light has been thrown on its possible action by an interesting observation of Dr. Copeman's.

He writes¹⁶ of pernicious anæmia: "When a drop of blood was removed from the finger and allowed to fall on a glass slide, then when the edge of the drop had dried somewhat a cover glass was gently placed upon it, crystals of hæmoglobin gradually formed in the film of blood in from ten to forty-eight hours without any further preparation. The only exception to this was in the case of patients who had been treated with arsenic for some days, after which crystals could not be obtained, although, if then the arsenic were discontinued for an equal length of time, they again put in an appearance."

It would appear from this important observation that arsenic exercises a direct influence upon the red corpuscles, lessening their vulnerability, which we have seen is one of the characteristics of anæmia, especially of hæmolytic origin. Arsenic has been shown to diminish the glycogenic function of the liver, and it is possible it may exercise some influence in restraining the hæmolytic function of this organ. In poisonous doses arsenic exercises a destructive influence on the red corpuscles, reducing the hæmoglobin and impairing its oxygenating powers. An interesting point in connection with the administration of arsenic is the fact that it sometimes produces bronzing or pigmentation of the skin. How this is brought about is a disputed point; but it is probable that it is by increasing the activity of the pigment-producing tissues. It is probable that the increase of colour of the urine in some cases of pernicious anæmia during the administration of arsenic is in some way connected with this action.

Quinine is sometimes useful in the pyrexial attacks of pernicious anæmia. Phosphorus has proved useful in one case recorded by Dr. Broadbent, but has failed to do good in others. The evidence regarding mercury is conflicting, but Keys has asserted it increases also the number of red corpuscles. Betanaphthol has been suggested by Dr. Hunter, and this drug and the other disinfectants I have named perhaps deserve a trial, but I have no personal experience of their employment in anæmia. Too often in pernicious and other forms of hæmolytic anæmia, all treatment is incapable of preventing the final issue in death. Arsenic may arrest the disease for a time, and in a few cases effect a cure, but more often, as we have seen, its effects are more transitory than is generally believed. Indeed, the position to-day is but little altered since Addison said of it, "The disease presented in every instance the same general character, pursued a similar course, and, with scarcely a single exception, was followed after a variable period by the same fatal result."

I had intended to have dealt with Transfusion in the treatment of anæmia, but my time is exhausted, and I must leave this undiscussed. This is the less to be regretted, as my own experience on the subject is small, and distinctly unfavourable. The literature is voluminous, and the matter a very complex one. Moreover, the subject has been very fully dealt with by M. Hayem, and quite recently by Dr. Hunter,¹⁷ and the outcome of their experiments, and the general medical experience, is against the employment of transfusion, though cases of recovery from pernicious anæmia have been recorded after transfusion. Intraperitoneal and subcutaneous injections of blood have also been tried, especially on the Continent, but such treatment, even in the most skilful hands, has been shown by Cohnheim not to be free from great danger, fatal peritonitis having occurred in several cases after intraperitoneal injections.

But I must now bring my lecture to a close. I am deeply conscious of the imperfect manner in which I have accomplished my task. I feel that, in trying to cover so wide a field, I have dealt in a sketchy and imperfect manner with many parts of the subject.¹⁸ Still, I cannot but believe that it is important that a survey of the whole subject of anæmia should be made, so as to fit the many and detailed observations of the numerous workers into one harmonious whole. The enormous amount of work that has been done in recent

years, and the complexity of the subject, render the office a difficult one, requiring an abler exponent than myself.

In conclusion, I desire to express to you, Sir, and the Council of the Society, my sense of the honour conferred upon me in inviting me to deliver these Lettsomian Lectures, and also to thank the Fellows and gentlemen who have patiently listened to them.

ON THE TREATMENT OF PSOAS, ILIAC, AND OTHER LARGE TUBERCULOUS ABSCESES BY HOT WATER FLUSHING WITHOUT DRAINAGE.

By ARTHUR E. BARKER, F.R.C.S.,
Surgeon to University College Hospital.

HITHERTO the usual treatment of large tuberculous abscesses, whether connected with a diseased spine, with broken-down glands, or in the soft parts, has left much to be desired. Whether they were simply allowed to burst, or were opened and dressed antiseptically, or whether they were aspirated with or without subsequent injection of germicidal fluids, the results have often been far from satisfactory. Either the discharge, however sweet, has gone on for an indefinite time through open sinuses, or the abscess has become infected with saprophytic organisms, and only too often with acute septic processes.

Most of us must have always felt, in dealing with these large collections of curdy and often semisolid material, that the great difficulty was their complete evacuation. But I question whether many of us realised what complete evacuation really ought to involve until comparatively recently. Formerly, it simply meant the escape of as much of the liquid contents of such an abscess as would flow freely either through a limited opening or through an aspirator needle. But it is only lately that thorough evacuation of a tuberculous abscess has come to mean not only the removal of its fluid contents, but also of all solid and semisolid, caseous or calcareous, *débris*; and not only this, but of that lining of half organised exudation material which covers the whole inner surface of the abscess, formerly called the "pyogenic membrane." It is in this last structure, if left behind, that we probably have the greatest obstacle to the complete obliteration of simple tuberculous abscesses of soft parts when otherwise emptied by methods hitherto in vogue. So long as it remains behind, we leave the most active part of the tuberculous material undisturbed, and this is capable of continuing indefinitely the process which originally produced the fluid contents of the abscess. Outside of this material is found the firm wall of the cavity, which is nothing else than more or less perfectly organised fibrous tissue. This latter may be regarded as a natural barrier thrown out by the tissues around the tuberculous focus by plastic exudation, and tending to protect the system against the spread of the infective process. In everything that is done to a tuberculous abscess, this natural wall therefore must be respected as far as possible. Further, in evacuating such an abscess, we must guard the freshly-cut surfaces of the healthy tissues through which we have to cut in order to reach the tuberculous matter against inoculation with the latter in the course of its removal. If this precaution is not taken, our scar will often break down weeks after primary union has taken place, and the process of reinfection may again take place over the whole tract of the recently closed abscess cavity.

Now if we adopt this view of the nature of tuberculous abscesses, and the principles of eradication which should be applied to them, the question how to accomplish thorough evacuation forces itself upon us very urgently. It would serve no useful purpose here to review all the various methods of treating the abscesses in question now in practice, but I shall briefly sketch one which has yielded me excellent results of late years, indeed better than any I have ever had by other methods.

Having had considerable experience in the removal of tuberculous material from widely diseased hip-joints by hot

¹⁶ *St. Thomas's Hospital Reports*, vol. xviii, p. 103.

¹⁷ Arris and Gale Lectures, *BRITISH MEDICAL JOURNAL*, 1889, vol. ii.

¹⁸ I regret exceedingly that a very able and important paper by Dr. Edington, "Report on the Morphology and Development of the Blood," *BRITISH MEDICAL JOURNAL*, May 31st, 1890, has entirely escaped my observation until too late to deal with. It should be consulted by the reader.

water flushings applied in a special way, and having seen case after case heal completely and permanently without any drainage, under one dressing, after such treatment, I have been encouraged to apply the same method to large tuberculous abscesses elsewhere. The results have exceeded expectation, and have encouraged to further trial.

The *modus operandi* is simply this: Take the case of a psoas abscess, in which the bone lesion is apparently stationary, or perhaps healing, but where a large collection is steadily, though slowly, advanced towards the skin of the thigh. In such a case a 2-inch incision is made through sound structures over the lower end of the swelling. Through this opening a hollow gouge is inserted, which is connected with a reservoir of hot water at 105° to 110° F. by a rubber tube some 6 feet long. This reservoir (a 3 gallon can) is raised about 5 feet above the operating table. When the water is now turned on it rushes through the long gouge to the fundus of the abscess with considerable force, and the reflux carries the contents of the cavity out by the incision. By gently scraping with the flushing scoop the more solid caseous matter is dislodged, the hot water carrying it clear of the cavity at once. Then the walls of the cavity are gently scraped in a methodical manner until the soft lining is loosened and carried away from every part of the abscess. In order to effect this thoroughly I have had these scoops made of varying length, so that the deeper parts can be reached. In the case of a psoas abscess they can be carried up under Poupart's ligament nearly, if not actually, to the spine. In using them all violence must be avoided, lest important structures should be torn, or lest the fibrous wall of the abscess should be broken through, and, finally, to avoid bleeding. With hot water the bleeding is but slight if the peeling be done cautiously.

When the water runs out clear after having been carried to all recesses of the cavity, the instrument is withdrawn. Then any excess of water is squeezed out, and if the deeper parts are accessible sponges are used to dry out the last traces of moisture. Then two or three ounces of fresh iodoform emulsion are poured into the deepest part of the abscess, and stitches are inserted in the edges of the incision. Before these are knotted all excess of emulsion should be squeezed out of the cavity. The knotting of the silk sutures then completes the procedure. As no drain tube is used at all, a simple dry dressing of salicylic wool is alone required, but it should be laid on in considerable quantity, so as to exert elastic pressure over the whole area of the abscess when bandaged. Such a dressing may be left on for about ten days, when it is time to remove the stitches, and the wound should then be firmly healed. A piece of salicylic wool secured by collodion at the edges should, however, be laid over it to keep it from chafing for a few days longer, and the elastic pressure should also be kept up.

Such a procedure is only demanded for the larger tuberculous collections, such as, for instance, psoas, iliac, and lumbar abscesses. Of course, for those which can be fairly isolated, no treatment is better than to dissect them cleanly out without rupturing them—a practice I am very partial to. This can be done in perhaps a much larger proportion of cases than is commonly supposed, even when the contents are fluid. Again, in the case of softening tuberculous glands, it is the proper thing to dissect round them and remove them entire, and wounds thus made ought to heal by first intention and without drainage. Some of the larger abscesses, such as those alluded to above, may also ultimately be cured by aspiration of their contents and injection of iodoform emulsion. But in my own experience of many such cases this requires considerable time, is uncertain, and is only to be achieved when the contents are very fluid. Where there is much solid matter which will not pass through the needle, I know no method so reliable and so speedy as that of mechanical hot water flushing. I have always called this "flushing," as it is something totally different to mere irrigation, which does not carry away the material one is anxious to have removed.

A few cases illustrating this method may now be quoted out of many such by way of illustration.

E. C., aged 13 years, a cripple from spinal caries for nine years, was admitted into University College Hospital on December 31st, 1889. Two years before there is said to have been a swelling in the groin, which subsided. On admission

there was marked angular curvature in the dorsal region. There was also a swelling at the upper and inner part of the right thigh, and some fulness in the iliac fossa, with fluctuation between the two spots, due to a large psoas abscess.

On January 3rd, 1890, I attempted to aspirate the abscess, but the contents were too thick to flow through even a large needle. A short incision was therefore made in the skin over Scarpa's triangle, and a very large trochar was thrust through it into the abscess. But even through this the thick material only escaped slowly. The cavity was then washed out with carbolic solution, and filled with iodoform emulsion. Then the incision was closed with fine silk sutures without any drain tube, and covered with collodion and wool. On the twelfth day there was a little oozing along the stitches, and they were removed. The incision was quite healed. On the fifteenth day it was quite plain that the scar was infected with tubercle from the abscess at one or two small points, which appeared knotty. I therefore removed an oval piece of skin, including the scar and stitch punctures, by two curved incisions meeting above and below. The abscess was now carefully flushed with hot water and scraped as above, the flushing gouges being carried high up under Poupart's ligament into the abdominal part of the cavity. The latter was then dried, filled with iodoform emulsion, and closed with eight silk sutures without any drainage. The salicylic wool dressing was removed on the fifth day, and the stitches on the fourteenth. Primary union of the most complete kind was found. There was slight evidence of the presence of fluid in the abscess at the first dressing, but at the second it was disappearing. There was no pain or any bad symptom, and the patient left hospital on the twenty-eighth day after operation cured of the psoas abscess.

Writing on November 8th, 1890, Dr. Owen Fowler, of Thornton Heath, reports as follows: "I saw to-day the child you kindly operated on for me. She is very well, and has been ever since. All swelling has gone down round about the place of incision. She has no pain or tenderness anywhere, gets about as well as before the abscess began to form, and has certainly grown fatter. There never has been any discharge from the wound, which healed perfectly."

The microscopic examination of the piece of skin, including the scar of the first operation in this case was singularly interesting. Immediately on its removal it was hardened in spirit. Then sections were made by Mr. Raymond Johnson, our surgical registrar. These sections, now before me, show in the neighbourhood of the scar tissue a healthy papillary layer, and under this the fine-celled infiltration about the cicatrix. In the middle of the latter are typical tuberculous foci with their giant cells. Deeper down is some of the abscess wall in process of degeneration.

It is quite plain, then, both from the naked-eye appearances and microscopic characters, that the scar of the first incision was inoculated, either during or after evacuation, by the contents of the abscess. And as the foci were already softening about the stitch holes, it is probable that the whole wound would soon have broken down, and an open sinus would have resulted had I not excised the whole piece of skin. The danger of this in the case of a large psoas abscess need not be emphasised, to say nothing of the loss of time and discomfort to the patient. All this was prevented by the treatment employed, and the second scar was saved from inoculation by the thorough flushing.

W. A., aged 19, was admitted into Mr. B. Hill's ward in University College Hospital, on January 27th, 1890, suffering from curvature of the spine, for which he had been treated at St. George's Hospital in 1883. For the last six months before admission, a swelling had been forming in the left groin, which was now large and fluctuating, with a red patch of skin over it the size of a half-crown piece.

On January 22nd this abscess, which was typically tuberculous, was aspirated, and 22 ounces of the usual fluid was drawn off.

On February 5th Mr. Hill excised the red patch of skin by two curved incisions, and a large quantity of tuberculous fluid was evacuated. In addition to this, several ounces of tough, semisolid material, sufficient to fill two hands, was gouged out with my flushing gouges, through which hot boric solution was rushing. When all the numerous pockets of the abscess had been scraped and flushed, the cavity was sponged

out, and it was filled with iodoform emulsion. Then the incision was sutured with silk, without drainage, and a dressing of sal alembroth gauze and wool was applied over all.

On the 9th some discharge had escaped, and this dressing was removed. Primary union was found everywhere except the lower angle, where there was still some leakage of serum. On the 11th the stitches were removed. On the 13th the edges at the outer angle were pared and sutured. On the 21st these sutures were removed, as primary union had taken place. From this a sound union persisted, and the patient was discharged well, and without swelling, on March 1st. The maximum temperature before operation was 99° ; after, 99.8° .

In this case boric solution was used, but the result was no better than with hot water; indeed, not quite so perfect. This, however, was Mr. Hill's first trial of this method, and some detail of dressing or pressure may have been overlooked. The amount of semisolid degenerated tuberculous tissue in this case was very striking, and it was quite evident, as Mr. Hill remarked at the time, that without some method of gouging and flushing, such as that employed, it could not have been dislodged adequately.

In addition to these two cases, which may be taken as types, I have had other private cases of extensive tuberculous abscesses in the neck, in which a similar operation has been followed by perfect union by first intention, and also without drainage. The resulting scar in each case has been almost imperceptible.

In both the first two cases it is probable that the bone lesion had healed. But, from what I have seen in the case of joints where the tuberculous process in the bones was still in progress, I should not despair of obtaining the same results with caries of the spine, by reaching up to the bone with the long flushing gouges which I have had made for the purpose. By means of these small sequestra might be dislodged, and the carious cavity be thoroughly cleansed. But, even if this were not to be done perfectly, the conditions of the abscess after flushing would be far more favourable to repair of the bone lesion than where the latter was bathed in broken down tuberculous *débris*. And should the abscess ultimately fill again a second flushing of the same kind could be undertaken. At all events, there can be no doubt that this mechanical scouring out of deep abscesses, by means of a large and continuous stream of fluid, enables the surgeon to attain his object with a minimum of scraping or other violence to the walls of the cavity. And, as the fluid employed is simply sterilised hot water, there is no limit to the amount which may be used.

My reasons for employing hot boiled water for some years past may, perhaps, be restated here with advantage, although already given fully in an original communication two years ago.¹

In the first place one used often to see considerable shock and carbolic intoxication in former years when using carbolic solutions even to irrigate large cavities of the kind in question, and the same effect was to be expected from other strong chemical germicides. For this reason it was impossible to contemplate the employment of the latter under high pressure, and in such very large quantities as were necessary for flushing, and, indeed, such germicides would be uncalled-for; for, really, what was aimed at was simply a thorough mechanical evacuation of the abscess with as little violence as possible, and this could be done by any fluid provided only it was sterile. This end then appeared best secured by using a copious stream of hot water under considerable pressure. This I thought would tend to peel off shreds of degenerated tissue without damage to sound structures, and would carry all *débris* at once clear of the cavity. The hollow hydraulic scoop simply carried this hot water to every part of the cavity, and loosened by gentle scraping any material too firm to be dislodged by the stream. In the case of the hip, it was used to gouge away diseased bone from the acetabulum, and help out any sequestra or semisolid material present. In the case of the spine it is possible that the bone could be similarly treated with one of the longer scoops, but this I have not yet tried for want of a suitable case.

Now no germicide could safely be used by the gallon in this way for a large abscess. Again, hot boiled water, besides being sterile, has a tendency to check oozing of blood from

granulating surfaces. Moreover, by its warmth it would tend to counteract shock, and this has been my experience with it. But after it had done its work, there was no reason why a limited amount of germicide should not be placed in the abscess to act upon any tuberculous foci accidentally left behind in it. For this reason the iodoform emulsion has always been used in these cases at the end of the operation, for I am one of the many who still believe in its beneficial effects in tuberculous troubles, all laboratory experiments to the contrary notwithstanding.

But to get rid of the drainage tube appeared to me to be very nearly the most important innovation of all. As long as an opening exists into a large abscess, so long must elaborate antiseptic dressings be employed. With a soundly closed external wound and a thoroughly cleaned cavity within, the processes of repair in the latter might be trusted to pursue their course to final obliteration with confidence. In extensive excision and arthrectomies of the knee, one has almost made it a rule to do without drainage. In excisions of the hip done by this method no drainage has been used. If these extensive wounds could be trusted to heal *per primam* and definitively, as has usually been the case, there appeared to be no reason why a psoas or iliac abscess should not do the same under allied conditions. The cases now recorded prove that drainage in properly treated cases may be dispensed with entirely without danger. In the earlier flushing cases I used the drain tube for a short time, but in the last never, and there has been every reason to conclude that the latter practice was the best.

DEATH OF A CHILD FROM HYDROPHOBIA TWO YEARS AND FOUR MONTHS AFTER BEING BITTEN BY A RABID DOG.

By W. G. SPENCER, M.S.,

Assistant-Surgeon to the Westminster Hospital.

[From the Brown Institution.]

THE patient was under the care of Dr. A. C. Crane and Dr. R. F. Starkie.

G. C., aged $5\frac{1}{2}$ years, was bitten by a dog in Pimlico on August 25th, 1888. The dog, an adult Skye terrier, had been taken by its owner for a walk. The dog rushed wildly about, and became very hot. The owner observed that something must be the matter with the dog, and gave it water to drink. On the way home the dog attacked the child, to whom it was strange. The child either fell or was knocked down, and whilst on the ground the dog bit the child in the right popliteal space, which was bare.

A man who saw the accident, and had had some acquaintance with poisoned wounds in India, sucked the bite, and took the child home. It was taken immediately by its mother to Dr. Crane. He found two wounds, both caused by the same bite, on the right leg; one a deep punctured wound such as might be caused by the canine tooth over the insertion of the biceps tendon, and the other more superficial and nearer the middle line behind. He injected liq. hydrargyri perchloridi, *B.P.*, into the deepest parts, washed the surface with the same fluid, and then cauterised the wounds.

A boy applied to Dr. Crane on the same day who was said to have been bitten by the dog. There was a bruise on his leg, but the skin was not in the least broken. The owner, a man aged 80, came to Dr. Crane on August 27th, 1888. The dog had bitten his hand, and had entirely removed the skin from a surface as large as a sixpence, besides making some scratches and indentations. The bite had been inflicted half an hour before. The animal had been "strange in its manner," and, when he had tried to get it from under the bed, it bit his hand. The dog died in the night of August 27th-28th, 1888. Dr. Crane formed the opinion that the dog had died rabid. He took full notes at the time, and tried to get the carcass or a piece of the spinal cord sent to the Brown Institution, but his efforts were frustrated. The mother summoned the owner, who was fined £1 by the magistrate, and the man who had sucked the wound received a small pecuniary acknowledgment. The child's wounds healed in a few days. Dr. Crane treated the owner for several weeks with per-

¹ BRITISH MEDICAL JOURNAL, January 19th, 1889, pp. 121.