nations of temperature must be extreme, and the bowels are, no doubt, often kept in a state of continued catarrh from rapidly recurring impressions of cold.

Where the constipation is due to this cause our first care must be to protect the infant's sensitive body so as to put a stop to the series of catarrhs. To do this it will not be sufficient to swathe the belly in flannel. The legs and thighs must also be covered, for a lengthened experience of these cases has convinced me that so long as a square inch of surface is left bare the protection of the child is incomplete. We should next see that the infant's dietary is regulated with due regard to his powers of digestion. Excess of starch must be corrected, and it is best to have recourse to one of the malted foods. Mellin's food is especially valuable in cases where there is this tendency to constipation, as in many children the food has a very gentle laxative effect; but as Mellin's food contains no unconverted starch, and can do nothing to prevent the formation of a dense clot when the curd of milk coagulates in the child's stomach, it is advisable, when giving it with milk, to ensure a fine division of the curd by the addition of some thickening material such as barley water. A child of six months old will usually digest well a good dessert-spoonful of Mellin's food, dissolved in milk, diluted with a third part of barley water. A certain variety in the diet is of importance in all cases where the digestive power of the infant is temporarily impaired. Therefore, it is advisable to order an additional food to be given alternately with the Mellin and milk. Benger's "self-digesting food" is useful for this purpose, and rarely disagrees. It must be given, like the Mellin, with cow's milk, but without the barley water, for the pancreatine it contains has a digestive action upon the curd, and removes the tendency of the latter to firm coagulation. In addition to the above, if the child has reached the age of ten months, he may take a meal of veal broth or beef-tea once in the day, and with this it is advisable to give some vegetable, such as broccoli or asparagus, thoroughly well boiled. At this age, too, the milk for the morning meal may be thickened with a teaspoonful of fine oatmeal, and sweetened with a teaspoonful of malt extract. In the case of many infants suffering from habitual constipation, the appetite is very poor, and great difficulty is found in persuading them to take a sufficient quantity of nourishment. This indifference to food is almost invariably associated with coldness of the extremities, and usually disappears when measures are taken to supply necessary warmth to the feet and legs.

In all cases where an infant's bowels are habitually costive, it is of the first importance to enter thoroughly into these questions of clothing and diet. In addition, care should be taken that the bowels are regularly stimulated by manipulations from without. The sluggishness of peristaltic action which forms a part of every case of habitual constipation may be very materially quickened by judiciously applied frictions. The nurse should be directed to rub the child's belly every morning after the bath. She should use the palm of the hand and ball of the thumb, and, pressing gently down upon the right side of the abdomen, carry the hand slowly round in a circular direction following the course of the colon. The frictions may be continued for five minutes. In obstinate cases the child may be laid down upon the bed, and the bowels gently kneaded with the thumbs placed side by side; but in this case, too, the movements should follow the course of the larger bowel.

In addition to the above treatment, more special measures have often to be employed. These may be divided into two classes: the class of suppositories and injections, and that of remedies given by the mouth.

The class of suppositories and injections aims at producing an immediate evacuation of the bowel, and in no way tends to promote more regular action in the future. These remedies are, therefore, useful in clearing the way for further treatment, but there their value ends. A suppository of Castile soap introduced into the rectum is a time-honoured method of inciting an evacuation in the child. Another old-fashioned plan has lately been revived, which consists in the injection of forty or sixty drops of pure glycerine into the lower bowel. In each case energetic peristaltic action of the alimentary canal is induced, and the bowel is thoroughly emptied of its contents. Of these applications the action of the glycerine is very rapid, and in a few minutes the effect of the injection is seen. The soap suppository acts more slowly.

Injections of soap and water, or other liquid, have an entirely mechanical action in relieving the patient. To be effectual such injections must be large, consisting of at least half a pint of

fluid, and should be thrown very slowly into the bowel. Still, although of service when given only occasionally, the frequent use of large injections is not to be recommended; indeed, this method of treatment is distinctly hurtful in cases where the costiveness has become a habit. Even in young babies great dilatation of the bowel and serious weakening of its muscular coat have often followed the daily use of the enema pump.

For the permanent cure of habitual constipation remedies given by the mouth are greatly to be preferred, but, at the same time, strongly acting purgatives are worse than useless. Our aim should be to find the smallest dose which will awaken a normal degree of energy of peristaltic action, and to give this dose regularly so as to induce a habit of daily evacuation. The daily dose is most efficacious when combined with a remedy which tends to give tone to the muscular coat of the bowel. For this purpose a useful draught is composed of half a drop of tincture of nuxvomica combined with ten drops of tincture of belladonna and twenty of infusion of senna, made up to a fluid drachm with infusion of calumba. This draught should be given at first three times a day before food, but soon two doses in the day will be sufficient, and it is rarely long before one dose given at bedtime has a sufficiently laxative effect. Our object is not to excite watery evacuations, but to induce as faithful an imitation as possible of a normal action of the bowels. The liquid extract of cascara is useful in many cases, especially if combined with tincture of belladonna. Twenty, thirty, or more drops of cascara extract, with ten of the belladonna tincture, may be given with a few drops of glycerine in a little water every night. In the west of England a remedy held in high esteem consists of half a grain of sulphur coloured red with cochineal. That this apparently insignificant dose is often efficacious when given regularly every night I can testify from my own experience.

In cases where the motions are drier than natural, as if from imperfect secretion of the intestinal glands, the addition of liquid to the diet, already recommended, may be supplemented by the administration of some saline aperient two or three times a day. This treatment is made more effectual when the saline is combined with small doses of nuxvomica and quinine. For a baby of 6 months old five to ten grains of sulphate of soda may be given with one quarter of a grain of quinine, half a drop of tincture of nuxvomica, and a minim of aromatic sulphuric acid, in a teaspoonful of water three times a day before food. As in all cases where the remedy prescribed has been chosen with judgment and given in appropriate quantity, the continued administration of this draught, so far from rendering the bowel dependent upon the medicine, stimulates it to act spontaneously, so that the dose has soon to be given less frequently, and in no long time can be discontinued altogether.

By means such as the above the most obstinate case of constipation in the infant can be cured with little difficulty, but to be successful the treatment must not be restricted to mere drug-giving. The food of the child must be regulated with care, his clothing must be inquired into, and his general management passed under review. Where this is done, drugs given in comparatively small doses will act with sufficient energy, and will soon restore their normal regularity to the bowels.

ACUTE SUPPURATION OF THE KNEE-JOINT TREATED BY CONTINUED IRRIGATION.

By FREDERICK TREVES, F.R.C.S.,

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ACUTE suppurative of a joint, as a result of injury, is becoming a less frequent surgical possibility. An improved method of treating wounds, a more exact acquaintance with the inflammatory process, and, above all, a fuller knowledge of the disposition of serous membranes, have all tended to make this condition comparatively uncommon. Some fifteen years ago it is probable that there were very few large accident wards that could not have provided an example of a joint in a state of acute suppurative. Although the condition is less frequent in occurrence, it is hardly less serious in result, especially where a large articulation is involved, and the inflammation is vigorously established. There may be no great risk to life or even to limb, but there is a prospect of long-continued trouble, and of a joint recovering with much impaired functions.

In the present paper I have described a mode of treatment which had long appeared to me the best adapted theoretically to a large joint acutely inflamed and full of pus, but it was not until recently that I have had opportunities of carrying the theory into practice.

A schoolboy, aged 16, was admitted into the London Hospital under my care, on April 16th, 1886, with *hydrops articuli*. The lad was well developed and in good health. There was no suggestion of scrofula nor of hereditary syphilis. The joints presented the following conditions. The right knee was greatly distended with fluid. The whole synovial sac was demonstrated. The patella dimpled the swelling, and the ligamentum patellæ formed a groove in it. The swelling extended four fingers' breadth above the knee-cap, and the greatest circumference of the knee was fifteen inches and a half. The articulation was free from pain, tenderness, or thickening. The left knee was in the same condition, but the effusion into the joint was more extensive. The swelling reached five inches above the patella, and the joint measured sixteen inches in circumference. Both ankle-joints were distended with fluid, the effusion in each instance being more obvious on the outer and anterior aspects. There was *hydrops* of the left elbow, the distended synovial membrane forming a conspicuous projection about the olecranon. All the affected joints were free from pain and tenderness. The patient only complained of feeling tired in the legs if he walked far—if he walked over three miles. His gait was awkward and rolling, but he was not lame. His general muscular condition was fair. No enlarged glands were to be found in any part of the body. The temperature was normal.

The following was the patient's history of himself. He had always lived in Essex, and had enjoyed good health. His father was a little liable to rheumatism in the winter, but, apart from this, there was nothing to note in his family history. In September, 1882, he had rheumatic fever; all his joints were swollen and painful, and he was confined to bed five weeks. In the early part of 1883 he noticed that his right knee was swollen. The swelling increased slowly and painlessly. By June, 1883, the joint had become so large that he sought advice. He was kept in bed nine weeks with the leg on a splint. At the end of this time he wore a Martin's elastic bandage, but the knee had not exhibited any marked improvement. The swelling in the left knee was not noticed until 1885, and the patient was unaware of swelling in other joints.

Between 1882 and 1886 the patient had, in spite of his swollen joints, indulged in vigorous exercise, and had more than once walked a distance of eighteen miles.

On May 8th, 1886, I tapped the right knee-joint under a carbolic spray, and withdrew three ounces and a half of fluid. One ounce of a solution of iodine was then injected into the joint, and allowed to escape at the end of five minutes. The wound was sealed with collodion, and the limb firmly fixed upon a back splint. The fluid removed separated into two strata on standing; the upper was clear, the lower formed a kind of loose yellow coagulum. The specific gravity of the fluid was 1020. It was thick and sticky, faintly alkaline, and solidified by heat. With acetic acid it gave a copious opalescent deposit. It was cleared by liquor potassæ, and slightly clouded by nitric acid. It contained $\frac{1}{2}$ per cent. of uræa.

No pain and no rise of temperature followed the little operation. After becoming much swollen, the joint again diminished in size. By May 20th the circumference of the knee was 14 $\frac{1}{2}$ inches, and by June 12th, 13 $\frac{1}{2}$ inches. The back splint was kept on.

On June 12th the left knee was tapped, and injected with iodine in the same manner; 2 $\frac{3}{4}$ ounces of fluid were removed. No pain and no rise of temperature followed the operation. The joint very soon refilled, and attained its original dimensions. The fluid showed no sign of abatement.

As the patient was becoming enfeebled by long confinement to bed, and as the injection of the joint had failed in both instances in effecting a cure, I resolved to open and drain each joint in turn. On June 25th I opened the left knee-joint from in front, making an incision on either side of the patella. A drainage-tube was then passed through the joint under the patella. The operation was performed under the spray. The splint was retained. A dressing of carbolic gauze and iodoform was applied. No disturbance and no rise of temperature followed the operation. The dressing was taken off for the first time on the fifth day, and the drainage-tube removed. No pus had formed. By July 15th the little wounds were entirely healed, and the joint was sound. No fluid appeared in it again.

On August 6th, during my absence from town, the right knee-joint was opened in the same way, and a drain passed through under the patella. The drain was removed on the sixth day, and by that time, through some flaw in the antiseptic appliances, the joint was suppurating. The patient's temperature rose for the first time since his admission. The knee became red and greatly swollen. On August 15th it was necessary to make fresh incisions into the joint, and to introduce two drainage-tubes. On August 23rd the patient came again under my care. His temperature was now between 101° and 103°. He had had rigors. He was very feeble, had lost his appetite, and was unable to sleep. For nine days his average temperature had been 102°. His tongue was dry. His general condition had become greatly changed. The whole limb was swollen, and the foot and leg were very oedematous. The joint was the seat of a great deal of pain. Through four openings drainage-tubes passed from the joint, and from these much pus was issuing. Within the last day or so the part had been poulticed. The joint was in a condition of acute suppuration, and so marked a change had taken place in the patient's state that the question of possible amputation was discussed. I resolved to apply continued irrigation according to a method I had already adopted in some other suppurative conditions.

The patient was anaesthetised. The limb was well secured by straps and buckles to a back splint with a foot-piece, and with large bays cut out of the splint on either side of the knee-region. The splint pad was covered with gutta-percha tissue applied with chloroform. The whole limb was then slung from a large cradle. The knee-joint was well washed out with carbolic lotion; the drains were removed, and in their place one fenestrated tube was passed right across the joint under the patella, two of the existing sinuses being made use of. One end of the tube was connected with an india-rubber pipe that passed into a large bath and was made to act as a syphon. This bath was placed at some distance from the bed, and its base was one foot above the level of the patient's limb. The other end of the drain was conducted into an "arm bath" placed below the cradle, and thence the escaping water passed to a reservoir under the bed. A screw clamp was placed on the tube before it entered the knee-joint, and another clamp on the tube after it had left the articulation. By means of these clamps the amount of fluid passing through the joint could be regulated, and also the degree of distension of the joint could be varied. I am much indebted to my house-surgeon, Dr. Perry, now assistant-physician to Guy's Hospital, for the ingenuity and care with which he carried out these arrangements. When the syphon action of the tube was established a stream of water could be made to flow evenly through the joint, and to flush all parts of it. This stream of water ran through the patient's knee-joint, without a moment's cessation night or day, for the period of one month (thirty days). For the first few days some of the fluid escaped through the two sinuses unoccupied by the drainage-tube, but within a week these openings closed, and the skin was soon quite dry. Cold water was employed, to which was added a minute quantity of corrosive sublimate, carbolic acid, or boracic acid. The limb was kept out in the open air of the ward. Twice a day, by closing the lower clamp, the knee-joint was fully distended with water. No trouble was experienced in keeping the apparatus in action. The effect of the irrigation was very pronounced. At once the patient was freed from pain; he slept well, his tongue cleaned, and his appetite returned. His temperature steadily fell and reached the normal line on the third day. During the remainder of his stay in the hospital the temperature never rose to 99°. The swelling of the leg subsided, and the parts assumed their normal appearance.

The irrigation was discontinued on September 22nd. The tube was removed a few days afterwards. The sinuses were healed over by October 5th, and on October 15th the patient left the hospital. At this date both knee-joints were quite free from fluid; both patellæ were movable, and the stiffness existing in the articulations was no more than could be accounted for by the long confinement of the limbs upon splints.

I saw the patient again in June, 1887, seven months after the irrigation. He was in excellent health; his joints were all free from effusion; both knee-joints were of normal appearance, and both exhibited a normal degree of mobility.

It is well known that acute peritonitis is more readily treated when it supervenes upon a chronic form of the trouble, and it is probable that the acute inflammation of the knee-joint in the present case was rendered more amenable to treatment by the

circumstance that the articulation had already been the seat of a chronic inflammation. Even with this possibility before one, it may be questioned whether simple drainage and intermittent irrigation of an acutely inflamed joint would lead not only to the recovery of the limb, but also to the perfect restoration of the functions of the articulation.

In the second case, recorded below, the question of the influence of a previous chronic inflammation did not confuse the issue. The case was a simple one of acute suppuration following injury. The patient, a stoker, a vigorous, healthy man, aged 23, was admitted into the London Hospital on November 7th, 1887, with acute synovitis of the right knee-joint.

On November 1st he had fallen and had received a violent blow upon the knee. He was disabled and was taken home. The joint did not become visibly swollen until the evening, some hours after the accident. There was no wound. The patient had never had any previous joint trouble, nor, indeed, any notable illness.

When seen on admission the patient appeared ill, and was much worn out by pain and want of sleep. The right knee-joint was a little flexed, was extremely distended with fluid, and was the seat of great pain. The skin covering the articulation was red and oedematous, and the oedema had extended some little way beyond the joint district. The temperature was 100° F. The case was evidently one of suppurative synovitis. The limb was fixed upon a straight back splint, and the joint was opened by two lateral incisions, each about one inch in length; through the incisions escaped much synovial fluid mixed with pus and flakes of lymph. A drainage-tube was passed through the joint underneath the patella, and the irrigation apparatus was adjusted precisely as in the case already detailed. Cold water containing a little boracic acid was allowed to run through the joint without intermission night or day for one month. The temperature became normal the day after the operation, and never rose again above 99°. The patient was at once quite easy.

The tube was removed on December 8th, and was replaced by two short tubes for either incision. On December 17th all drains were left off, and the splint was removed. There had been no rise of temperature, no suppuration, and no sign of a relapse. The wounds were now (December 17th) quite healed, and passive movement was commenced. The patient left the hospital on January 8th.

In the following month I exhibited the patient at the Harveian Society. His recovery had been complete. The patella was quite movable, and he could execute a complete range of movements with the right leg; indeed, there was no appreciable difference between the right limb and the left, except that the former presented two cicatrices.

The treatment advocated is exceedingly simple, and would appear to be efficacious. In my previous experience of other methods of treatment I have never seen complete restoration of function to follow an acute suppuration of a large joint.

THE FORMATION AND EXCRETION OF URIC ACID, CONSIDERED WITH REFERENCE TO GOUT AND ALLIED DISEASES:

BEING A THESIS FOR THE DEGREE OF M.D. IN THE UNIVERSITY OF OXFORD.

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SOME researches on the excretion of uric acid, on which I have been engaged for several years, now seem likely to throw new light on the part played by this substance in the causation of disease.

The diseases to which my results more especially apply are gout a certain form of headache (migraine) (*Med. Chi. Trans.*, vol. lxx), some cases of epilepsy (*Neurologisches Centralblatt*, March 1st, 1888), and, lastly, rheumatism, acute and chronic, though the evidence of uric acid causation is not equally strong in all.

My researches show, (1) that the excretion of uric acid (*Journal of Physiology*, vol. viii, Nos. 3 and 4) can be controlled by drugs and foods in a way and to an extent not previously known; that, whatever the amount excreted to-day, it may, within certain limits, be made either greater or less to-morrow.

2. That, when uric acid excretion is diminished relatively to the urea, the diminution is due to retention in the liver and spleen, and possibly in some other organs and tissues, of part of the uric acid which was formed; and, conversely, when uric acid excretion is increased relatively to the urea, such increase is due to a washing out of a store previously accumulated in the above organs and tissues.

3. That the formation of uric acid bears an almost constant relation to that of urea, though its excretion can be varied by food and drugs to a considerable extent.

4. That uric acid is probably never in excess in the blood, except when alkalies or other solvents wash it out in considerable quantities from the stores which have gradually accumulated in the above-mentioned organs.

5. That excess of uric acid in the blood, brought about in this manner, is a sufficient cause of many of the symptoms of the diseases I have mentioned, and probably of others also.

6. That drugs and foods which diminish the solubility of uric acid diminish its excretion and lead to retention and accumulation; and, conversely, foods and drugs which increase its solubility facilitate its excretion and prevent retention.

7. That drugs which diminish the solubility and excretion of uric acid are harmful in the diseases connected with it, while drugs which increase its solubility and excretion are useful in these same diseases.

I began my research by investigating a form of migraine, or, as I now prefer to call it, uric acid headache, from which I had been a sufferer all my life; and my first observation of importance was that leaving off butcher meat (*Practitioner*, Aug., 1884, and March, 1886) produced gradually-increasing immunity from attacks. This and the clinical relationship of the headache to gout led to my examining the urine and finding a very marked rise in uric acid excretion, corresponding to the headache (*Med.-Chir. Trans.*, vol. lxx).

I then began to speculate as to the cause of this uric acid fluctuation; and, having noticed the apparently great gout-producing power of ales, and their strong acid reaction, I was led to test the effects of acids, alkalies, and, finally, of many other drugs, on the excretion of uric acid, obtaining results some of which form the subject of this paper.

The processes used in my experiments are as follows: for urea, the hypobromate test, with the apparatus of Dupré, variations of temperature and pressure being allowed for; for uric acid, Professor Haycraft's process (see *JOURNAL*, vol. ii, 1885, p. 1100); and for acidity, a solution of phenol-phthaleine with a graduated solution of soda.

I soon found that acids (*Journal of Physiology*, vol. viii, Nos. 3 and 4) always diminished the excretion of uric acid, and alkalies always increased it; and it thus became easy to see that butcher meat, beer, wine, etc., had made my headaches more frequent, because they caused a rise of acidity, prevented the free elimination of uric acid, and accumulated a store of it in the body, which on a future occasion would produce a headache. Alkalies, or a somewhat vegetarian diet, on the other hand, by facilitating the regular excretion of uric acid, would prevent any such troubles; and, in proof of this, I found that by first accumulating uric acid with acids, and then washing it out into the blood with an alkali, I was able to produce the headache in question.

Sir A. Garrod (*JOURNAL*, vol. i, 1883, p. 653 [Lumelian Lectures]) has discussed the gout-producing powers of wines and beers and puts it down entirely to the unfermented matters they contain. In discussing the matter he says the light wines which contain a considerable quantity of acid vegetable salts do least harm; while the heavy wines, as those of Spain, do most harm and are almost devoid of vegetable salts.

Speaking of acidity he says that fresh fruits diminish acidity, through conversion of their vegetable salts into carbonates, and this I think gives us the key to the whole matter.

Both the above kinds of wines are strongly acid, but in the light wines the acidity is due to vegetable salts which are converted in the body into carbonates and act as alkalies, so that they cause no retention of uric acid, and have, as observed, but little gout-producing power; the heavier wines, on the other hand, have an acidity due to more fixed acids, they act as a dose of acid does, and have great gout-producing power, and the same applies to ales and stout, which are as I have shown (*Med.-Chir. Trans.*, vol. lxx, p. 12 of paper) strongly acid and cause great retention of uric acid; so that the acidity of these beverages explains their action in gout production far better than their unfermented matters, the action