quantity of the force used, and as to the direction of the currents. Since every nerve in a limb contains fibres of two functions—motor and sensitive—whose forces are travelling, we suppose, in opposite directions, it follows that, if a galvanic current be made to run along the nerve, it may favour the action of one of these streams of force and oppose the other. This seems to be the case by experiments on frogs and other creatures, where a galvanic current passed down the leg will cause contraction of the limb, whereas if the poles be reversed the animal will cry out, and every muscle of the body will start. This experiment would seem to show that direction should vary according as we wish to affect a motor or sensory nerve. At present we simply test the different modes of application on our patients, and treat them accordingly.

As regards the different effects of the primary and secondary currents, it has been suggested that these are due simply to the fact that the one is continuous and the other interrupted; therefore, that if the battery-current were broken, it would be found that a muscle or nerve could take cognisance and be affected by it (supposing the susceptibility to faradisation had been shown), whereas if it flowed simply through these structures it would pass unfelt. We have tried the experiment, but hitherto without the result expected; and therefore for the present we have been obliged to regard the two forms of galvanism as practically different. Then, again, it is said that the battery-current acts directly on the nerves, whilst the faradic current acts immediately on the muscle; but a discussion of this matter involves the larger inquiry as to the dependence of the muscle upon the nerve for its contractility. The question has not yet been settled. On the one hand, we observe the contraction of muscle on the application of a stimulus when it is entirely severed from the nerves of the body; and, on the other hand, we know that the muscle gains some kind of stimulation through the nerve, since we observe the dropped face in paralysis of the portio dura, and the falling of the head if sleep overtake us in our chairs. Dr. Marshall Hall believed that whilst a muscle retained its connection through a nerve with the spinal cord its contractility remained, but if the connection were severed this quality was lost. He thus by means of galvanism endeavoured to show the nature of the paralysis. In all probability some of his observations were correct; and no more important question in relation to galvanism can be studied than this, for by making experiments on muscles and discovering the connection between their condition under the influence of electricity, and the integrity of the nerve-centres, we shall be able to use the therapeutic agent as a test. By observing the behaviour of muscles under the influence of galvanism, we may form an opinion as to the state not only of the muscle itself, but of the nerve-centre from which some of its qualities are derived. Of course, when Marshall Hall used the expressions "cerebral and spinal paralysis", he meant in the one case, where a limb was paralysed because cut off from its connection with the brain; and, in the other case, where it occurred from disease of the cord itself. There is no such thing as cerebral paralysis in the sense in which he used it. As a matter of fact, we find, as he asserted, these different effects. Thus there are now in the wards two cases of paraplegia in which the continuous current, whilst exciting contraction in the one, has no effect on the other.

Another question which we want solved is this: Is the continuous flow of galvanism or electricity through the body of any service? It has been thought that the current passes simply over the surface of the body, and thus must be quite ineffectual in influencing the deeper structures; but I believe such a view has been found to be erroneous, and that a current of electricity may, for example, be made to pass quite through the brain. We require often not only to put more life into a portion, but into the whole of the body, as, for example, into that of a little child who may be lying completely powerless after an attack of chorea. Now I believe Pulvermacher's chains are supposed to act in this manner—that is, by simply supplying a stream of electricity to the body. I have seen these instruments much in use, but I cannot say from my own observation that I have ever witnessed much good accrue from them. We are, however, about to make a machine which the patient can wear on his back, and thus I hope we shall soon be able to solve the problem. Since the effect would not be immediate, the method must be long continued. We have also been making experiments with an electric bath, but at present the results are doubtful. With respect to other uses of galvanism, as in cure of aneurism, as an actual cautery, etc., I leave them to be treated of in their special departments.

ON THE VARIOUS MODES OF APPLYING REMEDIES TO THE INTERNAL SURFACE OF THE UTERUS.

By ROBERT BARNES, M.D.,

Obstetric Physician to and Lecturer on Midwifery at St. Thomas's Hospital; Examiner in Midwifery in the University of London; etc.

THE treatment of morbid conditions of the body of the uterus by *intrauterine injections* is a subject that calls for earnest discussion on account of its utility and its dangers. If we treat morbid conditions of the eye, mouth, throat, larynx, bladder, rectum, and vagina, by injection, with such manifest advantage that we have come to look upon this method as in many cases indispensable, it seems reasonable to expect equal advantage from its action on the mucous membrane of the cavity of the uterus. Experience amply justifies this expectation. Topical applications to the diseased mucous membrane are in many cases essential to cure; but, in the form of injected fluids, they are not free from danger. Almost every author who has written upon the subject refers to cases of accidents attending intrauterine injections ranging from severe pain to shock, collapse, metritis, perimetritis, and death. It is desirable to refer to some of those cases which best illustrate the conditions of danger.

Dr. Henry Bennet relates a case which occurred under Jobert. A girl aged 24 had a large fibroid of the uterus. Jobert made an astringent injection into the cavity of the neck. Almost immediately there arose shiverings, agonising pains in the abdomen, then fever, then death in a few hours from metro-peritonitis. Bennet performed the necropsy. He found nothing besides the marks of peritonitis.

In my work on *Obstetric Operations* (2nd ed., 1871), I have related a case which occurred in the London Hospital after I had left that institution. The history was supplied to me by Mr. Hermann, the resident accoucheur at the time; and the account of the necropsy by Dr. Sutton. A woman aged 48 had had six children and five abortions. For eighteen months she had suffered from menorrhagia. On admission, there was decided retroflexion of the uterus. An injection of perchloride of iron, in the proportion of one part of the saturated solution to six of water, was used. About half a pint of this was injected through a double-channel catheter attached to a Higginson's syringe, the patient lying on her left side. The fluid appeared to flow out as fast as it entered. The catheter was kept half-rotated, so as to keep the uterus in its proper axis during the injection. The os uteri had been well dilated. Immediately after the operation, the patient complained of intense pain in the abdomen. In the evening, the pain was worse, and she had vomited. The pulse and temperature rose, and she died in collapse fifty-eight hours after the injection. In the peritoneal cavity was found a quantity of blackish-green opaque puriform fluid. Much of the peritoneum covering the intestines around the uterus was of a black colour. There was a quantity of pus in the pelvis. The left Fallopian tube was enlarged, and the vessels on its peritoneal surface highly injected. The outer half of the tube was much dilated, and filled with dirty pus-like fluid. There was marked retroflexion of the uterus. Dr. Sutton's opinion was, that the fatal peritonitis was caused by the iron-solution escaping through the Fallopian tube into the peritoneal cavity.

Dr. v. Haselberg relates an instructive case (*Monatsschrift für Geburtskunde*, 1869). A *puella publica*, having had an abortion six months before, came under treatment with ante flexion of the uterus to such an extent as to render the passage of the sound difficult. She suffered from profuse menorrhagia, and it was determined to try injection of perchloride of iron. It was only after repeated trials that the syringe was made to pass beyond the seat of flexion into the cavity of the uterus. The patient suffered no pain at the time, but at night had a severe rigor. On the fifth night, rigor was accompanied by severe vomiting, and abdominal pains immediately followed. On the following night, this was repeated; thereupon she fainted and died. The intestines were found united by recent exudation. The lower parts of the pelvis were filled with stinking pus; the source of this was discovered in a cyst in the right ovary, which through a small opening gave issue to like matter. The right tube was permeable throughout its whole length by a large sound. The mucous membrane of the uterus was stained as if with ink, and the same appearance extended along the right tube. The black patches showed iron by chemical tests. One fact at least is clear from this case, that perchloride of iron, like other fluids, may run along the Fallopian tubes. But it is not so

THE will of the late Dr. Cavendish Lister Wall, of Addison Road, Kensington, has been proved under £35,000.

THE Monmouth Rural Sanitary Authority has appointed the Poor Law Union Officers Medical Officers of Health.

obvious that the fatal result was due to this accident. No immediate symptoms followed the injections. The signs of intra-abdominal injury seem due to the perforation of the ovarian cyst under the pressure of vomiting.

Hourmann of Lourcine relates the following. A girl aged 19 had profuse leucorrhœa. He injected a decoction of nut by a *clyso-pompe* into the uterus. At the first stroke, she cried out and put her hand to the left iliac region. Severe shivering set in, and lasted several hours; then febrile reaction followed. The pain spread to the abdomen, indicating metropéritonitis. Hæmorrhage appeared in two days, and she was relieved.

The danger of fluids running along the Fallopian tubes seems to depend upon undue patency of these canals. This undue patency in its turn is due, in many cases at least, to obstruction at some lower part of the utero-vaginal canal. Thus in von Haselberg's case, and in the one at the London Hospital, there were decided flexion of the uterus and dilatation of the tubes.

It is not enough to know that patients occasionally die after injections are thrown into the uterine cavity: we want to know why they die. Knowing this, we may learn how to avoid the causes of danger without abandoning the use of a mode of treatment which renders in a great number of cases incontestable service.

Many experiments have been made on the dead body to ascertain the behaviour of injections. Hennig, Klemm, Guyon, Fontaine (on puerperæ), Alph. Guérin, Guichard, and others, have done this. These experiments generally show that there is extreme difficulty in making fluids run along the tubes, especially if the injecting syringe do not completely fill the os uteri internum. I will not relate or analyse these experiments, because they appear to me to be of little practical value. The conditions of the dead and of the living tissues are essentially different. For example, in the dead body there is no muscular contractility, no irritability under stimulus, no response of the nervous centres to peripheral injury. Yet these are conditions which come into play when injections are thrown into the living uterus. It may, indeed, seem at first sight that these experiments would, at any rate, illustrate the problem of the permeability of the Fallopian tubes; but even here their value is small. They may prove that great force is necessary to drive fluid along these canals; and that, unless the cavity of the uterus be closed below, as at the cervix, fluids will rather regurgitate than run onwards. But it is certain that, in some of the cases where fluid injected into the living uterus ran along the tubes, the accident could not be accounted for by the very small amount of injecting force employed. Another force, therefore, must have been in action; and this could be no other than that exerted by the uterus itself, contracting spasmodically upon the irritating fluid thrown into it. This force, the lower or cervical orifice of the uterus being closed, would pump the fluid onwards into the tubes.

Again, it is not necessary for the production of alarming or even fatal accidents that the fluid should run along the tubes. The fluid injected into the cavity of the uterus may cause metritis, and the inflammation may spread to the adnexa and to the peritoneum; or severe pains, shock, and collapse, may be the immediate and simple result of the irritation produced on the uterine superficies by the contact and retention of the fluid. The agony attending some cases of dysmenorrhœa is simply due to the irritation set up by retained blood causing uterine contractions or colic. The pain, the prostration, the other nervous phenomena attending dysmenorrhœa, are sometimes as severe as those attending the intrauterine injections.

In some unfortunate cases—as in one related by Tessier—the fluid injected has been not simply of styptic and coagulating power, but actually caustic. It ought to be needless to point out so fundamental an error; but it has been committed more than once, and the fault of the operator has been assigned to the method.

It is not even necessary that fluids should be injected into the uterus at all. I have seen pain and collapse so severe, as to cause the utmost anxiety for the result, follow an ordinary injection of weak sulphate of zinc into the vagina. This occurred in the case of a lady whose maid was administering, as she had often done before, a zinc solution by means of a Higginson's syringe. The cervix in this case was patulous, but it is certain that the pipe of the syringe was not inserted into it. She recovered in a few hours, no inflammation supervening.

It will further be remembered that the mere touch of a sound or bougie against the fundus uteri will in some cases produce severe pain, and even prostration.

Again, symptoms resembling in character and severity those caused by injected fluids are occasionally observed after the use of solid or unctuous substances, which cannot, from their nature, flow along the tubes—which must, in short, act *in loco*. Thus Aran says he has known three cases of fatal peritonitis from actual cauterisation of the os uteri, and one

case of fatal ovaritis from the application of Vienna paste. I have known the most severe pain and prostration, followed by hæmorrhage and metritis, caused by the application of solid nitrate of silver to the interior of the uterus.

The severity of the accidents is not explained by the nature of the fluids injected. Alarming symptoms have followed the use of comparatively weak solutions. It has been supposed in these and other cases that the untoward phenomena were due to the forcible propulsion of air along with the fluid. In some cases this hypothesis may be well founded; but I think its importance has been exaggerated. It is even doubtful whether a quantity of air at all calculated to produce serious distress can be driven into the vessels or tissues of the unimpregnated uterus; and the small quantity that might possibly run along the Fallopian tubes into the peritoneal cavity could hardly do much harm.

Dr. Cohnstein gives (*Beiträge zu chronischen metritis*, 1868) a careful historical survey of the practice and opinions of those who have related their experience upon this subject. The general conclusion arrived at is, that injection of very powerful caustics is likely to excite inflammation of the uterus and peritoneum, or severe prostration and uterine colics; and that these dangers are less urgent if care be taken first to dilate the cervix. Dr. Lente (*New York Journal of Medicine*, 1870) discusses this question, passing under review the various topical methods of treating disease of the cavity of the uterus. Iodine in solution he has known cause intense pain and alarming collapse, which, however, passed away, no further bad effect ensuing. The leading gynecologists of New York have also discussed this question: instances of serious accidents were adduced. The general opinion seemed adverse to the use of intrauterine injections; whilst Dr. Thomas was especially emphatic in his condemnation.

To avoid the dangers of intrauterine injections, several precepts have been enjoined. The great object aimed at is to avoid or lessen the risk of the fluid running along the tubes. This it is sought to attain—1. By securing free dilatation of the cervix uteri before injecting, so that the fluid may readily run back into the vagina. For this purpose the preliminary use of laminaria-tents is advised. 2. By using only graduated quantities of fluids, and injecting very gently and slowly. 3. By using a double cannula, so as to secure a return-current. To effect this the more surely, the openings of the cannula at the uterine end are made at different levels.

I have not much faith in the double cannula. The end which should serve for the return-current is liable to be choked. The preliminary free dilatation of the cervix, and the use of gentleness in propelling the fluid, should never be omitted: but I do not believe that the observance of these precautions is an absolute guarantee against accidents. It is probable that the mere forcible impact of any fluid striking upon the inner surface of the uterus, especially upon the fundus, may cause severe pain and prostration. Since nothing is gained by forcible injection, this consideration affords additional reason for injecting with all possible gentleness; hence it is well to use injecting-pipes having lateral opening of very fine calibre, so as to “pulverise” the liquid.

I strongly advise not to use injections at all in cases of marked flexion of the uterus. Even if we dilate the cervix first by tents, and maintain the uterus erect during the injection, we cannot always be sure that the flexion will not be reproduced, so as to prevent the issue of the fluid; and it must not be forgotten that it is especially in these cases that the uterine cavity is likely to be enlarged, and the Fallopian tubes dilated.

The general conclusion at which I have arrived, is to restrict the use of intrauterine injections within the narrowest limits. I rarely employ them now, except in cases of urgent danger from menorrhagia.

We may obtain almost all the advantages that injections are capable of giving by other means. For example, the same agents which are useful in the form of solutions for injection, may be employed either by swabbing, or solid, or in the form of ointment. Thus, where the use of chromic or nitric acid, or perchloride of iron, or iodine or bromine is indicated, these agents can be applied soaked on a sponge or piece of cotton, or on a glass- or hair-pencil, the cervix having previously been well dilated. Nitrate of silver is far better applied in the solid form: even then it is liable to cause severe colic. The risk of this may be lessened by reducing the caustic, by fusing it with an equal part of nitrate of potash. The ordinary way of using the solid nitrate of silver—that is, by holding a piece of the stick in a forceps or portecrayon—is objectionable. The piece may fall out or break, and a fragment left behind in the cervix or body of the uterus may give rise to intense agony, and even metritis. To avoid this accident, I have for many years adopted a contrivance I learned from Sir Benjamin Brodie, who armed the ordinary probe by dipping the end into nitrate of silver, fused in a watch-glass over a spirit-lamp. I use special probes of pla-

tinum or silver, mounted on handles of convenient length. These probes may be curved to follow the course of the uterine canal. This is far the best way of applying nitrate of silver to the os and cervix uteri; and it is the only safe way of applying it to the interior of the uterine cavity. The armed end of a probe may be passed into the uterus without the speculum, although the aid of this instrument is sometimes convenient. For example, unless the armed probe be protected by a cannula, the caustic will first touch the vulva and vagina in its passage, which is apt to leave unpleasant effects, and the guiding finger of the operator will be stained.

One of the most widely useful topical applications to the mucous membrane of the cervix and body of the uterus is sulphate of zinc. The value of this agent, when applied to the relaxed or morbid mucous membrane of the vagina in the form of injections, is familiarly known: how to apply it to the uterine mucous membrane is, therefore, a matter of great interest. This has been accomplished by Messrs. Johnson, the well-known assayers, on the suggestion of Dr. Braxton Hicks, who prepared small cylindrical sticks of fused sulphate of zinc weighing three and five grains. These can be carried quite into the uterus without having touched the vagina by the way, by means of a cannula, first made on my design by Messrs. Weiss, and now generally sold by instrument-makers. It consists of a silver cannula of the size of a No. 8 or 9 catheter, gently curved, open at the end, and supplied with a stilet or piston. The stick of sulphate of zinc or other material is placed in the uterine end of the cannula; the instrument is then passed into the uterus just as the uterine-sound is passed, the patient lying on her left side; and the operator's finger, placed on the os uteri, guides the instrument. It is a great advantage of this contrivance that the use of the speculum is quite unnecessary after it has aided in establishing the diagnosis which supplies the indication in treatment. When the instrument has gone the proper depth, the piston pushes out the stick, and the instrument is withdrawn, leaving the stick to dissolve. This it soon begins to do, and, by its speedy effect in constricting the mucous membrane, it keeps itself *in situ* until it is completely dissolved.

Nitrate of silver, reduced by admixture with nitrate of potash, may be used in the same way; so may persulphate of iron, but this should be considerably reduced. When used nearly pure, I have known it cause severe colic and bleeding.

A most precious way of applying astringents, caustics, solvents, or alternatives to the interior of the uterus, is in the form of ointment or pisma. In this way almost any substance can be applied. Where grease is objectionable as a vehicle, a pisma of suitable consistence may be made by aid of glycerine or other matters. In this form we may use substances which cannot easily be applied in any other way. For example, we can hardly use bromine, or iodine, or mercury, in a solid shape; and to use them in liquid form is open to the objections already discussed. Almost anything can be made into an ointment or pisma, and thus we get a complete practical command over a large range of useful agents.

To introduce ointment into the cavity of the uterus, Messrs. Weiss have made from my design a very convenient instrument, also capable of being used like a sound without the speculum. The instrument is easily charged by dipping it into the ointment—a sufficient quantity of which is carried into the uterus, and, by pushing up the piston, is deposited there.

If it be desired to apply a powerful liquid caustic, as chromic acid or strong bromine, to the interior of the uterus, this can be done by the ointment-carrier. A few shreds of asbestos may be packed in the space between the eyelet-holes and charged with the fluid. On ramming down the piston, the fluid will be squeezed out.

In discussing the action of powerful styptic injections in arresting flooding after labour, the conditions under which the practice I have recommended is indicated have not always been accurately appreciated. The great agent, of course, in stopping hæmorrhage, is the constriction of the uterine vessels by the muscular wall in which these vessels run. All the ordinary means of arresting hæmorrhage are aimed at producing muscular contraction. But muscular contraction depends on nervous power. Thus cold, grasping the uterus, introducing the hand, galvanism, all depend for their efficacy upon the spinal cord being able to respond to the peripheral call. When, therefore, these means prove sufficient, the inference is generally warranted that the case, although serious, is not desperate. The condition is very different when the excitomotor function is suspended; when neither by peripheral excitation, nor by centric stimulus, the nerve-force can be drawn or sent from the spinal cord to the uterus in sufficient intensity to cause contraction. At this point, unless the bleeding is arrested by syncope, or by temporary enfeeblement of the circulation, the patient is in the most imminent danger of death. The slightest shock or disturbance will extin-

guish the flickering spark of life. Under such circumstances I have known death follow, to all appearance immediately caused by, the injection of cold water, or passing the hand into the uterus. If, instead of cold water, we inject a solution of perchloride of iron, the same catastrophe may ensue. Is it more likely to ensue? Very careful observations are required before this question can be answered in the affirmative. People are apt to think that cold water is so simple a thing that it cannot do any harm. But if it cannot do any harm, is it not probable that it is, under the conditions discussed, equally powerless to do any good? Harmless remedies, as a rule, fail in great emergencies. Now, cold water fails not because it is harmless, for the shock and depression which it causes are extremely dangerous; but it fails because, nervous power being exhausted, it cannot excite uterine contraction, and it has no other virtue in arresting hæmorrhage.

Here, then, it is that styptics come to the rescue. The emergency is extreme, and would be desperate, but for the new power invoked. If blood be still running, it is instantly seized at the mouths of the vessels, which become sealed up by coagula. It also constricts the inner surface of the uterus, and thus further closes the vessels. The system then has time and opportunity to rally, and by and by the contractile power returns. In estimating the relative value, then, of cold water and perchloride of iron, we must reflect that iron acts and saves life when water is inert or injurious. If occasionally death follows, and is apparently accelerated by, the iron injection, we have, on the other hand, to remember that it was used as a last resource, when the patient was likely to die even if nothing were done, and that even under these unpromising conditions *many lives, to all appearance doomed, have been saved.*

The great lesson to learn is to take courage to use the styptic in time; that is, before the vital power has sunk too low. It was not to be expected that a remedy powerful enough to save under the last extremity should be altogether free from danger. But I have seen so many women bleed to death, and have seen so many saved by the timely use of the iron injection, that I am much more afraid of the bleeding than of the remedy.

In some cases, there is reason to believe that the iron enters the uterine vessels. I have known intense pain in the uterus follow immediately on the injection. How is this explained? If blood were present in the vessels, it is a chemical necessity that contact with the iron would cause coagulation. I infer, then, that in some cases the vessels are for a time nearly empty; and that there is a certain amount of suction-action induced by the relaxed state of the uterus, and by the lateral or semiprone position of the patient. I would therefore urge that the patient be placed on her back, and that the uterus be grasped firmly between the two hands of an assistant during the injection.

In some cases, it is easy to carry a swab of sponge soaked in the iron solution into the uterus. In this way probably some of the risk attaching to injection is avoided. The persulphate of iron, which is preferred by our American brethren, may have its advantages. Its styptic force is probably greater. It may be used in the form of one part of the liquor ferri persulphatis of the *British Pharmacopœia* to six or eight of water. The proper strength of the perchloride solution is one in ten.

ARTERIO-CAPILLARY FIBROSIS.

By LIONEL S. BEALE, M.B., F.R.S.,

Professor of Pathological Anatomy in King's College, and Physician to King's College Hospital, London.

WITH reference to the observations of Dr. Johnson in the last number of the JOURNAL under the above heading, I beg permission to remark that my colleague is altogether mistaken in the inference which he has drawn concerning my opinion as regards the results of his labours, for nowhere have I even hinted that Dr. Johnson had "mistaken amyloid disease or other forms of degeneration for true muscular hypertrophy". My words are: "It has, I think, been too hastily assumed that the thickening is really hypertrophy of the muscular coats of the arteries. If this thickening is to be regarded as hypertrophy, it is unquestionably associated with great change and degeneration of the normal tissue." And then follows the paragraph quoted by Sir William Gull in the JOURNAL of the week ending December 28th, 1872. These extracts are taken from the last edition of my book on *Kidney-Diseases, Urinary Deposits, and Calculous Disorders*, pp. 71-72, and were written nearly five years ago. The book was published in October 1868.

The difficulties under which I then laboured have not been removed; and Dr. Johnson must pardon me for remarking that, as far as I am able to judge, there is, so to say, still plenty of room for differences of opinion upon the question at issue. My friend speaks of "true mus-