Browne, by my father, and by myself. At 10 P.M. the parasites had disappeared, the last being found at 5 P.M.

"September 19th.—No parasites were discovered. The temperature is normal. I am feeling quite well. There is no splenic enlargement and no tenderness. Appetite has returned.

"September 25th.—In good health. No recurrence of malarial symptoms."

EXPERIMENT II.

A wooden hut, constructed in England, was shipped to Italy and erected in the Roman Campagna at a spot ascertained by Dr. L. Sambon, after careful inquiry, to be intensely malarial, where the permanent inhabitants all suffer from malarial cachexia, and where the field labourers who come from healthy parts of Italy to reap the harvest after a short time all contract fever. This fever-haunted spot is in the King of Italy's hunting ground near Ostia, at the mouth of the Tiber. It is water-logged and jungly and teems with insect life.

The only protection against mosquito bite and fever employed by the experimenters was mosquito netting-wire screens in doors and windows and, by way of extra precaution, mosquito nets around their beds. Not a grain of quinine was taken. Dr. Sambon and Dr. G. C. Low, Signor Terzi, and their two Italian servants entered on residence in their hut early in July. They go about the country quite freely—always, of course, with an eye on anopheles—during the day, but are careful to be indoors from sunset to sunrise. Up to Sept. 21st, the date of Dr. Sambon's last letter to me, the experimenters and their servants had enjoyed perfect health, in marked contrast to their neighbours who were, all of them, either ill with fever or had suffered malarial attacks.

For the present I content myself with announcing this result. Complete details of their experiences will doubtless be made public by Dr. Sambon and Dr. Low at the termination of the malarial season and of their experiment at the end of October. Suffice it to say that these gentlemen express themselves as satisfied that protection from mosquito bite protects from malaria and that protection from mosquito bite is perfectly compatible with active outdoor occupation during the day.

It remains for the public to apply the lesson taught by these experiments. Will this be done? Already I have heard objections and difficulties mooted. I saw it advanced recently that it is impossible to avoid mosquito-bite in the tropics and that it was useless to try to do so. One has sometimes to go out in the evening; a medical man, for example, must visit his patient at any hour. This is quite true; but, surely, because we cannot escape a risk altogether this is no reason why we should not try to minimise it. Dr. C. W. Daniels, who has recently returned from British Central Africa, tells me that not one mosquito in a thousand in that country carries malarial zygotes—that is to say, is infective. If a man exposes himself, therefore, in British Central Africa to mosquito-bite habitually, so that he gets bitten, say, ten times every night, the chances are that he is effectually inoculated with malaria some four times a year; but if the same man systematically protected himself from mosquito-bite and, in consequence of his care, reduced the chances of being bitten to once a month he may be 100 years in British Central Africa before he gets infected. This minimising of risk is certainly worth striving for.

The question of expense cannot for a moment be entertained in discussing the means for protection. One life saved, one invaliding obviated, would, even in a pecuniary sense, pay for all the wire gauze and mosquito-netting requisite to protect every European house in West Africa.

These experiments, together with the work of Ross, Grassi, Celli, Bignami, Bastianelli, and other Italians, and the recent observations on native malaria by Koch and the representatives of the Malaria Commission of the Royal Society and Colonial Office, plainly indicate that the practical solution of the malaria problem lies (1) in avoiding the neighbourhood of native houses, the perennial source of malaria parasites; (2) in the destruction, so far as practicable, of the breeding pools of anopheles; and principally (3) in protection from mosquito-bite.

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PUERPERAL SEPSIS¹

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PUERPERAL sepsis is nothing more or less than a surgical fever arising from the infection of a wound, the only differences being—(1) the large extent of surface liable to infection; (2) the structures involved; (3) the presence of a quantity of dead material which easily lends itself to infection; and (4) the fact that the patient is undergoing certain physiological changes, this, perhaps, making her more liable to infection. The different varieties of puerperal sepsis are as follows: (1) *sapraemia*, or septic intoxication due to a local cause; (2) *septicæmia*, or acute septic infection or acute sepsis; and (3) *pyæmia*. We shall consider these three conditions separately.

I.—SAPRÆMIA.

Sapraemia is a fever due to the absorption of the products of decomposition from the parturient canal or due to the absorption of toxins produced by micro-organisms in the structures surrounding the parturient canal. It may be divided into different varieties according to the cause: (1) *foetid sapraemia*; (2) *suppurative sapraemia*; and (3) *inflammatory sapraemia*.

1. *Foetid sapraemia*.—This is due to the absorption of the products of decomposition in the parturient canal, and the materials which may decompose are the lochia, blood-clot, retained pieces of membrane, or portions of placenta. The symptoms of this variety are: first, a headache which often precedes the initial rise of temperature and pulse, which, as a rule, occurs on the third or fourth day succeeding the confinement but may occur later, and which is usually proportional to the quantity of decomposing material. The lochia of course are abundant and foetid; the pulse, which is full and bounding, varies from 110 to 120, and the temperature varies from 101° to 103° F. The tongue at first is clean, but in a day or so it becomes heavily coated. The patient sleeps very well and has no pain, and on the second day of the fever the headache usually disappears. In severe cases the symptoms may be ushered in with a rigor, and if the case be allowed to continue without treatment the symptoms become aggravated and the patient's complexion becomes sallow. The milk function is not interfered with and perspiration is usually excessive. The treatment of this condition consists in efficient douching with creolin solution (half an ounce to one gallon of warm water) until the temperature falls to normal. If a vaginal douche be not sufficient to reduce the temperature and the rate of the pulse it should be followed the day after by a uterine douche, and in severe cases this should be administered twice daily. The diet should be generous and easily digestible. In cases, however, where in spite of douching the symptoms do not abate, and where there is reason to believe that some of the membranes or part of the placenta have been retained, a gentle curetting with Rheinstädter's flushing curette will be of service.

2. *Suppurative sapraemia*.—This is a *sapraemia* due to the absorption of toxins produced by suppuration on the surface of the parturient canal. It includes puerperal ulcer, either on the perineum, the vaginal wall, or on the cervix, suppurative colpitis, and septic endometritis. This condition is usually more sudden and severe than *foetid sapraemia*, being generally ushered in with a rigor, with high temperature (from 103° to 105°) and very rapid pulse (from 120 to 150). There is no pain and the lochia are septic but not so abundant or foul-smelling as in cases of *foetid sapraemia*. This condition may commence any day during the puerperium after the second, either independently of, or as a consequence of, *foetid sapraemia*. The pulse and temperature continue high, and in cases where a small extent of surface is involved and is properly treated the temperature quickly falls to normal, usually by crisis; in other cases—especially in those of considerable septic ulceration of the vagina—the temperature may remain high for some days in spite of treatment, and then suddenly falls to normal by crisis. The tongue is heavily coated. The patient sleeps fairly well, takes her

¹ An introductory communication to the Northumberland and Durham Medical Society on March 8th, 1900.

food well, but generally feels ill. A puerperal ulcer may appear on the perineum, on the vaginal wall, or on the cervix, and always in the situation of a laceration. This ulcer is irregular in outline and its surface is of a dirty greyish appearance and secretes a small amount of highly septic pus. It can be easily seen by separating the vulva and looking at the perineum or examining the cervix by means of a speculum. The treatment consists in washing it three times daily with creolin or corrosive sublimate solution, dusting it with iodoform, and keeping a piece of iodoform gauze applied to it. The ulceration may, however, extend to the whole vaginal wall, causing the pulse and temperature to rise very high—the temperature from 104° to 106° and the pulse from 140 to 160. The treatment which answers best in this condition is similar to the last-mentioned—viz., douching twice daily with creolin solution and packing the vagina loosely with iodoform gauze. Stimulants are usually indicated (small doses at frequent intervals) and concentrated and liberal diet. Septic endometritis is the most fatal form of sapræmia. Its symptoms are much the same as those of a severe case of foetid sapræmia and its treatment is somewhat similar. The question of curetting in this condition is still subject to discussion. Some authorities maintain that it is best to curette in order to remove the diseased endometrium, while others consider that, no matter how carefully it is performed, curetting will only remove part of the diseased endometrium, leaving a large raw surface for further infection, and the protective layer which is formed under the diseased endometrium is also removed,² predisposing to the spread of the septic processes into the connective tissue of the uterus itself and thereby causing a septic metritis or perhaps even acute sepsis. The method, however, recommended by Dührssen of douching and plugging the uterine cavity with iodoform gauze has met with the greatest success. Extirpation of the uterus has also been advocated by some authorities, but in the performance of this operation we are confronted with three grave dangers. The first is the condition of the patient herself prior to the operation, the second is the danger of infecting the patient during the operation, and the third is the impossibility of ascertaining whether the septic condition is limited to the endometrium or has extended into the surrounding structures. The results attained will perhaps teach us not to advise this operation. As a consequence of septic endometritis, salpingitis or puerperal pyosalpinx may supervene. This comes under the head of gynecology.

3. *Inflammatory sapræmia.*—This is due to an acute inflammation of the vagina, uterus, or parametrium. This condition is invariably associated with considerable pain. In simple colpitis the vagina is red, hot, and tender, with pain on micturition and defecation, but the lochia need not necessarily be foetid. Douching with weak creolin solution will give considerable relief. The bowels should be kept freely open. In cases of metritis there is considerable pain on palpating the uterus which is enlarged and the lochia are red and abundant. The treatment, besides occasional douching of the uterus, is chiefly symptomatic. Parametritis is an inflammation of the cellular tissue surrounding the uterus and of that between the layers of the broad ligaments. It is usually a consequence of metritis or of sepsis extending through a cervical laceration. The pain is referred to either iliac fossa, and a tender swelling can be felt bimanually on either side of the uterus. The patient may lie with either one or both legs drawn up, indicating that the inflammation has extended to the cellular tissue of the iliac fossa. It is often associated with pelvic peritonitis. The treatment consists in perfect rest, aperients, good, concentrated, easily digestible diet, syrup of the iodide of iron, or small doses of iodide of potassium internally, and tampons of cotton wool, permeated with glycerine and ichthyol (10 per cent.), placed daily in the vaginal fornix. Parametritis usually ends in resolution, but may break down into abscess.

II.—SEPTICÆMIA.

Puerperal septicæmia, otherwise known as acute sepsis or acute septic infection, is an extremely fatal condition, but fortunately comparatively rare. It may arise independently or as a consequence of any of the preceding conditions. Its chief symptoms are an initial rigor occurring from 36 to 60 hours after the date of infection, with an extremely rapid pulse (from 140 to 160), which is weak and compressible; the temperature is irregular; in some

cases it remains normal and in others it may rise to 106° or higher. Vomiting, sometimes uncontrollable, is a common symptom, and the patient has little or no desire for food. She is sleepless and restless and throws her arms about, and although she has an extremely anxious and pinched expression on her countenance yet she says "she feels quite well." This condition is known as "euphoria." The milk is absent or it rapidly disappears from her breasts, and the lochia are scanty or absent. The patient gets rapidly worse, the pulse disappearing altogether at the wrist and the conjunctivæ turning yellow shortly before death. The pathology of this condition is that septic micro-organisms get directly into the blood through the lymphatics, where they multiply by myriads, and the severity of the poison is so great that the sensorium is incapable of receiving impressions of pain and the patient feels and says she is quite well. In cases of septicæmia which are not consequent on septic conditions in or around the parturient canal death is so rapid that pathological conditions have not time to develop. Besides local treatment, such as douching and plugging the uterus with iodoform gauze, large doses of alcohol have been recommended with strychnine and digitalis, but no treatment has as yet been proved to be of any avail. The patient dies in from two to five days.

I dare say that the members of this society would consider me guilty of a grave omission if I did not mention something about what was supposed to be a panacea for this condition—viz., antistreptococcic serum. Well, I have never seen a true case of puerperal septicæmia treated successfully with this serum, neither have I ever read of one. I have seen, however, several cases of different forms of sapræmia treated with it without any beneficial result whatsoever, either transitory or permanent. I have also read a few reports of cases of different forms of puerperal sapræmia which were, in my opinion, wrongly diagnosed as puerperal septicæmia and treated by it with alleged good results which I believe were merely coincidences. In some of these cases great importance was attached to the fall of the temperature and the pulse which usually followed the injection of the serum. This might possibly have been due to the profuse diaphoresis caused by the serum and not to any beneficial result of the serum on the patient. I remember treating a patient about the beginning of 1899 who was very ill from puerperal sepsis. On a certain Sunday morning her condition was extremely grave and I decided to inject some antistreptococcic serum. I was, however, unable to obtain it until the following day, but I am happy to say that this patient anticipated me by having a normal temperature the following morning. Had I been fortunate enough to have had the serum at hand and to have used it that Sunday I might possibly have attributed her improved condition on the following morning to the use of the serum, and this case might possibly have figured in the annals of medical literature.

Now it appears to me, from the very small number of supposed successful cases reported and considering that the antistreptococcic serum is being and has been used very extensively throughout the British Islands and by the ablest obstetricians, that the good results claimed for it have not been sustained. I am also inclined to believe that these reported successes have been merely coincidences and especially so as these cases were apparently cases of sapræmia and not puerperal septicæmia as reported. I went into the shop of a well-known local druggist recently and asked if he kept any antistreptococcic serum. He said that he used to keep a quantity of it but that he did not keep it now as it was never asked for. From this fact, I suppose, puerperal septicæmia has entirely disappeared from this whole district.

III.—PYÆMIA.

Pyæmia is due to the absorption of a septic thrombus in one of the uterine sinuses into the blood-stream by means of the veins. It may spread by continuity of the veins or septic emboli may form and be carried and lodged in any part of the body, causing localised purulent inflammations or abscesses. The symptoms may develop up to the twenty-first day following the confinement, or perhaps later, by a rigor which is usually followed by a succession of rigors. Its symptoms, sequelæ, and treatment are similar to those of surgical pyæmia.

Now, speaking generally, it is well to remember that any obstetrical operation—even the making of a vaginal examination—is similar to a surgical operation and the sources of infection are exactly similar. You will find it stated in Lusk's "Science and Art of Midwifery," which is one of

² Lusk: Science and Art of Midwifery, p. 666, Plate IV.

the very best of modern obstetrical text-books, that "the ordinary carriers of infection are unquestionably the unclean hands, instruments, utensils, clothing, wash material, and the like, which are brought in contact during or after labour with the genitals of the female." Now, this is perfectly true if we have a healthy patient to deal with, but I believe it is quite possible for an unhealthy patient to infect herself. By unhealthy I mean a patient suffering from a gonorrhoeal vaginitis or other form of septic vaginitis, or a patient who has suffered on a previous occasion from some septic condition of the internal genitals.

I have not said much about the bacteriology of puerperal sepsis because this matter is at present undergoing investigation and definite conclusions have not yet been formed, and I do not think that until they are formed we can say anything definite as to the use or value of antistreptococcic serum. It is, I believe, possible to grow cultures of streptococci from some samples of this serum, and besides, by injecting a patient with a quantity of this serum it is quite possible to produce a condition known as antistreptococcic neuritis—a condition which has been observed not only in this country but also on the continent and which, if it occurred, would materially prolong the puerperium.

Now there are a few rules which, I think, if they were strictly observed would materially lessen the prevalence of puerperal sepsis.

1. The thorough disinfection of the patient's external genitals and the hands and forearms of the medical attendant and the nurse, prior even to a vaginal examination. It is very easy to understand how, when a vaginal examination is made with fingers which have not been thoroughly washed and disinfected, material may be carried into the vagina which will be rubbed off the fingers and remain there. This material may in some instances be washed away by the liquor amnii, but in a certain proportion of cases it will remain there and cause decomposition of the lochia or perhaps it may get into some of the fissures of the vaginal wall consequent on parturition and either set up acute inflammation or perhaps cause acute sepsis itself.

2. The abolition of routine ante-partum and post-partum douching. The three principal solutions used for this purpose are corrosive sublimate, creolin, and carbolic acid. Corrosive sublimate solution has no advantages over creolin solution and has several decided disadvantages. If it is used for ante-partum douching, besides washing away Nature's antiseptic lubricant³ (the vaginal mucous secretion), owing to its astringent properties it hardens and corrugates the vaginal mucous membrane, predisposing to extensive fissuring of the vaginal wall and a large laceration of the perineum during parturition, thereby considerably increasing the danger of septic infection. When used post-partum it does not act as an antiseptic because the mercury unites with the albuminous constituents with which it comes in contact, forming an insoluble albuminate of mercury, which is inert. This remains adherent to the surface of the parturient canal, being absorbed into the system later, and causes severe diarrhoea or diarrhoea with melæna (symptoms of corrosive sublimate poisoning). Besides, by hardening the surface of the parturient canal it prevents the natural secretions from taking place, predisposing to subinvolution of the uterus and consequent metritis and endometritis. Creolin and carbolic acid solutions (half an ounce to one gallon) are quite free from these disadvantages. In giving a uterine douche it is not a question of the amount of harm you can do to the bacteria inside the uterus, as this must necessarily be associated with serious injury to the patient. It is more a question of washing away the bacteria out of the uterus, without at the same time doing further injury to the patient, consequently it is the quantity and not the quality of the douche which is important. Routine ante-partum and post-partum douchings are not only unnecessary but are often dangerous.

3. All instruments used during an obstetric operation should be aseptic and when not in use should be kept in aseptic cases.

4. The proper conduct of the third stage of labour. This means, briefly, conducting the third stage with the patient on her back, the obstetrician's hand on the fundus, and waiting until the placenta comes naturally into the vagina before expressing it. If the placenta does not come naturally into the vagina within half an hour massage may be used to the

fundus and gentle expression. In case the membranes get caught the placenta should be lifted gently and the membranes twisted so as to secure their coming away entire. The placenta and membranes should be now examined and if any large piece of either be retained steps should be taken to remove it. The uterus should be well contracted before the binder is applied.

5. The strict limitation of vaginal examinations. In an ordinary case where there is no unusual delay one vaginal examination is sufficient, made after the rupture of the membranes to ascertain if there is a prolapse of the cord. Any further information, especially as regards the position of the foetus, can be more easily and more accurately obtained by means of abdominal palpation.

6. The disuse of all so-called "aseptic lubricants." The use of lubricants is only a means of carrying infection into the parturient canal and preventing the infection from being washed away by the liquor amnii. Lubricants are absolutely unnecessary, just as they are unnecessary in performing an abdominal section except where the patient has sores on the vulva or vaginal wall, in which case a practitioner should use them for his own safety. The commonest so-called aseptic lubricant is carbolic vaseline. It has been proved to be a good culture medium for bacteria, the vaseline protecting the micro-organisms from the action of the carbolic acid. I once saw a large puerperal ulcer which I believe was directly due to the use of this lubricant.

7. The immediate suturing of all perineal lacerations, not only for the sake of the patient's comfort in after life, but also to diminish the extent of surface liable to infection.

Newcastle-on-Tyne.

THE ETIOLOGY OF SCARLET FEVER.

By WILLIAM J. CLASS, M.D.,

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IN the *Berliner Klinische Wochenschrift* of July 2nd and 9th there appeared an article by Adolph Baginsky and Paul Sommerfeld in which they announce the discovery of a micro-organism whose constant presence in the throat secretions and blood of patients suffering from scarlet fever causes them to believe that it is probably the causative factor of this disease. It is this article that has inspired me to a further communication, as well as a desire to present to the medical profession the evidence that has so far accumulated favouring the view that the diplococcus scarlatinæ, the germ discovered by me, is the cause of scarlet fever. The only notice taken by Baginsky and Sommerfeld of my investigations into the cause of scarlet fever is the statement that I had found a diplococcus resembling a very large gonococcus, which organism was considered by me as being the cause of scarlet fever. As the source on which this statement was based they mentioned a leading article on the subject which appeared in THE LANCET of Nov. 18th, 1899 (p. 1385). This article dealt with a preliminary report made on the subject under consideration. I mention this fact, not because I feel in the least hurt by receiving such scant consideration at the hands of Baginsky and Sommerfeld, but for the reason that if they had taken the trouble to read some of the later contributions by myself and others on the diplococcus scarlatinæ they would not have failed to notice the similarity in many particulars of this germ with the one whose discovery they announce. I do not presume to state positively that these two germs are identical—in fact, this would be almost impossible without having seen their cultures; but I will take the liberty to compare certain parts of the description of their organism with those made of the diplococcus scarlatinæ. The reader may then judge for himself whether there is any similarity or not. In order not to be accused of any inaccuracies or twisting of terms I shall give Baginsky and Sommerfeld's statements in German exactly as they appeared in their article. Before beginning this comparison, however, I will say a few words in regard to the term "streptococcus."

In recent medical literature it is quite common to find an organism described as a streptococcus when a culture shows short chains of three or four cocci mixed with single cocci. I have even seen an organism described as a streptococcus where an examination showed perhaps one or two short chains in a microscopical field filled with single cocci. It

³ The Bacteria of the Vagina and their Practical Significance, by J. Whitridge Williams, American Journal of Obstetrics, October, 1898.