

of the blood, which is at its height immediately subsequent to the injection. If the quantity of tissue-fibrinogen injected is large enough, the increase of coagulability leads to the immediate occurrence of intra-vascular coagulation. The coagulation which occurs under these circumstances in the case of the dog occurs only in the portal vascular area; but I have been able to show that we can determine it to any predetermined vascular area by increasing the venosity of the blood in the veins of that particular district, or we can generalise the coagulation and obtain it all over the vascular system, both in the arteries and the veins, by increasing the amount of CO_2 in the blood generally. These alterations in the direction of the "positive phase of coagulation," to use Wooldridge's convenient expression, form, however, only a part of the effects which result from the injection of a solution of tissue-fibrinogen.

We have further to deal with a negative phase of coagulation—i.e., with a condition of diminished coagulability brought about by injections of tissue-fibrinogen. This diminished coagulability was described by Wooldridge in connexion with the blood of the extra-portal vascular areas, where intra-vascular coagulation had occurred in the portal system. I have, on the other hand, I believe, succeeded in establishing that the negative phase of coagulation is due to a general reaction of the system to the injection of tissue-fibrinogen, and that it is possible, by slow injection of moderate amounts of tissue-fibrinogen, to obtain a general diminution instead of a general rise of coagulability. The blood has, therefore, the power of breaking down tissue-fibrinogen into some substance or substances which condition the loss of coagulability. I will here adduce from my note-books an experiment, which seems to me to establish distinctly the sequence of events which I have just described.

EXPERIMENT I.

Dog 119.—Cannulas inserted into the jugular vein and the carotid artery, and animal anæsthetised with a mixture of ether and chloroform. Samples of blood drawn off from the carotid to determine the condition of coagulability. Sample 1 (5.43 P.M.): Can invert tube at 5.51 P.M.; time, 8 minutes. Ran in 10 cc. of tissue-fibrinogen solution at 5.43 P.M. Sample 2 (5.44 P.M.): Still liquid 1 hour after. Ran in 10 cc. more of tissue-fibrinogen solution. Sample 3 (5.45 P.M.): Still liquid 1 hour after. Sample 4 (5.46½ P.M.): Still liquid one hour after. Sample 5 (5.48 P.M.): Still liquid 1 hour after. Ran in 10 cc. more tissue fibrinogen. Sample 6 (5.50 P.M.): Can invert tube at 5.58 P.M.; time, 8 minutes. Sample 7 (5.51 P.M.): Can invert tube at 6.4 P.M.; time, 13 minutes. Ran 10 cc. more at 5.52 P.M. Sample 8 (5.53 P.M.): Can invert tube at 6 P.M.; time, 7 minutes. Ran in 10 cc. more at 5.54 P.M. Sample 9 (5.55 P.M.): Can invert tube at 6 P.M.; time, 5 minutes. Ran in 10 cc. more. Sample 10 (5.56 P.M.): Can invert tube at 6 P.M.; time, 4 minutes. Ran in 10 cc. more. Sample 11 (5.58½ P.M.): Can invert tube at 6.2 P.M.; time, 3½ minutes. Sample 12 (6 P.M.): Can invert tube at 6.4 P.M.; time, 4 minutes. Sample 13 (6.2 P.M.): Can invert tube at 6.9 P.M.; time, 7 minutes. Sample 14 (6.7 P.M.): Can invert tube at 6.14½ P.M.; time, 7½ minutes. Ran in 20 cc. more tissue-fibrinogen solution. Sample 16 (6.14 P.M.): Can invert tube at 6.16 P.M.; time, 2 minutes. Sample 17 (6.16 P.M.): Can invert tube at 6.20 P.M.; time, 4 minutes. Sample 18 (6.19 P.M.): Can invert tube at 6.22 P.M.; time, 3 minutes. Sample 19 (6.22 P.M.): Can invert tube at 6.26 P.M.; time, 4 minutes. 6.26 P.M.: Clamped the trachea to increase the coagulability of the blood, and ran in 20 cc. more tissue-fibrinogen solution. Death occurred instantaneously, and both sides of the heart and the whole of the aorta were found occupied by a solid clot. No clot in the portal vascular area. Urine gave a very distinct biuret reaction.

We have thus proved that the positive and the negative phase are successive in time, and it was evident that the positive phase is associated with the presence of tissue-fibrinogen, as such, in the blood. It still, however, remained to be determined to what the negative phase of coagulability is due, and I have ventured in my paper referred to above to suggest that it is due to the presence in the blood of albumoses which have been split off from the tissue-fibrinogen by the action of the blood. The evidence upon which I based that suggestion is as follows: (a) The plasma from the negative phase areas no longer contains any of the injected tissue-fibrinogen. (This, I may remark, is an

observation which was made by Wooldridge.) On the other hand, the blood of the negative phase areas was found by me to have acquired the characters of peptone or albumose blood—that is to say, it clots with CO_2 , and on dilution. Coagulation can also be inaugurated in it by an addition of lime salts or of tissue-fibrinogen or leucocytes. Further, (b), there is a very close analogy between the distribution of the areas of the positive and the negative phase after tissue-fibrinogen injections and the distribution of coagulability after injections of peptone. For instance, the coagulability is in the case of tissue-fibrinogen injections increased up to the coagulation point in the portal area and to a lesser extent in the venous system generally. Similarly in the case of peptone injections the coagulability is retained in the venous system, and especially in the portal venous system, long after it has been lost in the arterial system. Again, the positive phase after tissue-fibrinogen injections can be extended to the arterial system by rendering the blood there venous; and I have been able to show we have something quite similar in the case of peptone injections, for it is only necessary to render the arterial blood venous in order to restore its lost coagulability to it. Lastly (c), I would point out that an excretion of albumose or peptone occurs both in the dog and in the rabbit after the injection of tissue-fibrinogen into the veins or into the subcutaneous tissue. Here, again, I think we have evidence that the tissue-fibrinogen is broken down into albumose in the system.

On the whole, therefore, I think we may perhaps regard it as pretty well made out that the occurrence of a negative phase after tissue-fibrinogen injections stands in some close relation with the liberation of albumose by the disintegration of tissue-fibrinogen in the blood.

(To be concluded.)

ON IRREDUCIBLE DISLOCATIONS OF THE GREAT TOE AND OF THE THUMB SUCCESSFULLY TREATED BY OPERATION.

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THE analogies seen in the following two cases lead me to report them together.

CASE 1. Dislocation of great toe backwards; unsuccessful attempts at reduction; operation; recovery.—William G—, aged forty years, groom, was admitted into Queen's Hospital, Birmingham, under my care, on June 18th, 1889. Shortly before admission a horse he was riding slipped on a granite roadway and fell on its side, with the patient's right foot beneath it. The man says that his heel came first to the ground, and that the whole weight of the horse came on to the toe of his boot with the foot in a vertical position. The sole of the boot was bent transversely across towards the front of the limb. The pain of the accident was exceedingly severe, and he was unable to stand. On admission the right great toe was found completely dislocated on to the back of the metatarsal bone; it was slightly abducted and was flexed at the phalangeal joint. It could be moved laterally without much pain. The rounded head of the metatarsal bone projected prominently in the sole of the foot, the skin being stretched tightly over it. There was already a great deal of effusion into the tissues. The diagnosis of the injury could be made without any difficulty. Chloroform and ether mixture was given by the house surgeon, and attempts made at reduction by traction and manipulation in all directions. I first saw the man on the following day, and although the parts were much more swollen recognition of the exact nature of the case was quite easy. The limb was thoroughly cleansed with hot water, soap, and turpentine, and an anæsthetic again administered. All attempts at reduction being unsuccessful, the limb was made bloodless by elevation, an elastic tourniquet applied, and a two-inch vertical incision made, with its centre over the head of the metatarsal bone, which lay immediately beneath the skin. The head of the bone was found to have thrust itself between the heads of the flexor brevis pollicis muscle, the internal head of

which was about half torn across. The anterior ligament with its embedded sesamoid bones was torn away from the metatarsal bone, and had "shut back" behind the rounded head, constituting itself the chief, if not the entire, obstacle to reduction. The tendon of the flexor longus pollicis lay on the inner side of the metatarsal bone. With the parts exposed before me I was unable to reduce the displaced bone until I had completely divided the anterior metacarpophalangeal ligament and the sesamoid bones by a free vertical incision made in their middle line. Reduction was then effected at once, but the dislocation just as easily recurred. The wounds between the sesamoid bones, the capsule, and the muscle were sutured closely with catgut, and reduction then remained permanent. The tissues around were infiltrated with coagulated blood. No vessel was tied at the operation. The parts were dusted with powdered boracic acid, a small drainage-tube introduced to the deepest crevice in the wound, the skin brought together with wire sutures, and a dry absorbent dressing applied. The limb was put up on a Nevill's splint, to which it was firmly fixed by strapping, and swung in a Lawrence's cradle.—June 26th: Wound dressed for the first time; perfect primary union; tube and sutures removed. Temperature 98.2°; pulse 70.—July 13th: Wound dressed again and found absolutely well, with skin pale and shrivelled and toe in perfect position. No attempts at movement were ordered to be made. The limb was put up in plaster-of-Paris, and the patient was sent home. A few weeks later all the dressings were discontinued, and the man returned to his work without feeling any inconvenience from his injury.

CASE 2. Unreduced dislocation of thumb backwards; operation four months afterwards; cured.—Elizabeth N—aged seven years, was admitted into the Birmingham Children's Hospital, under my care, on Nov. 27th, 1890. From the mother I learnt that about four months previously the child had slipped, and in falling had caught her right thumb against the side of the door. She felt great pain at the time, and was at once taken to the Birmingham General Hospital, where she was seen by a junior officer, who kept her under observation and treatment for more than two months. What treatment was adopted or what opinion was given I could not satisfactorily elicit from the mother, but she seemed very much surprised when I told her that the child's thumb was "out of joint." On admission the thumb was found completely dislocated backwards. The head of the metacarpal bone projected markedly forwards, and was covered by a resistant layer of soft parts. The base of the first phalanx lay behind the metacarpal head, and was slightly abducted. The phalangeal joint was semiflexed and readily movable. When the child closed its fist the thumb stood straight outwards, and could not be brought anywhere near to the flexed fingers. No pain had been complained of for several weeks. On Dec. 1st, the limb having been previously sterilised and an Esmarch's tourniquet applied, I made a two-inch incision over the front of the metacarpal head in the line of the thumb. Below the skin the bone was covered with newly organised fibrous tissue, which was divided, and the articular surface of the metacarpus exposed. The phalanx lay completely behind the metacarpal bone, and had attached to its base the anterior metacarpophalangeal ligament which had been torn from its upper attachment, and had "shut back" behind the metacarpal head. The heads of the flexor brevis pollicis muscle had been torn apart, and lay posteriorly to the metacarpal bone, where they had become attached by newly formed fibrous tissue. The anterior ligament was freely divided vertically at its middle, and, after a few fibres of the internal head of the short flexor had been divided transversely, reduction was with little difficulty effected. The tendon of the long flexor was not seen; it certainly did not lie between the bones. Displacement after reduction easily recurred, but was overcome when the divided ligament and muscle were sutured together in front of the metacarpal bone. No vessels were tied. The wound was dusted with powdered boracic acid, and dressed with dry absorbent dressings without drainage. The limb was put up with the phalanges acutely flexed towards the palm, the fingers bent over them, "fist like," and the whole hand firmly bound with bandage. The arm was carried in a sling, and no splint of any kind applied.—Dec. 7th: Wound dressed for first time; perfect primary union; all sutures removed. Temperature 98.4°; pulse 82.—20th: Wound dressed again; quite well; thumb in perfect position, with a little movement of flexion and extension.—27th: Made out-

patient, merely wearing a thumb stall, and without any tendency to return of the deformity. I saw the child a few weeks later, and improvement was still going on, but there was slightly limited movement in the joint when compared with the other limb.

Several theories have been advanced as to the cause of the irreducibility in this class of injury. The one most generally accepted, and the one still taught in most of our modern text-books, is that it depends upon the tight embrace of the two heads of the flexor brevis pollicis muscle, between which the metacarpus is supposed to be thrust as through a button-hole. A point of greater importance, however, lies in the fact that the head of the bone pushes its way through the muscle above the level of the sesamoid bones, the anterior metacarpophalangeal ligament being at the same time torn away from its metacarpal attachment, and these two structures, which are closely incorporated with each other, "shut back" behind the protruding head and become closely applied to the anterior part of the articular surface of the displaced phalanx. The "shutting back" of these structures is due partly to their own elasticity and partly to the pull of the remaining attachments to them of all the short muscles of the thumb or great toe. In the first of the above cases the inner head of the flexor brevis pollicis was to some extent torn across, and the neck of the metacarpus was only loosely held by the sides of the rent through which it passed; but the sesamoid bones lay between the base of the phalanx and the back of the misplaced head, and constituted in themselves the sole obstacle to reduction, and when these structures were split vertically the head slipped back to its proper position with the greatest ease. A precisely similar condition existed in the second case. An excellent description of this arrangement of parts was given many years ago by Dr. Laurie.¹ He says: "The end of the metacarpal bone is driven completely through the inner fibres of the external head of the flexor brevis muscle. The anterior ligament is completely torn from the metacarpal bone, and remains attached to the phalanx and sesamoid bones in such a manner that the torn ligament and the sesamoid bones are carried backwards by the phalanx and placed between it and the metacarpal bone. The state of parts is aggravated and rendered permanent by the contraction of the muscles attached to the sesamoid bones and the anterior ligament. The result is that the opening in the ligaments by which the metacarpal bone escaped is thrown back nearly half an inch, and the remains of that ligament and sesamoid bones form a partition between the displaced ends of the bone which forms a mechanical obstacle to the reduction."

Mr. J. C. Wordsworth published a paper in THE LANCET (vol. ii. 1863, p. 443) on "Dislocations of the Thumb at the Metacarpophalangeal Joint," showing that the difficulty in reducing them arises from malposition of the tendon of the long flexor. He describes three cases, one of which "was irreducible, and here the long flexor tendon was found between the ends of the bones, having passed round the ulnar side of the head of the metacarpal bone, and by traction having been drawn across the joint." It is possible that Wordsworth's explanation may be the true one in a few cases, but the peculiar displacement of the long tendon between the bones will not be found in all these irreducible dislocations.

The first of my cases is of especial interest, because of the rarity of the accident in the foot, and because, so far as I can ascertain, it is the first dislocation of the great toe which has been treated by open operation. Its likeness in every detail to the analogous injury of the thumb was conspicuously striking, and its treatment by open incision in an exsanguineous limb was simple and satisfactory. The second case is chiefly of interest because of the length of time—four months—which intervened between the accident and the operation. Although much organisation had gone on in the damaged tissues, it was still possible without great difficulty to effect a return of the dislocated bone. It is worth noting, too, how readily displacement recurred in both cases, and how completely this was overcome by closely suturing the opening in the flexor muscle and between the sesamoid bones. This procedure is better than that of excision of the extruding metacarpal head, as has been sometimes recommended. Mr. G. R. Turner read a paper before the Clinical Society of London (Mar. 9th, 1888) on "A Case of Dislocation of the Thumb backwards, in which excision of the head of the metacarpal bone was

¹ Medical Gazette, vol. xxi., 1837, p. 93.

practised eleven days after the accident." The usual anterior incision was made, and "the lateral aponeuroses of the short flexor divided. The main obstacle to reduction was found to be the flexor longus tendon, which had slipped inwards. Dislocation was reduced, but easily recurred. The head of the bone was therefore excised and a good recovery followed." Although there is now but little danger or difficulty in excising the metacarpal head, it appears to me that recurrence can be prevented in the manner adopted in my own cases, and that excision therefore is altogether unnecessary.

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A NEW TREATMENT OF ACUTE GONORRHOEA.

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WITH A NOTE ON THE ACTION OF THIS TREATMENT,
AND OF SOME ANTISEPTIC INJECTIONS ON
THE GONORRHOEAL DISCHARGE,

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NOT feeling at all satisfied with the results of the various treatments of acute gonorrhoea usually adopted, I devised the following method. The patient is first made to micturate, and thus remove the discharge from the urethra as far as possible. The endoscopic tube, warmed and oiled, is then passed into the urethra, the patient lying on a couch. As a rule the passage of the instrument gives rise to but slight pain, but occasionally in sensitive patients, or where inflammation is very acute, a 10 per cent. solution of cocaine previously injected up the urethra will be found useful. The urethra is then thoroughly mopped with dry cotton wool fixed in a stilet and examined by the electric light. The exact limit of the inflammation can then be clearly seen. It is, as a rule, quite five inches from the meatus; it may be four inches even so early as the third day of the disease. The implicated surface is at once to be recognised by its swollen, bright-red appearance, as contrasted with the rosy colour of the healthy urethra. Occasionally distended vessels can be seen coursing over the inflamed surface. It is important not to pass the endoscope needlessly far beyond the posterior limit of inflammation, which is usually sharply defined. The diseased membrane should be now carefully remopped with dry cotton wool, so as to remove every vestige of secretion and have a perfectly clean surface. A mop of cotton wool on a stilet, and charged with a solution of silver nitrate (ten grains to the ounce of water), should then be passed down the endoscopic tube and thrust through its distal aperture. The tube and the mop are then withdrawn simultaneously. By this means the walls of the urethra contract upon the mop and are thoroughly moistened by the solution. For the two inches of the urethra near the meatus a fresh mop is used, so as to completely saturate this portion of the passage, in which the disease commences, and where also the inflammation is most intense. The patient will always complain of slight burning pain for a few minutes; but this gradually passes off, and in ten minutes or so he feels quite comfortable. He is recommended to take a hot bath at night and to remain quiet, in bed if possible, the following day. The diet is regulated as usual. A saline purgative, with an alkaline or copaiba mixture, is given internally, and the patient is instructed to use a mild cleansing injection, such as Condy's fluid (one drachm to the pint). But it should not be left to his unaided discretion to accomplish this task for himself. There is art even in such a slight proceeding as the administration of an injection. The injection is required to clean the diseased passage, not to distend the canal violently throughout its whole length. A glass syringe with a bulbous nozzle holding *only* two drachms is used. The patient, having micturated, should fill this syringe with hot water, and, removing any air that remains, insert the nozzle between the lips of the meatus, keeping it on the floor of the urethra and pressing these lips from side to side on to the nozzle. He now carefully empties the

syringe up the urethra. As the meatus is a vertical slit, if he presses the lips on to the nozzle vertically the aperture will gape, and so the injection will escape by the side of the nozzle and not pass up the canal. Hence the importance of lateral pressure. This warm water is simply intended to clean out the passage. Now he takes the medicated injection and uses it in a similar manner, only this time he removes the syringe but keeps the injection up the urethra quite half a minute by pressing tightly the lips of the meatus. As regards the frequency of injection, the oftener the better. I always recommend quite six times a day, but not the last thing at night time, as the distension of the canal which may result predisposes to chordee. I use only a two-drachm syringe, for after many experiments I have proved that this amount of fluid, when injected into the urethra after death distends the canal completely for rather more than four inches. If this amount be injected into an inflamed and thickened urethra, not to mention its tendency to spasm, more of the urethra must be distended, and this is not only unnecessary, but for manifest reasons inadvisable.

Forty-two cases of acute gonorrhoea have now been treated by me in this manner. With two exceptions the condition had existed in every case for many days, and in several instances was associated with severe chordee. The average time taken before these patients were well was a little under twelve days. As this duration is calculated from the date of the beginning of treatment to the date of the first visit at which the patient was found to be quite free from discharge, the above average result is somewhat in excess of the true time before cure, for more than one patient has stated that he had been already well for two or three days. Early cases, as might be expected, are more amenable to treatment than those which have been established for some time. Two of the forty-two cases attended to were of two days' standing only. In each the inflammation was intense, and had extended backwards about four inches. The urethra was lined with thick purulent discharge clinging to the walls, and so difficult to remove that it certainly would not have been washed away by any injection. The discharges were well mopped away, and the patients treated in accordance with the method described. The result was in each case a complete cure in five days, without a single annoying or bad symptom. Cured cases have been examined with the endoscope, and a perfectly healthy and normal urethra was invariably found. The immediate effect of the treatment is to produce a fairly free purulent discharge during the first twenty-four to forty-eight hours. The pus is thick, and often stringy and very tenacious. The discharge rapidly diminishes in amount after this time, often being quite slight in four or five days. It is watery in appearance, and usually disappears entirely in seven or ten days. From the time the treatment is adopted the patient is quite free from scalding on micturition, and should he have suffered from chordee, the dilatation of the urethra which the treatment entails diminishes, and often abolishes, that terrible complication.

From these results it seems clear that the treatment compares most favourably with the ordinary treatments, for under it gonorrhoea becomes a quite curable disease in a limited time, and does not result necessarily in that only too prevalent disease, gleet. It is not an abortive treatment in the old sense of the term, when powerful caustics were applied blindly and, as a rule, unsuccessfully. The idea of the abortive treatment was, however, less in fault than the method of its execution, and most of the objections to it would be removed if the technique I have advocated had been employed. It is not suggested that a discovery has been made by which every case of acute gonorrhoea can be conducted to a rapid and satisfactory conclusion. There are two classes of cases which cannot be treated successfully by this method: namely, those in which the meatus is abnormally small, so that the passage of the endoscope is impossible; and those in which the disease has extended so far back that it is out of reach of the application. The strength of the solution of silver nitrate may be modified as experience dictates, and the question of a second application will sometimes arise. In none of the forty-two cases has this been found necessary.

The main points of the treatment are: 1. The treatment rests in the hands of the surgeon instead of being left to the patient. 2. The urethra can be thoroughly cleansed, so that there is no doubt that the remedy is applied directly to the affected mucous membrane. Examination of the