

humerus. Sometimes the anterior fibres of the infraspinatus are probably divided before satisfactory adduction is obtained. The only vessel likely to give any trouble is the anterior circumflex. The deltoid and pectoral are brought together with a continuous catgut suture and the wound closed with a subcuticular thread stitch. The pronators of the forearm, if shortened, should be stretched. In three of my earlier cases the coracoid process seemed to project outwards abnormally and obscure the view, so it was divided temporarily and brought together again at the end of the operation with wire or fishing gut. The glenoid, as is to be expected, is shallower than normal. In a girl of 9 years the glenoid was even convex and a fibro-cartilaginous ridge passed downwards and backwards from it; this was probably an attempt at the formation of a false socket, but its exact extent could not be ascertained.

The arm is put up in the position suggested by Whitman in plaster-of-Paris (Fig. 11). The elbow is put to the side and well back, only a thin layer of wool lying between the arm and chest, the elbow is bent at a right angle, and the forearm is supinated fully and directed well outwards—i.e., the humerus is rotated out fully. I usually put a pad of cotton wool behind the upper end of the humerus and another over the shoulder to keep down the scapula and prevent recurrence of the abduction. The arm is retained in this position for three months, the plaster being renewed when the wound is dressed on the tenth or fourteenth day, and again later if necessary. After removal of the plaster, massage, passive movements, particularly extension of the shoulder, external rotation of the humerus, and supination are persevered in for many months. If only the services of a skilled masseuse can be obtained the result should be excellent. Unfortunately, among hospital patients there are few who can make use of their opportunities for regular massage, so the results I have obtained are not so good as they ought to be. Nevertheless, the results are, in my opinion, sufficiently good to justify amply the operative treatment. In every case treated by open operation the head of the humerus is now in its normal position in relation to the scapula, and the external rotation of the humerus is maintained. (Figs. 9 and 10.) Parents have been satisfied with the advantage to the child resulting from the operation, even in cases that I know could have been much further improved by prolonged and skilled massage, &c. In those few that have received more adequate after-treatment the results are excellent.

It must be remembered that the shoulder joint is probably the very worst joint in which to obtain free mobility in a child. It is well known how readily a child will restore, unaided, perfect movement to a joint after acute arthritis. In the case of the shoulder a young child can do practically anything he wants to without moving the shoulder-joint itself, the scapula being so freely movable. As a result the infant does little or nothing to improve this condition, and, in fact, he hinders the mother's efforts by crying and resisting to the utmost. Nevertheless, the position of the limb after operative reduction enables the child to make much better use of his hand and forearm, the muscles of which are usually healthy.

Finally, it seems to me obvious that massage and exercises are to a large extent wasted on an arm crippled by a subluxation of the shoulder, and that replacement of the head of the humerus in the glenoid cavity must precede all other efforts to restore the function of the limb.

In conclusion, I wish to offer my sincere thanks to the Senate of the University for the honour they have done me in inviting me to deliver this lecture.

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**LITERARY INTELLIGENCE.**—Messrs. Baillière, Tindall, and Cox announce for immediate publication a new edition of Castellani and Chalmers's "Tropical Medicine." The new edition has been revised up to March, 1913. Some 250 new illustrations have been introduced, and the text has been increased by the addition of about 500 pages. The price, however, remains the same.

## A CASE OF ANKYLOSTOMIASIS IN BIRMINGHAM.

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A MINE foreman, aged 42, was sent to me by Sir Havelock Charles on Dec. 12th, 1912, complaining of attacks of fulness with splitting or boring pain in the head which had been troubling him for the last eight months. He had fallen down in these attacks and lost consciousness. For nine years he had been a foreman in a coal-mine in Assam, but returned home in September on this account. On the whole he had enjoyed very good health, with the exception of occasional bouts of malarial fever of the ordinary ague type, but he had had none of these since the hot weather of 1911. Eighteen years ago he was in a mine accident as the result of a fall of coal, but he recovered completely and had had no recent injury. He is married and steady in his habits, taking very little alcohol; he denies syphilis. A year ago he was treated for "hook-worm disease."

On examination he was a well-developed, well-nourished man; complexion dark and pale, but he said he was always pale; his mucous membranes were a good colour; weight, 13 st. (he was 11 st. 6 lb. before leaving India); pulse 72; blood pressure 124; knee-jerks lively; physical signs normal; tongue clean; teeth mostly artificial, no stumps; hæmoglobin 80 per cent.; urine acid, no albumin, no sugar. The ophthalmoscopic appearances were negative, and there was no history of epilepsy. On being further questioned he said the attacks came on generally when he rose suddenly to his feet, but might do so when he was sitting quietly in his chair. As nothing else could be found to account for his symptoms it was suspected that ankylostomiasis might still be present.

On Dec. 11th he was given thymol, 60 gr., divided in two doses, and on examination of the stool passed subsequently a male and a female ankylostomum (*Ankylostoma duodenale* Dubini) were found together with numerous ova. There were traces of blood in the stool. The treatment was repeated on the 27th, when the small smear of faeces sent to me afterwards contained numerous ova but no worms. The thymol was repeated again on Jan. 10th and 24th. As ova were still numerous he was admitted into a bed at the Birmingham General Hospital, placed at my disposal by Sir Robert Simon. The blood, examined by Dr. O. M. Holden, resident medical officer, showed: Red cells, 4,400,000; leucocytes, 7560; hæmoglobin, 80 per cent.; colour index, 88. Differential count of leucocytes: polymorphonuclears, 72; eosinophiles, 6; lymphocytes, 20; and large mononuclears, 1.

The patient said that his head attacks had been less frequent, but as the ova were still abundant the thymol treatment was repeated on Feb. 7th. On the following day one worm was found in the stool, which also contained a little blood. Mr. James F. Brailsford, of the Public Health Laboratory, University of Birmingham, who undertook to examine the stools, subsequently found two more worms, as well as numerous ova of ankylostomum and of trichocephalus. The patient complained that the thymol treatment caused a good deal of burning pain with subsequent depression; his urine was darkened with it. The dose of thymol on the last three occasions had been increased to 90 gr. On account of these disagreeable results it was decided to try oil of chenopodium, recommended by Schueffner as having proved satisfactory in the treatment of this disease in the Dutch East Indies. The dose given was 30 m in 5 m. capsules—three capsules at 8 A.M. and three more at 10 A.M., preceded and followed by purges as with thymol. It was tried on Feb. 19th and 21st, but no adult worms were found, although numerous embryos and ova were seen. He was allowed to go home after the second dose.

The thymol treatment (90 gr.) was continued at home. On March 1st the patient reported that he had had another slight giddy attack. On the 11th he took 120 gr. of thymol; ova and embryos were still present. On the 25th the above treatment was repeated, but the stools on the 27th still contained ova and embryos. On the 31st he was given eucalyptus and chloroform, as recommended by Dr. C. W. Daniels—

eucalyptol 30 m., chloroform 45 m., castor oil 10 drachms, divided into two doses taken at an interval of one hour, and preceded and followed by sodium sulphate as before. He complained of the mixture as very nauseous, and had vomited slightly after the second dose. Three days later he suffered from palpitation, which lasted four days, and when seen by me on April 10th his pulse was 60, but intermitting every fifth or sixth beat. Ova and embryos were still present in the fæces. Whether the cardiac disturbance was the direct effect of the eucalyptus oil or the indirect result of the gastritis set up by the mixture I cannot tell, but in either case I did not think it advisable to repeat it, and have returned to the use of thymol.

Five years ago Professor Ralph Stockman, of Glasgow, published a case of ankylostomiasis in a miner living in the west of Scotland who had been a soldier in India and apparently had been infected in that country. He showed the signs of marked anæmia, his hæmoglobin being only 28 per cent. After three doses of 20 gr. of thymol and a course of Bland's pills his blood became normal and ova disappeared from the fæces, or their presence was no longer looked for.

The method of administering thymol which has been followed is that recommended by Dock and Bass, the drug being finely powdered with an equal quantity of sugar of milk and given in cachets or capsules; 1 oz. of sodium sulphate is given the previous night, and the same amount two hours after the last dose of thymol. The dose of thymol has varied from 60 to 120 gr. Fasting has also been insisted upon during the day preceding treatment, although the patient has been allowed to drink hot or cold water, soda water, milk and water, bouillon or bovril; and on the second day no food was allowed until after the final dose of sodium sulphate had been taken. The patient was kept in bed until after the bowels had acted in the afternoon of the second day, but he was advised, although not compelled, to stay in bed the whole of that day. I found the patient was generally more or less upset by the thymol; he felt ill, often complained of burning pain behind the sternum, and his urine was dark, so that he was usually content to stay in bed.

Ankylostomiasis is common in Assam, where its prevalence among the coolies on the tea-gardens has made it of considerable economical importance, owing to the reduction of efficiency in the working capacity of affected persons as well as to its by no means inconsiderable mortality. A warm, damp climate like that of Assam is especially favourable to the worms, as the ova require heat and moisture for their development after their escape from the bowel. They hatch and the embryos grow rapidly in warm mud, whence they are readily transferred to the naked feet and legs of Indian coolies. It is now believed that the larvæ gain access to the body by penetrating the skin, and that this is the most usual mode of infection. Penetration of the skin is an affair of minutes only—four minutes according to one estimate (Bass). Looss accidentally infected himself by allowing a drop of a culture of the larvæ to fall on his hand; a few minutes later he felt a lively itching and scraped the surface of the skin, which under the microscope showed a number of empty moults or discarded outer coverings of the embryos; three months later ova were found in his stools.

In answer to my questions the patient assured me that he had never gone about with bare feet or with any part of his body unclothed except his face and hands, but as portions of the mine under his supervision were some miles from his bungalow he was in the habit of taking food in his pocket to eat for lunch, so that it is probable that infection in his case has been by the mouth. It is possible that the skin of his hands might have been infected, but as infection of the skin is signalled by a rash (ground itch, Bentley), which he denies having had, infection by the mouth is more probable.

The symptoms shown by this patient are unusual. Vertigo, noises in the ears, mental depression, and apathy have been commonly observed and attributed to anæmia, but the report on the blood and the state of the mucous membranes are inconsistent with this explanation of the attacks. If the symptoms depend upon the presence of the parasite, as I believe, it is more likely that they are the effect of a poison secreted by the worms comparable with that which is formed by bothriocephalus. "Giddiness, epileptiform seizures, chorea, hallucinations and other neuroses" have been attributed, apparently with justice, to the presence of tapeworms;

hysteria, convulsions, and chorea to threadworms; vertigo, hysteria, convulsive seizures, and mental disturbance to round worms; but in the accounts of ankylostomiasis the references to nervous disorders are scanty. Brumpt mentions vertigo, noises in the ears, impaired vision, mental depression, and apathy; Manson, tinnitus, vertigo, dimness of sight, mental apathy, and depression; Dock and Bass, headache, dizziness, mental dulness, insomnia, loss of knee-jerks, impotence, diplopia, nystagmus, and melancholy; Austregesilo and Gotuzzo have reported a case of delusional insanity cured by expulsion of the worms; and Macdonald has met with "moral perversity." But all these symptoms are such as might be caused by anæmia or by greatly impaired general health, which is often profoundly affected, but my patient's aspect is healthy; he has gained nearly 2 st. in weight since leaving India, and his organs of digestion and assimilation appear to be performing their work perfectly.

The presence of traces of blood in the stool is in accordance with the usual experience. The evidence in my case was a positive reaction with Boas's benzidine and peroxide of hydrogen test, but the amount was small. The worms undoubtedly suck blood and their alimentary canals are often full of blood when they are expelled, but the quantity lost by the host in this way is not estimated to be serious. It is supposed that the worms shift their position, frequently leaving wounds which bleed; some suppose that a more important cause of anæmia is the presence of a hæmolytic toxin demonstrated by Whipple, and the toxic effect is greater than the loss of blood. Looss believes that the worms not only suck blood but feed on the mucosa, but Dock and Bass express some doubt of the frequency of this occurrence.

The amount of eosinophilia present in this case was slight; it is now recognised that this blood change is most significant of parasitism, but it is not constant and may be absent in quite severe cases (Dock and Bass). In Stockman's case the eosinophilia varied from 12 to 43 per cent. of the total leucocytes. Boycott and Haldane in their report on the outbreak of the disease in Cornwall do not refer to this point. According to Dock and Bass the presence of eosinophilia shows that things are not so bad as they might be, and, in fact, they regard a rise of the eosinophilia as of good prognosis, while a fall is bad.

There was in this case no epigastric pain. This is a gnawing discomfort which patients seek to relieve by eating earth or coffee grounds or by chewing tobacco or gum (resin); indeed, in the Southern States of America doctors are said (Dock and Bass) to recommend tobacco chewing as a remedy.

The case illustrates the difficulty of successful treatment, for although the patient has taken remedies at intervals on an average of 14 days during the last five months ova are still discharged in the fæces, and therefore living females must be present in the bowel. As the worms do not develop in the intestine, the eggs undergoing no change until they reach the external air, and as my patient knows how to take proper precautions to prevent reinfection, I hope that a cure is being slowly reached; his head attacks have ceased entirely, and he maintains the same weight (April 29th, 1913). He is not at work, and has not been since his return to England. I have been disappointed at the small number of worms seen in the stools after each treatment; at no time have I found more than three worms in a single stool.

Owing to the need of a high temperature for the incubation of the eggs there is little fear of their developing in our northern climate except in mines, where the temperature is, of course, higher than on the surface of the land. Happily, so far it is only the Cornish miners that have become infected, and as they keep to their tin mines, and do not migrate to work in coal mines, the disease has not spread beyond Cornwall. If it did, there is no reason for supposing that it would not permanently infect the mining population in England as it has done in Belgium and Germany, and once the disease has become established it is extremely difficult to eradicate. As many of the harbourers of these worms present no symptoms yet are a source of danger by spreading the disease, it would be necessary to examine every individual in a mining population and to put all the infected persons under treatment, isolating them until it was proved that their fæces contained no ova. It is doubtful whether such a radical method of treatment would be practicable; it would certainly be very expensive.

Owing to the grave danger of allowing a carrier of this

infection to return to work, the treatment will be continued until the ova disappear from the fæces.

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Birmingham.

## RADIUM EMANATION THERAPY.<sup>1</sup>

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IN speaking of radium therapy it is best to distinguish between radium therapy in the narrower sense and radium emanation therapy. It is well known that in the former, which may be assumed to be most in vogue in surgery and dermatology, very strong radium preparations are used; the effect is produced by the rays emanating from the radium, the  $\alpha$ ,  $\beta$ , and  $\gamma$  rays. The effects in question are, therefore, very strong; they resemble those of the X rays of the Roentgen therapy. As examples I may mention the radiating of skin diseases of the most malignant and obstinate type, including even lupus and cancer—in which this treatment is often startlingly successful, and also injections in the case of malignant tumours, and recently in diseases of the hematopoietic system. In these two examples we have at the same time paradigms for the biological effect of the radium salt on the living tissue, which effect is twofold, namely, irritant—i.e., inflammatory and producing hyperæmia—and, secondly, destructive. In the application of radium emanation, the second kind of radium therapy, called radium emanation therapy, we have a weakened effect. This therapy most interests those who have to deal with internal diseases, and it is of this that I wish to speak in this article.

At Kreuznach, formerly known only for its brine mother-lye baths, a certain amount of experience as to the nature of the radium emanation and the manner in which it acts has been acquired during the five years that have elapsed since the systematic practice of radium emanation therapy began; and during these five years the Kreuznach physicians have endeavoured to give themselves and others some account of their experience in an annual collection of essays, the so-called “Radiologische Mitteilungen” (“Radiological Communications”). Not only does Kreuznach possess highly radio-active springs, it is also able to prepare very valuable radium solutions out of the residue obtained in the production of mother-lye; it possesses the only radium factory in Germany.

A number of investigations as to the biological effect of the radium emanation have been made and reported, which do not, indeed, yet give any unobjectionable explanation of the clinical results of the radium emanation therapy, but do justify the hope that such an explanation will one day be found. The nearest approach to a solution of the problem seemed to be made during the investigation of the effects of radium emanation on certain body-ferments or on processes in the human or animal organism in which, according to the present teaching of science, enzymotic forces must be supposed to play a part. The actuating influence of radium emanation on the pancreatin, the peptic ferment, and the autolytic ferment is known. The explanation of Van der Velden's observation that radium emanation strikingly increases the coagulability of blood may also be that emanation exercises an actuating influence on certain ferments operative in coagulation.

We may assume a similar influence when we hear that Richet was able to promote the fermentation of lactic acid by a slight dose of emanation and to retard it by a stronger one. The same may be said of the fermentation of yeast, in which an exactly similar, partly retarding, partly promoting effect under the influence of different doses of emanation has been observed.

Von Noorden and Falta believed a connexion to exist between these fermentative processes and what they

observed of the behaviour of the white blood corpuscles under the influence of radium emanation. In the human subject they found after emanation treatment a rise in the number of the white blood corpuscles and then an increased decay. They concluded that, as the white blood corpuscles were supposed to be the seat of the ferments, such a connexion was possible if the actuation of the ferments was really to be regarded as an essential effect of the radium emanation.

These biological influences at any rate show that the relation of radium emanation to the radium preparation as such somewhat resembles that of a concentrated medicament of very violent physiological effect to a diluted one; in the former very strong, violent biological effects, demanding the utmost caution in determining the dose and in the manner of application; in the latter a weakened effect, allowing us to apply the remedy more fearlessly. In certain circumstances the radium rays destroy the tissue, whereas the radium emanation actuates and promotes the processes in the body. In the same sense the increase of the phagocytosis, recently ascertained by Laqueur, is to be valued. Here, too, the question was of therapeutically applied doses. The fact that radium emanation has a retarding effect on the growth of several kinds of bacteria, including pathogenic ones, or even kills them, has been harmoniously ascertained in several different quarters. It cannot be turned to therapeutic account without more ado, because in the test-tube experiment comparatively high doses were given; but it is biologically interesting. Contrariwise Falta and Schwarz have ascertained by experiments in the field of vegetable physiology that even large doses of emanation may have a furthering effect on a physiological process. Emanation has an intensely furthering influence on the growth of oat germs.

It has also been ascertained by Plesch that the maximum pressure of the blood sinks under the influence of radium emanation, and that in some of the cases examined the medium pressure decreased, so that a diminution of the work done by the heart must be assumed. In many persons emanation increases the gaseous interchange, frequently also the elaboration of albumin. Finally, Kikkoji and Bernstein say they have ascertained an increase of the combustion of sugar.

We see, then, that in many cases the effects of radium emanation in experiments and in practical application run parallel. We find that it has an intensely stimulating effect on all the factors of assimilation, that it enhances, as it were, the vital processes. In this sense also I interpreted the results of a series of experiments which I made two years ago. Originally induced by the favourable effects of radium emanation on sufferers from gout, and following von Logham's example, I produced artificial tophi in rabbits. I injected liquid preparations of uric acid into the subcutaneous connective tissue, and observed the behaviour of the deposits under the influence of emanation. Untreated control animals with the same deposits served as objects of comparison. The slow resorption of the deposits which set in in obedience to physiological laws was quite considerably accelerated under the influence of radium emanation, the effect becoming noticeable within 24 hours. At the time when the experiments were made one might have been tempted to regard this phenomenon as a specific effect on gouty deposits, for at that time Gudzent's experiments had not yet been tested. It is known that Gudzent believed himself to have demonstrated that uric acid is found in the blood as urate of mononatrium, and that in two forms—a stable and a less stable one. Under the influence of emanation he found in the test-tube a transformation of the former form into the latter, and believed that in this phenomenon he had discovered an explanation for the removal of the uric acid from the organism, which is really observed. The experiments have been tested in two quarters and not confirmed. This, as is known, was one of the things that led to the rather vehement discussions of last spring, which somewhat discredited the emanation therapy. Unfortunately, or rather, not quite justifiably, for, firstly, Gudzent's experiments were afterwards confirmed. In Madame Curie's laboratory Mesernitzky, who conducted his investigation somewhat differently, found the same results. He worked, it is true, with very high doses of emanation. The question must be declared at least undecided.

<sup>1</sup> A lecture given at a clinical meeting of the Municipal Hospitals at Dortmund.