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## OBSERVATIONS ON STERILITY IN THE MALE.\*

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THE object of this communication is twofold. First, I wish to point out that in the event of a childless marriage the finger of suspicion points at the woman with shocking frequency. It is almost a reflex act on the part of the physician, to say nothing of the husband. The fault is hers, and even in the absence of some definite abnormality of her genitalia, she falls a ready prey to curette, dilator, or glass plug. Second, I wish to consider, in a general way, the sterile man, and to discuss some of the causes of his sterility.

There seem to be no very accurate figures as to the frequency of childless marriages. According to Huhner (Sterility in the Male and

Female, Rebman, New York, 1913), 10% of all unions are sterile. In France the number is put at 20%. But in a general and impersonal investigation of statistics on this point one must not forget that the clandestine, but admittedly widespread use of the many methods for the prevention of conception is a factor of unknown, but immense importance.

Therefore all the material upon which we must base our figures consists only of those comparatively few couples who, anxious to have children, come to the hospital or to the physician's office. Even in such cases there is no general agreement as to the number of times in which the husband is at fault. Hunter (*American Journal of Surgery*, April, 1912) quotes numerous writers whose percentages vary from 1 to 80. Lier and Ascher (cited by Scholtz, *Arch. f. Dermatologie u. Syphilis*, 1910, 101) found the fault to lie with the husband in 71% of the sterile marriages which they investigated. Huhner, in 129 couples, found this figure to be 59%. Kehr's 40 cases (Huhner, *loc. cit.*) indicted the husband in 35%. S. W. Gross (Huhner, *loc. cit.*) in 192 cases from various authors, found the husband responsible in 17%. Vedder (Huhner, *loc. cit.*), examining 50 husbands, found them sterile in 70%.

In view of these facts it might be supposed that a community such as ours, would proceed with caution under such circumstances. As Bel-field (*Journal American Medical Association*, 1912, lix, 1419) aptly says:

"The investigation of childlessness should begin, not with the curettage of the wife, but with the microscopic examination of the husband's semen."

But the facts show the contrary to be true. From one of our largest public hospitals I have collected data of 108 women, in whom a diagnosis of sterility is recorded. Some of these women had been married many years. Three had been married more than once. In justice to the male sex, and to the particular individuals here involved, these patients are not to be included in our statistics.

In 31 cases the records do not contain any statement as to advice or treatment either of the wife or of the husband. Of the remaining 74, 37 were advised to undergo operative treatment, while the remaining 37 actually went through this ordeal. In many this advice was given or an operation performed in the presence of a negative pelvic examination. In only 5 of these 105 women (4.76%) was the husband first examined!

If these operative procedures had led to the much desired pregnancy we might feel somewhat justified. But failure is written in large type over the results. Twenty-five of the women operated upon were followed for a year or more. Only 2, or 6%, had become pregnant or borne children. An attempt to examine the husbands of the remaining 23 cases met with poor success. He rarely can be approached, and

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even when found to be sterile, usually as a result of his own indiscretions, he shrinks from the comparatively simple procedures which might result happily. However, 4 such husbands were examined. Two were evidently normal in every respect. In the other 2 the semen contained no spermatozoa, and an examination of their genitalia showed evidence of an old gonorrheal infection. One of these men had been married twice, neither wife had ever become pregnant, the present incumbent had gone through two fairly serious operations, yet the husband's powers of procreation had clearly become obsolete years before.

Bearing in mind the figures already given as to the frequency of the sterile husband, it is fair to assume a similar percentage in the cases here presented.

One might suppose that in hospital practice the pressure of work furnished an excuse for an inexcusable blunder; one might further suppose that this does not apply to our private cases. Unfortunately it does. Through the courtesy of several gynecologists, I have now seen the husbands in 40 childless marriages. Twenty were actually sterile. Yet the wives of 4 (20%) of these had had more or less severe operations done upon them before it occurred to the operator that perhaps, after all, the husband was at fault.

While these figures are small, we believe them to be representative, not only of this community, but elsewhere. When it is remembered that a man is so often sterile as a result of his own ignorance, and that the innocent wife very frequently falls a victim, should we not be more careful as to where the blame is placed?

Now as to the causes of sterility in the male. While in women nature seems to be responsible in many cases, in man disease plays the chief rôle. In the event of bilateral undescended testicles Belfield (*loc. cit.*) says that no spermatozoa are formed. On the other hand, Simmons and Odiorne (*Annals of Surgery*, December, 1904) and more recently, McGlannan (*Journal American Medical Association*, February 28, 1914) have observed adult spermatozoa and a normal histologic picture in a considerable number of such organs.

In the rare malformations, such as epispadias, certain types of hypospadias, and exstrophy of the bladder, the spermatogenetic function of the testicle may be and generally is unimpaired, but owing to the nature of the defect, coitus is either impossible, or the semen cannot be ejaculated into the vagina.

There are several non-venereal diseases, which, if they attack the testicle or epididymis, may produce sterility in the male. Of these mumps, especially when occurring after puberty, is the most common, with an incidence of orchitis, generally bilateral, estimated at anywhere from 5% (Keyes *Genito-Urinary Diseases*, 1911) to nearly 33% (Comby, *Osler's Modern Medicine*). Atrophy of the testis with

destruction of its spermatogenetic function follows in a vast majority of these cases.

When we consider that approximately 15% of the adult male population is infected with syphilis and that this may involve the testicle we are at once confronted with another cause of sterility. Syphilis (gumma) of the testicle is fortunately not common, and is generally unilateral. Keyes (*loc. cit.*) records 67 cases, of which only 10 were bilateral. But even if bilateral, the prognosis, after proper anti-syphilitic treatment, is said to be good. Those portions of the testicle which are not sclerosed may functionate and secrete spermatozoa. Gosselin (quoted by Watson and Cunningham) has found spermatozoa in the semen after the cure of this condition. That a restoration to, or a continuance of fertility under these conditions is of doubtful value to the community or to posterity seems to be clear.

The incidence of abscess of the testicle (usually unilateral) in typhoid is only about 2%. The destruction of the organ may be, and usually is, complete.

Tuberculosis of the genital tract, although primary in the epididymis, and even when unilateral, results in azoospermia in about 85%. This catastrophe is to be explained in part by an occlusion of the genital ducts through early involvement of vas deferens, prostate and seminal vesicles. The prognosis is bad, for a considerable experience has shown that, even if early operation removes the diseased epididymis, its fellow becomes involved within a year in more than half the cases.

The abuse of alcohol is also a potent factor in the production of sterility. Simmonds (Keyes, *loc. cit.*) estimates that 61% of all alcoholics are sterile. But in such a condition of narcotism is it not reasonable to suppose that concomitant diseases, generally those of venereal origin, are far more productive of the sterility than is alcohol? Also may not such a loss of the procreative function be desirable under the conditions? Certain experimental evidence, at least, would seem to bear out this conclusion.

Another possible cause of sterility which does not seem to be mentioned elsewhere, is absolute and protracted continence. This statement, made to me by a colleague, is based on the case of a man who was married fifteen years ago. At this time healthy spermatozoa were found in the semen. For reasons best known to themselves the couple have abstained from sexual relations, and there have been no intercurrent diseases. A recent examination of the husband shows azoospermia.

It also seems to be a fact that the otherwise healthy testes of normal, active and sexually vigorous men may occasionally be entirely unproductive of spermatozoa. I have recently been told of such a case occurring in the practise of one of my colleagues, and both Belfield (*loc. cit.*) and Janet (*L'Assoc. Franc. d'Urol.*, 1909, xiii) mention similar examples. The possibility in

such cases of a congenital atresia of the spermatic ducts is not to be disregarded.

Another source of sterility of considerable importance is repeated and prolonged exposure (especially of the genitals) to the Roentgen ray. Those affected therefore, are physicians, x-ray workers, and patients to whom this has been prescribed as a therapeutic measure for other conditions. Brown and Osgood (Trans. American Association Genito-urinary Surgeons, 1907) carefully investigated this question and found, among other things, that (1) spermatozoa themselves are highly resistant to the x-ray, (2) the spermatogenic cells of the tubules of the testis show degenerative changes, (3) there is no deterioration of sexual activity produced. These investigators also found that in a very small percentage of cases fertility may return after removal of the offending cause.

Infection by the gonococcus is by all odds the most frequent cause of male sterility. From a numerical standpoint all other etiological factors fade into insignificance. The disease is so widespread that statistics collected from various sources place the incidence at from 50 to 75% of the adult male population. It is also well established that prostatitis, generally with more or less involvement of the seminal vesicles, occurs in the vast majority of cases.

The involvement of these organs may result in sterility, a point on which there seems to be general agreement. If the site or severity of the inflammatory process is such as to disturb the patency of the ejaculatory ducts, there will be either azoospermia or oligospermia, depending upon the degree of closure of these structures. When one considers the small calibre of these ducts, their proximity one to the other, and the relation of their orifices to the prostatic urethra, where the inflammatory process is at its height, such an outcome is not to be wondered at. On the other hand, one might well ask why sterility from this cause does not occur with greater frequency. But the procreative capacity of the husband is done away with in prostatitis in another way as well. In such cases there is frequently found asthenospermia, the semen containing a few weakly motile or abnormally shaped spermatozoa, or necrospermia, where these bodies are absolutely motionless, tightly curled on themselves and abnormal in size or shape. These changes are to be accounted for by an alteration in the reaction or composition of the prostatic or vesicular secretion. Just what this change is, or in which organ (prostate or vesicles) it arises, we do not know. But we do know that spermatozoa are killed or inhibited in an acid medium, while they thrive in an alkaline medium. It is probable that in addition to other chemical changes there is sufficient combined or free acid in the secretion of these glands to deprive the spermatozoa of their vitality. Further knowledge, based on scientific, rather than on empirical

principles, is much needed before we can discuss this point intelligently.

A fourth complication of gonorrhea following close upon the heels of prostatitis is epididymitis. Its incidence is considerable, Finger (Blenorrhea of the Sexual Organs and Its Complications, Trans. 3rd ed. 1894) reporting 29% in 1844 cases of gonorrhea. While involvement of one side (usually the left) is the rule, the opposite side becomes affected in no small number. In the latter event the percentage of sterility (azoospermia) is exceedingly high. Finger collected 242 such cases from different authors and found azoospermia in 92%. The figures of other authorities, while not so high, give us reason to regard the incidence of sterility in men so affected as 75 or 80%. This unfortunate result is due to occlusion of the genital duct, usually at the lower pole of the epididymis, but often at other points as well. While such a condition would appear to be hopeless, the ingenious operation devised by Martin, of anastomosing the vas deferens to an uninvolved portion of the epididymis, has resulted happily in a large number of cases.

But unilateral epididymitis is not without its drawbacks. Emödi in 31 cases found azoospermia in 9, and the investigations of Benzler (*Arch. f. Derm. u. Syph.*, 1898, xlv) are significant. The latter followed the subsequent history of German soldiers who had had gonorrhea, and who had been married three or more years. Of those without epididymitis 10.5% were childless. Where there had been unilateral epididymitis the percentage rose to 23.4%, while in the bilateral cases sterility obtained in 41.7%. Azoospermia in unilateral epididymitis is to be explained, not alone by a blocking of the genital duct on the opposite side, probably at the prostatic orifice, and without clinical evidence of its occurrence, but also by the prostatitis and vesiculitis which accompanies it.

Finally, gonorrhea may result in sterility by the production of a stricture of the urethra. When its calibre is so decreased as to prevent the free ejaculation of semen into the vagina the results are not difficult to explain. Also it must not be forgotten that behind every stricture there is a more or less well marked prostatitis, and we have seen that this in itself is capable of producing sterility.

I wish now to consider briefly my own experience with sterility in the male, of which, as already stated, I have seen 20 cases. The semen of 10 contained no spermatozoa after one or more examinations. One was a case of tuberculosis of the epididymis (unilateral), upon whom I finally operated, but whose initial symptoms had appeared eight years previously; one gave a history of some obscure scrotal swelling (probably mumps) years previously, and with marked atrophy of both testes; in a third, gonorrheal prostatitis and vesiculitis of long duration, and with numerous exacerbations, together with a pronounced atrophy of each testicle of

undetermined cause, was responsible for the condition. In the other 7, bilateral epididymitis of gonorrheal origin was to blame. In all there was also found a well defined prostatitis, the secretion containing much pus.

Six of my cases were found to have oligo- or necrospermia, or both. In 4 of the 6 there was a purulent prostatitis, one associated with an old bilateral epididymitis. The latter, occurring in a middle aged man, in whom no objective or subjective evidence of gonorrhea was found, was undoubtedly due to infection with the colon bacillus, a not infrequent occurrence. The other 3 had been produced by the gonococcus.

The semen of the 2 remaining cases contained only a few immobile and abnormally shaped spermatozoa. Careful examination and inquiry revealed no cause for the condition.

Four more of my series showed a peculiar intermittency in the presence of spermatozoa. None of them had been able to procreate even after years of marriage, and with wives pronounced normal by one of our most eminent gynecologists. At the first, second, and in one or two, the third examination of the semen, no spermatozoa, living or dead, were to be found. On the next occasion the specimen was swarming with myriads of them. Still later, spermatozoa were conspicuous by their complete absence.

One of these was a pronounced alcoholic, but young, and otherwise apparently normal. It seems likely that John Barleycorn furnished the answer.

In another there was a large left varicocele, with marked atrophy of the corresponding testicle.

In the third nothing could be found but a slight degree of prostatitis. In this case the first specimen of semen was sterile, and the second normal.

Lastly, a man with a small spermatocele and a generally cystic feel to the epididymis on the right side. The first sample of semen showed one or two dead spermatozoa. A week later it contained absolutely none. Two weeks later a similarly negative report was given me by Dr. E. L. Keyes, Jr., of New York, to whom I had referred the case. At the end of another week the news came to me that countless active and normally shaped spermatozoa had been found.

Finally, it is of interest that of the four private cases whose wives had already been operated upon, only one was found to produce spermatozoa. In two of the others a bilateral gonorrheal epididymitis excluded all possibility of procreation without previous operation. In the fourth the testicles had been put hopelessly and forever *hors de combat* by an attack of mumps in early manhood.

In closing, it seems worth while to state briefly the method which I have found to be efficient in the examination of such men. A careful history, with special reference to the causes of sterility already mentioned will often

give the clue at once. The man's sexual life should also be inquired into. Physical examination involves a rigid routine. The external genitalia are first carefully examined, especially epididymes and testes. Urethral discharge is looked for. The anterior urethra is irrigated with boric acid solution. The patient then urinates in two glasses, that in the first glass showing the condition of his posterior urethra. The urethra is calibrated for stricture. The bladder is filled with boric solution and a rectal examination made to determine the condition of prostate and vesicles. These organs are then gently but firmly massaged. In most cases this serves to express enough secretion to drip from the meatus. Two drops of this are placed on separate slides, one being examined at once for spermatozoa. If numerous and active, the hand of suspicion must then point elsewhere. To the second specimen is added a drop of acetic acid (36%). This is examined for its cell contents, and here the nuclei are so well stained by the acetic acid that one has no difficulty in distinguishing pus from round cells. The presence of pus indicates a prostatitis of greater or less severity. The absence of spermatozoa, however, does not indicate sterility. In the latter event the man is instructed to have intercourse wearing a condom of the thin membrane variety ("beaters skin"). After ejaculation he is instructed to remove this gently from the penis and to place it at once in a wide-mouthed bottle of warm water, keeping its contents from spilling by jamming the open end of the condom between the cork and the bottle. This should be examined at the earliest possible moment after ejaculation, meantime keeping it warm to insure the vitality of the spermatozoa. While haste is advisable, if instructions are carried out, I have found spermatozoa of great activity as long as ten hours after intercourse. If the first specimen is negative, ask for another, and even a third, but be sure that several days or a week of sexual abstinence elapse between. I regard three specimens as the least on which to safely base an opinion.

It will be seen that I have dwelt in this paper upon three points. First, the prevalence of sterile marriage, and the unjust and often unwarranted indictment of the wife; second, the main causes of male sterility have been discussed, and it has been shown that in a great majority of cases venereal disease is the underlying factor; and third, the method of determining the presence or absence of sterility in the male. A fourth point, one of vital importance, dealing with the prognosis and results of treatment in the various conditions enumerated, has been intentionally omitted. It is our purpose to deal with this at greater length in a subsequent communication.

This experience, although brief, is not without its lessons.

1. The cause of sterility in man is due to venereal disease (generally gonorrhea), in the vast majority of cases.

2. Oligospermia or azoöpermia may occur without obvious cause.

3. The production or ejaculation of spermatozoa may be intermittent for reasons as yet unknown.

4. A single examination of the semen is insufficient. At least two, perhaps three or four specimens, each taken after a considerable period of sexual continence, must be seen, before a prognosis can safely be given.

5. Marriage may continue to be sterile even with the finding of active spermatozoa in the husband, and a normal genital tract in the wife. Experience has shown us all that for some reason best known to herself, Nature delays procreation often for years.

6. It is noteworthy that in no case of male sterility regardless of the cause, is masculinity in the least impaired. This is to be explained by the fact that even though the spermatogenetic function of the testicles is inhibited, the internal secretion continues in full force.

#### STATISTICAL NOTES ON A SERIES OF 6000 WASSERMANN TESTS FOR SYPHILIS PERFORMED IN THE HARVARD NEUROPATHOLOGICAL TESTING LABORATORY, 1913.

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THE value of the present series of Wassermann tests is enhanced by the interest which the laboratory officers have taken in the clinical diagnoses of the cases tested and by the courtesy with which the clinicians submitting specimens have given important data.

Since the Harvard Neuropathological Testing Laboratory is not a commercial institution and has performed much charity work in addition to its other work (paid for virtually at cost), a spirit of cooperation has grown up which has helped in the solution of many problems of individual diagnoses.

The Testing Laboratory, of which the last year of work is here summarized, was, I believe, the first to be established in Massachusetts to make use of the ingenious discovery of Wassermann, and, since it has been in continuous action under its various heads, (1) Professor F. P. Gay (now of the University of California) who established the standards since maintained, (2) the late Dr. Emma W. D. Mooers, who brought to the work a great interest in both the technique and the clinical significance of the tests, derived from her work with Plaut in Munich, (3) Professor W. P. Lucas, (now of

the University of California) who turned his attention to numerous clinical problems, not only of children, but in general, and (4) their successors (see below), the Laboratory has had a very varied experience and has sustained most of the shocks which the numerous pitfalls of the test provide. The result has been an increasing confidence in the tests as made, and fewer and fewer complaints of lack of congruence between the results of the tests and clinical findings, especially when these latter are reviewed.

My own interest in the tests was in the first instance psychiatric and neuropathological, and I believe that the laboratory would hardly have survived, had it not been for the interest in these tests taken by the state institutions for the insane. The work published heretofore, based on this laboratory's tests, has been largely psychiatric, as the following titles illustrate:

Lucas, W. P. The Wassermann Reaction in its Application to Medicine. BOSTON MEDICAL AND SURGICAL JOURNAL, clxix, 1913, No. 4, pp. 116-121, July 24, 1913.

Paine, H. L. Results of the Wassermann Test in Two Hundred Consecutive Admissions to the Danvers State Hospital. BOSTON MEDICAL AND SURGICAL JOURNAL, clxviii, No. 14, pp. 501-503, April 3, 1913.

Morse, M. E. Correlations of Cerebrospinal Fluid Examinations with Psychiatric Diagnoses: A study of 140 Cases. BOSTON MEDICAL AND SURGICAL JOURNAL (in press) Worcester State Hospital Contributions No. 20, 1914.1.

I believe the value of the Wassermann reaction will always remain even more critical in the neurological arts than in those of the syphilographer who has so many more clinical data immediately accessible to him. It is to be hoped that some state agency will take over the entire task of Wassermann-testing on a scale commensurate with its value. If so, it is the experience of the present Laboratory, which has been virtually supported by cooperation of several of the larger hospitals for the insane, that psychiatric and neurological cases will absorb the lion's share of attention, although from time to time many series of sera will be submitted by physicians having special therapeutic tests (salvarsan, neosalvarsan) in hand.

There are Wassermann tests and Wassermann tests! In comparing our results with others, we often find tests described as Wassermann tests which are somewhat essentially different therefrom. Needless to say some workers omit various precautions and controls which are essential to reliable work. To make clear the policy of this laboratory, which has been managed in common by the writer, by Professor H. M. Adler, and by Dr. Annie E. Taft under the Department of Diseases of the Nervous System of the Harvard Medical School, I propose to set down (without description) the steps, precautions, and controls used in the series of tests, which are now being executed by Dr. W. A. Hinton.