeping in touch with the patient by questioning her can this point be determined. Restlessness on the part of the patient is often due to the operator's elbow resting on the patient's chest in abdominal work, or perhaps to the fact that some instrument is allowed to press on the region of hyperesthesia.

DR. FRED J. TAUSSIG, St. Louis: The work that is being done in the large clinics abroad and in this country will before long give us the exact indications and contra-indications for spinal anesthesia. Contrary to Dr. Babcock's views, I believe that in certain cases of myocardial disease I have had better results from spinal anesthesia than from any form of inhalation anesthesia. In the field of the radical abdominal operation for uterine cancer spinal anesthesia seems to be especially valuable. Any one who has operated on a considerable number of patients with this disease, doing the complete operation, knows what a severe strain it is on the individual. A very considerable reduction of about 30 per cent. in the primary mortality has been brought about by several operators with large experience, since in all of their operations they used spinal anesthesia in place of a general inhalation anesthesia.

I have encountered numerous failures when I have attempted to use the infiltration anesthesia spoken of by Dr. Gellhorn in a cervix that was still hard, as in cases of dysmenorrhea in multiparas in which dilatation and curettage were indicated. Here my percentage of failures was very great. In cases of recent abortion, however, with retained placental tissue or with hypertrophied endometrium, we can readily substitute infiltration anesthesia for general anesthesia. I have met practically no failures and believe with Dr. Gellhorn that recent abortion cases are much less liable to hemorrhage when such an anesthetic is used than when a general anesthetic is employed.

FURTHER POINTS ON THE STERILITY OF WOMEN *

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The treatment of sterility has long been one of the comparative failures of gynecology; and one of the most striking points of the case as I have seen them in practice has been the frequency with which women who have been in fact sterile to husbands who are known to have normal spermatozoa have, nevertheless, been pronounced normal even by practitioners of recognized authority. I have, moreover, seen this repeatedly, even when in my opinion a fully adequate cause for sterility was at once apparent in the genitals and when treatment of this condition resulted in prompt fertility. The frequent occurrence of such failures as these must evidently have a reason, which I believe to be that symptoms of ill health of sufficient degree to demand treatment are

* Read in the Section on Obstetrics, Gynecology and Abdominal Surgery of the American Medical Association, at the Sixty-Fourth Annual Session, held at Minneapolis, June, 1913.

* Because of lack of space, this article is abbreviated in THIS JOURNAL. The complete article appears in the Transactions of the Section and in the author's reprints.

* For untoward effects see: Babcock, The Danger and Disadvantages of Spinal Anesthesia, Proceedings of American Therapeutic Society, 1913.

always dependent on the existence of gross pathologic conditions which we have all long been trained to perceive, but that sterility, on the other hand, is usually dependent on mere perversions of function which are not readily perceptible anatomically, and can therefore be detected only by observation of their results as shown by an altered performance of the daily physiologic functions of the organs.

The use of the terms "gross pathology" and "perverted physiology," though strictly in accordance with modern thought, is so far new in this connection as perhaps to demand a definition of the sense in which they are used. Of course in an ultimate analysis any alteration of function is usually due to a variation in the anatomic state of the organ which performs it, but even important functional variations are sometimes so slight as to be unproductive of anatomic variations which are perceptible by the ordinary clinical observations; hence the distinction between a grossly perceptible lesion and one which can readily be appreciated only by its results seems practically helpful, and the expressions "gross pathology" and "perverted physiology" are used here in this sense.

The perversions of physiology which cause sterility in women may be classified under two heads:

1. Conditions of the mucous membranes of the genital tract which may be either small or great in degree, but which even if small lead to alterations of the secretions of these mucous membranes which are destructive to the continued life of the ova or spermatozoa which have been deposited in them, or which annul the effective motility of the spermatozoon in its efforts to reach the ovum.

2. Conditions in the ovaries which inhibit the formation of the ovum or prevent its release at maturity.

A paper which is limited to twenty minutes can evidently attempt no more than a summary of the main features of a large subject, and as I have recently published a much more extended paper on this subject,¹ I propose here to limit myself to such a brief recapitulation of the points there made as may render intelligible some further considerations which were omitted.

THE SECRETIONS

From the time the spermatozoa are deposited in the vagina and the ovum is released from the follicle to the time of their conjugation their only relation to the woman who is their host is that they live in her secretions. The primary condition for fertility is therefore that these secretions should be sufficiently normal to permit the continued existence of the sexual elements until their conjugation is effected.

The alterations of the secretions which destroy the life of the spermatozoa, or perhaps of the ova, are of two kinds: (1) changes in the secretions due to pathologic conditions of the mucous membrane which secrete them, and (2) mere fermentative or other chemical changes in the secretion poured forth by a normal mucous membrane.²

Either class of changes may be present either with or without detectible gross pathology and consequent symptomatology, but in either case the mechanism which produces sterility is the destruction of the spermatozoa or ovum by a hostile secretion, and it is therefore only by close observation of the secretions that we can determine

the cause and consequent treatment of a given sterility. Further, when gross pathologies are present they be no more than indirectly unrelated to the sterility; and their treatment, operative or otherwise, has then no effect on the sterility, unless the conditions which cause this are treated concomitantly.

The genital canal may be anatomically distinguished by the character of its epithelium into four sections, the vagina, cervix, uterus and tubes. The secretions of any one or all of these divisions of the canal may be so altered as to be destructive to the spermatozoa, and may be so altered either chemically or mechanically. The secretion of any one of these divisions may be abnormal without prejudice to the secretions which originate above it, but an alteration of an upper secretion almost necessarily implies a similar abnormality of the secretions below it and into which it is discharged. In the management of a given case the conditions of each of these divisions must be observed separately and often from the necessities of the case serially; they should consequently be so described; and it further seems conducive to clearness to discuss the conditions of each section first without complicating them by questions of treatment, which may then be taken up by themselves.

The Vagina.—The ideal, normal vaginal secretion is that of the healthy virgin, in whom the vaginal secretion is clear and translucent; barely mucilaginous, and in quantity just sufficient to keep the vagina moist and lubricated, and at the same time to permit of disappearance of the secretion by evaporation as it reaches the surface, without the appearance of moisture in quantity noticeable by the woman.

In the patent vagina, which alone concerns our present subject, the secretion is, however, almost never so absolutely normal as this. The vagina of the virgin may be sterile, but so soon as coitus has become habitual the vaginal secretion always contains bacteria of many kinds, which have normally, however, been decreased in virulence and rendered innocuous to their hostess either by the moderate normal acidity of the secretion or by its other chemical characteristics.

The most common alterations of the vaginal secretion are chemical in the form of overacidity, biologic in the presence of active pus cells, and mechanical in great profuseness. The importance of such hostile conditions of the vaginal secretions is susceptible of experimental demonstration by means of various modifications of normal semen on the field of the microscope and direct observation of the effect of these modifications on the living spermatozoa. The majority of such studies have been concerned with chemical modifications of the semen itself, but there have been in addition a few reports of the effect on the semen of specimens of normal and abnormal vaginal secretions. It has further been occasionally possible to combine the necessary examination of the spermatozoa of the husband with the submission of his spermatozoa to contact with the vaginal secretion in question under the microscope, though from the condition of the case the opportunity of so treating fresh spermatozoa will occur but seldom. I had this opportunity once, and although in that case the vaginal secretion was not the only one affected, the prompt disappearance of motion in the spermatozoa as they came into contact with it was quite strong evidence that the existing alteration of the vaginal secretion was in that case quite enough to have caused sterility by itself.

The importance of the vaginal condition must, however, be estimated differently in the nulliparae who form the great majority of the sterility cases and in the multi-

1. Reynolds, Edward: The Theory and Practice of the Treatment of Sterility in Women, THE JOURNAL A. M. A., Jan. 11, 1913, p. 93.

2. Such a change may, of course, in time react on the condition of the mucous membrane itself.

parae who occasionally consult us for the so-called one-child sterility. . . . In multiparae with lacerated cervixes and consequent eversion of a considerable portion of the cervical mucous membrane, it is easy to demonstrate that such a condition as, for instance, the existence of a hyperacidity of the vaginal secretion, is comparatively unimportant. The reaction of the vaginal walls and of the vaginal surfaces of the cervix may in such cases be shown by test paper to be actively acid, while the same paper applied to the cervical mucous membrane when it is thrown into eversion by a speculum will show a neutral or faintly alkaline reaction. With this surface freely exposed to immediate contact with the spermatozoa during the mechanical distention of the vagina in coitus, and remembering that the deposition of only a few spermatozoa on its surface may be sufficient for fertilization, it becomes evident that with such multiparae the hostile condition of the vaginal secretion is of little importance; on the other hand, in a nullipara with the same excessively acid vaginal secretion, but with a pinhole os, the acid reaction of the vaginal surface of the cervix, extending, as it does, to the very edge of the os, makes the chance of the entrance of the spermatozoon into the safety of the alkaline reaction before contact with the acid vaginal secretion so extremely small as to constitute practical sterility from the condition of the vaginal secretion alone. The same considerations probably apply with equal force to the other possible alterations of the vaginal secretion, though with them the actual demonstration is less easy than with the mere change of reaction.

The Cervix.—The importance of a differentiation between the condition of the cervix and that of the cavity of the uterine body may seem at first sight doubtful; but the existence of a differentiated cervix and cervical cavity is in its full development peculiar to the human race and forms an element which deserves consideration in all comparisons of the physiology of impregnation as between man and the quadrupeds. . . .

The normal mixed secretion of the uterine and cervical cavities is, as it emerges from the os, clear, limpid, translucent and of about the consistency of the white of an absolutely fresh egg. The normal quantity is just that which is sufficient to keep up a constant but almost imperceptible slow flow from the os. Excessive quantity, cloudiness, turbidity and either a mucopurulent or seropurulent appearance are alterations which usually affect both cavities, that is, both the uterine and cervical. Inspissation and stringiness of a portion of the secretion, while the rest remains abundant and substantially normal, is usually an alteration of the cervical condition alone.

The most common causes of alteration of the cervical secretion alone are retention and consequent inspissation of the secretion behind a pinhole os, in which condition the cervical cavity is frequently considerably dilated, thus forming a retention cavity, hypertrophy of the cervical mucous membrane, often semipolypoid in nature, and localized dilatation of cervical glands, with the resultant escape of small quantities of thick stringy secretion. It is probable that the occurrence of inspissation is usually dependent on contamination of the secretions, at least by some of the bacteria of fermentation.

The Uterine Cavity.—The shape and direction of the cervix and shape and situation of the os are always points of importance, because the extremely common underdevelopment of this portion of the organ usually impose

some degree of obstruction to the exit of the uterine secretion, and it is as true in this organ as in other mucous membranes that there can be no complete recovery from chronic inflammation without free drainage. It is only necessary to refer to the experience of the rhinologists in the nose and urologists in the male urethra to recall to your memory the extreme persistence of chronic alterations in secretions behind even partial obstruction. So long as the uterine secretion is thickened, clouded, mucopurulent or seropurulent there will be no pregnancy.³

The Fallopian Tubes.—It has not generally been realized that the fallopian tubes have a normal secretion, but they are lined with a mucous membrane and, moreover, with a moist and ciliated epithelium, the cilia of which row toward the uterus; it follows of necessity that there is a tubal secretion in continual drainage through the uterus. We are ignorant of the nature of this secretion, though it is probable that it is clear, limpid and scanty in amount; we do know that when the tube is infected its fimbriated extremity closes by adhesion and that it becomes distended with an altered secretion, the character of which varies with the individual infection.

Repeated observations in the course of abdominal operations made since I have been especially interested in sterility have convinced me that in addition to these gross salpingites with which everybody is familiar there are many minor alterations of the tubes, chronic congestions, often with thickening, which have not led to closure of the fimbriated extremity, though such would probably follow in time. Just as the distinct salpingites usually follow an endometritis, so these minor alterations of the tubes have seemed to me to be always associated with similar conditions in the uterine body, and from results I have inferred that they tend to disappear with the latter under the influence of complete drainage, in connection, of course, with depletion and other minor treatment. Remembering that the tubes are morphologically merely a portion of the uterus it would, moreover, seem that these things must necessarily be so.

It is to be remembered, however, that the tubes are double and it might be supposed that with one tube normal the condition of the other was comparatively unimportant; but we must also remember the principle already laid down that alteration of an upper secretion always implies alteration of all the secretions below it, and in accordance with this principle there is considerable evidence to show that with one tube normal and the other pathologic, the spermatozoa may be prevented from reaching the secretions of the normal tube by inability to pass through the abnormal secretions of the uterine cavity which are perpetuated by the continued existence of the other (diseased) tube above. When the abnormality of the tube is slight the diagnosis of such a one-tube sterility is often difficult, but may usually be established with a fair degree of probability by sufficiently careful examination under anesthesia and a comparison of the results of this examination with the tenderness noted without anesthesia and the probabilities derived from the clinical history. Close study of such cases, however, is well worth while, since after proper treatment of the abnormal condition below and the removal of the diseased tube their prognosis is extremely good.

3. It may be remarked in passing and without entering as yet on the subject of treatment, that for the majority of these conditions the routine expedient of dilatation and curettage is usually totally inefficient to the production of fertility, and the sooner the profession as a whole learns this the better it will be for their patients.

THE OVARIES

The existence of an ovarian infertility has long been accepted as a possible though vague explanation of some otherwise inexplicable sterilities; but descriptions of the actual conditions which produce ovarian infertility and study of the possibilities of remedying it are conspicuously absent from medical literature.

The alterations of the ovaries which are most commonly present in sterility cases are slight to moderate enlargements, caused either by the presence of numerous small to medium-sized retention cysts, or by the presence of unduly large, persistent and frequently cystic corpora lutea.

Multiple retention cysts may be distinguished from the normal presence of one (or very occasionally more than one) mature normal follicle by their persistence, undue size or large number. They are usually accompanied by undue thickness of the capsule and are usually bilateral.⁴ They are familiar objects to every abdominal surgeon. They are not usually considered of importance. In the course of a long series of conservative operations on enlarged ovaries for other reasons their relation to sterility had not occurred to me until a review of all my cases of conservative surgery of the ovaries led me to notice the considerable frequency with which this work was followed by pregnancy in women who had previously been sterile for a number of years. Since then I have watched this point in every case in which I have opened the abdomen and have seen but one case of bilateral enlargement of the ovaries by multiple retention cysts in a fertile woman. The addition of the conservative surgery of the ovaries to my armamentarium for the relief of sterility in carefully selected cases naturally succeeded and was at once followed by a marked increase in the list of successes.

The assertion that bilateral enlargement of the ovaries by multiple retention cysts bears a causative relation to sterility is at present incapable of either proof or disproof other than by clinical results, the histologic evidence which I had hoped by this time to be able to bring forward having been interrupted by the accidental destruction of a considerable number of specimens which had been carefully preserved for this purpose. I hope in the future to be able to produce such histologic evidence in proof or disproof of my present belief.

The importance of persistent corpora lutea as a cause of sterility is more easily established. Even the possibility of the existence of a pathologically persistent corpus luteum in the human ovary is a somewhat new suggestion, though scattered reports of such cases have appeared from time to time for many years;⁵ but it is a quite common surgical experience in the resection of ovaries to find apparently unduly large, and sometimes even cystic corpora in ovaries, some of which have been known to be enlarged for many months, or even years; and the whole trend of modern study warrants the view which some of the best authorities affirm as positively established that the presence of a corpus in the ovaries inhibits further ovulation. There is, moreover, interesting clinical evidence of their importance. Among my records of sterilities which have been successfully treated I find three cases in which a stationary enlargement of one ovary had been noted from periods of several months and in which the enlargement of the ovary was found at operation to be caused by a large and more or less

cystic corpus. I find four other cases in which a similar condition was found at operation but in which the patient had been under observation for but a short time before the operation was undertaken. In each of these seven cases the enlarged and apparently persistent corpus was removed from the ovary and its bed closed over, and in every one of the seven cases the operation was followed by the prompt appearance of pregnancy in a previously sterile woman. Further, a similar though less surgical method of removing the persistent corpus has been classical among veterinary surgeons in the treatment of sterile cows for many years and is stated to be very successful.⁶

The subject of the differential diagnosis between these several forms of moderate enlargement of the ovaries is one which I have been for some time studying and which I hope can yet be rendered probable by the differential symptomatology, but on which I am not yet ready to speak. It is of practical interest in connection with both of these alterations of the ovaries that they are seldom if ever seen in cases which are wholly free from alterations in the lower portions of the genital tract. I have so far seen no such case. It follows that the routine submission of sterile women to abdominal section without careful, exhaustive study of the other conditions is totally unjustifiable and would result in much unnecessary operating. The case as a whole must be carefully investigated first; even then the propriety of instituting an abdominal operation for sterility alone must rest on the conditions of the individual case. It is probably justifiable only when considerations connected with the health of the patient warrant a section independently, or in carefully selected cases after the lower alterations from the normal have been remedied by treatment without avail, and when the intense desire of the patient and her husband for children renders them fully ready to assent. It should certainly not be attempted for sterility alone by the unskilled operator.

METHODS OF TREATMENT

A complete discussion of the technical details of the treatment which has been found in my experience the most successful in the management of sterility dependent on (a) alterations of the secretions, or (b) ovarian alteration, would form a complicated subject which would necessarily run into great length; moreover, so much of the choice of detail is as yet necessarily empirical, that it would be difficult to put it on paper in clear form. The general principles which govern it can, however, be so stated. Their application to an individual case must be governed by experience as influenced by study of that case.

Treatment of the Altered Vaginal Secretions.—The alterations of the vaginal secretion are apparently always due to infection, with the exception of profuseness which is usually the result of a general pelvic congestion or of those hyperacidoses which are a part of general constitutional hyperacidosis. Treatment naturally follows along the lines indicated by these three etiologies.

The cause of a pelvic congestion must be ascertained and remedied.

General hyperacidosis demands the appropriate general medical treatment.

The results of infection vary in accordance with the bacteriology from mere fermentations of the secretion up to the gross pathologic conditions.

4. When strictly unilateral, they are probably not necessarily causative of sterility.

5. Hirst, B. C.: The Corpus Luteum of Pregnancy in Non-Pregnant Women, *Med. News*, April 5, 1890.

6. Williams, W. L.: *Veterinary Obstetrics, Including the Diseases of Breeding Animals*, Ithaca, 1909.

The Cervical Secretion.—When the vaginal secretion has been disposed of the condition of the cervix must be investigated. This should be carried out first by simple observation of the character of the cervical secretion, and of its quantity as observed for a considerable length of time through a speculum, and by expression of the retained cervical secretion by compression of the cervix; and next by examination of the shape and dimensions of the cervical cavity with a sound and by hooking out any thickened secretion from along its walls with the sound or wire loop.

The Uterine Secretion.—The only two methods of treatment of the uterine mucous membrane which need be mentioned are curettage and disinfection, and for safety and effectiveness both of these are dependent on the coincident institution of free uterine drainage. No disinfection of the uterine cavity is safe unless it is done in the presence of the complete distention and free drainage which is usually attained only after an operative opening of the canal; it is then harmless. Curettage is usually also necessary whenever the uterine mucous membrane is the seat of definite alterations; but no one who has had the experience of removing uteri which have just been curetted can have failed to be impressed with great skepticism as to the results of curettage as ordinarily performed. When a uterus is so inspected it is surprising to see how much of the mucous membrane has been left untouched even by a very careful curettage, and it is, I believe, usually impossible to perform even an approximately thorough curettage without the use of several curets, or of one which can be adapted to every part of the uterine cavity.

Such permanent free drainage is almost never effected by mere dilatation. It can be established only by careful study of the causes of defective drainage in the individual case and the adoption of appropriate plastic work to remedy its cause. Successful determination of these abnormalities often demands very close study; for instance, careful exploration of the region of the internal os after the cervix has been opened by a discission, with a sound which has had the extreme tip bent to an acute angle, often reveals unexpected angulations of the canal, or the existence of bars or prominences in the mucous membrane on the anterior or posterior wall, or both. These phenomena are quite preventive of free drainage and furnish the best of reasons for the persistence of abnormal secretions, yet they are quite unknown to those who merely practice dilatation of the os. All of these conditions are most frequent when the cervix is in ante-flexion and underdeveloped. These conditions may demand bilateral division of the cervix and its subsequent repair, the posterior discission and release of forward fixation of the cervix which I have described,⁷ or other plastics, or even operations from above; the choice must be left to the plastic sense of the individual surgeon.

After the performance of any of these plastics the uterus should be curetted and the curettage should usually be supplemented by thorough, deep disinfection of the uterine mucous membrane as a part of the operation, and while the canal is still in acute operative distention and consequently under freer drainage than it will have at any other time.

Tubal Sterilities.—The tubes and ovaries are not appropriate for minor treatment other than as the drainage and disinfection of the uterine cavity may usually be

relied on as aids to the subsidence of the minor tubal alterations described before, and as the institution of permanent free drainage from the uterus may often be depended on to relieve the minor abnormalities of both the tubes and ovaries. Both of these organs if directly attacked at all must be attacked by major operations; and as the technic of their reparative surgery is again a subject which must be left to the plastic instinct of the individual operator, which is extensive, and on which I have given my views elsewhere,⁸ I shall omit further reference to it here.

At the bottom of the whole subject of treatment lies the principle that even the ovarian infertilities are almost invariably associated with physiologically obstructive conditions in the genital canal, minor or major, and that the patency of a canal is only the patency of its most obstructed point; moreover, it must be remembered that I am speaking here not of that simple phenomenon, mere mechanical patency, but of that much more complicated and delicate matter, the physiologic patency, which permits the passage of a living ovum and of a living and actively motile spermatozoon to their point of conjugation, and finally to the implantation of a fertilized ovum. Perhaps the most important and certainly the most generally overlooked point in the whole subject is that the destruction of this delicate physiologic patency is frequently effected by alterations which are so minute in degree or limited in area as to escape diagnosis under merely routine observation.

Accurate, minutely accurate, diagnosis; the limitation of treatment to the areas affected without unnecessary invasions of normal structures above the affected areas; the attainment of complete drainage by appropriately planned and executed plastic work in combination with deep mechanical or disinfective treatment of the affected areas and of them only; and the recognition and treatment of ovarian infertility, when it exists, are the essential principles in accordance with which all the details must be planned.

The treatment of sterility is frequently operative and as such demands operative skill and readiness to assume a not infrequently considerable operative responsibility; but it also involves a minuteness of diagnosis and a patience in treatment which must be exercised sometimes before operation, sometimes independently of operation, sometimes after operation. These facts in connection with the exquisite balance which is necessary to the continued life of the spermatozoon and ovum within the genitals; to success in their search for each other, and to that conjugation and attachment to the decidua which means fertility, all combine to render this subject an intricate one, and to make its treatment one which is almost a specialty within a specialty; moreover, much more study is needed before its details can be placed within the category of accepted text-book knowledge, but that with patience, intelligence, and minute observation, treatment may be made satisfactory and successful is already assured.

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ABSTRACT OF DISCUSSION

DR. ROBERT T. FRANK, New York: Dr. Reynolds has modified our conception of the factors which enter into the production of sterility largely because he has not limited himself to the usual course of study in this subject. He has not confined his attention to the gross mechanical lesions, but has concentrated his efforts in trying to elucidate the "physiologic per-

7. Reynolds, Edward: Ante-flexion of the Cervix and Spasm of the Uterine Ligaments in Relation to Retroversion, Dysmenorrhea and Sterility, Surg., Gynec. and Obst., July, 1911, p. 17.

8. Reynolds, Edward: The Ultimate Results of the Conservative Surgery of the Ovaries, Surg., Gynec. and Obst., March, 1912, p. 255.

versions," as he happily terms them. Dr. Reynolds apparently lays a great deal of stress on the external secretions of the genital tract. Perhaps he is right. The factors which enter into the production of these sterilities are so complex that it is necessary to divide sterility into several classes. I agree with Dr. Reynolds that gross mechanical lesions play a subsidiary rôle. This is shown by the frequency of conception in the presence of vaginal septa and in the presence of fibroids, some of them obstructing the uterine canal. This is shown by conceptions even in the presence of every obstacle that Nature or art can place in its way. Conception has been reported through a vesicovaginal uterine fistula. In my opinion the condition of disturbed function, on which Dr. Reynolds laid so much stress, is really the factor we must study in order to advance in our treatment of sterility. The uterus is often at fault, but not as was formerly considered, not from an inflammatory lesion or chronic endometritis, for instance. In order that conception may successfully take place it is necessary that the ova grow up, ripen and be expelled and received into the tube. Then the corpus luteum must form in the ruptured follicle. Unless this last has occurred the uterine mucous membrane will not be sensitized for the reception of the ovum. This sensitization is necessary in order that the ovum may take root. The corpus luteum is the factor that produces this reaction. Dr. Reynolds, therefore, justly laid great stress on the persistence of the corpus luteum, because a persistent corpus luteum, among animals, has been shown to cause sterility by preventing further growth of all ova which have attained a good size in the ovary. Unfortunately, I think that in the human being we cannot consider the matter so simple as this, for, were the persistent corpus luteum a regular cause of sterility, these cases should always be accompanied by amenorrhea, which is by no means the case. The problem is therefore extremely complicated. The most necessary thing for us to determine, either through animal experimentation or from human observation, is in what case the condition of sterility is due to the uterus, in what case due to the ovary, and particularly whether or not menstruation and ovulation coincide. In this last matter, which has been so long sought for by gynecologists, lies the crux of the question.

DR. LAURA BRANSON, Iowa City, Iowa: I have long been interested in the subject of sterility of women, particularly in that form dependent on ovarian conditions. I was much pleased to hear Dr. Reynolds point out the possibility of the ovary having much to do with the condition of sterility. There is but little literature on this subject. In an April number of THE JOURNAL a report gives the following conclusions from a biologic point of view: (1) In vertebrates, the female possesses all sex qualities; (2) The habitat of these sex qualities is in the ovary; (3) These sex qualities are developed by the internal ovarian secretion. The biologic conclusions also point to the fact that the ovum is developed by this internal ovarian secretion and that it inhibits or prohibits the menstrual function. Right along this line, let me say that I am more than pleased at the conservative manner in which surgery of the ovaries is at present conducted, because now while biology and physiology are pointing in the direction of study of the ovaries we shall have material left *in situ* on which to base these investigations and experimentations, whereas a few years ago ovaries were removed which might have been saved to perform the functions for which they were intended.

DR. CHARLES S. BACON, Chicago: There is one feature of this subject which I think may be mentioned—the influence of the corpus luteum in sensitizing the decidua. This might possibly furnish a clue to treatment. One might use the products of the luteal body of animals or the corpus sensitized from the uterus. I have employed it in some instances in which, apparently, I obtained results. This gives us something for further study.

In addition, there is the question, How often do we have, not a very early abortion, but an incomplete nidation, resulting in an abortion? This, of course, is part of the sterility problem, and here also the early abortion may be due to the lack of the corpus luteum secretion. Here, too, possibly there may be some help from the early diagnosis of pregnancy. The diagnosis is most important in women who have irregular

menstruation. It is of the utmost importance to determine whether we have to do with early abortion. If the newer methods of diagnosis will help us in this, they will help in solving a practical problem.

DR. J. H. JACOBSON, Toledo, Ohio: We must be certain that there are no mechanical disturbances present before we suspect that the secretions are at fault. In short, we must demonstrate positively that there is a patent genital canal extending from the Graafian follicle to the vulva. If you will recall the anatomy of the fallopian tube, you will remember the differences in structure of the tube at its inner and outer end. The lumen at the outer end of the tube is large and there is comparatively little muscular tissue; at the inner end of the tube there is much wall and practically no lumen. The patency of the inner end of the tube is difficult to determine, and it is this particular part of the genital tract that I believe is often the seat of obstruction, the result of inflammatory changes at this point. For some time past, from specimens removed at operation, we have tried to determine the patency of the uterine end of the fallopian tube. We have found that in most cases in which there has been a previous salpingitis, even though of mild character, we could hardly ever get injected fluid through into the uterine cavity. I feel that in the surgical treatment of sterility this form of obstruction is probably the most important lesion to determine. The operation of hysterotomy, as advocated by Deaver, will find a field of application for this class of patients.

DR. EDWIN REYNOLDS, Boston: Dr. Jacobson brings out a point. We are dealing with something more than a question of mechanical patency. We are dealing with a question of a very delicate physiologic patency. Just as the strength of a chain is the strength of its weakest link, so the patency of a canal is the patency of its most obstructed portion. Now, the point which I wish especially to drive home, if I can, is that, while it is ridiculous to say that there is anything short of an absolute obstruction which can prevent the passage of the ovum, nevertheless, if there is a relative mechanical obstacle, a lack of mechanical patency, there will be a lack of physiologic patency from the inspissated, thickened and altered secretions behind that mechanical impatency, or partial impatency.

FUNCTIONAL TEST (PHENOLSULPHONE- PHITHALEIN) OF THE KIDNEY IN SCARLET FEVER*

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Rowntree and Geraghty¹ in 1910 introduced phenolsulphonephthalein tests as a method of determining the functional ability of the kidney. They found on subcutaneous injection of the dye that in normal persons from 40 to 60 per cent. is excreted after one hour and from 20 to 25 per cent. after two hours. They found that in acute nephritis the activity of the kidneys may fluctuate greatly in twenty-four to forty-eight hours. In parenchymatous nephritis there is a marked decrease in the amount of drug excreted and in chronic interstitial nephritis a low output was found in all cases. Later they² showed that the test is of value in that by showing a marked decrease in renal function, it indicates impending uremia when other signs are lacking. They conclude that intramuscular injections are better than subcutaneous. This work has been confirmed by Boyd,³

* From the DuRand Hospital of the Memorial Institute for Infectious Diseases, Chicago.

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3. Boyd, Montague L.: Phenolsulphonephthalein and Functional Tests of the Kidneys, THE JOURNAL A. M. A., March 2, 1912, p. 620.