

improved. Routine treatment was given in addition to the sensitised vaccine. The bubo suppurated and was opened on the 15th day of the disease. The patient recovered.

*Case No. 9.*—Kishan Singh, recruit, 2nd Guides, aged 25. *Inoculated against plague on 3rd October 1923.* The general condition of the patient on admission was good and remained good throughout. The bubo was in the left groin. The bubo suppurated.

The patient developed secondary syphilis and was given a dose of N.A.B. The patient recovered.

*Case No. 10.*—Kalu, sweeper, 1st Guides, aged 25. *Not inoculated against plague.* Bubo on the right side of the neck. The general condition of the patient was good on admission, but the pulse was quick. He came to hospital on the first day of the disease. After the first injection of sensitised vaccine the temperature fell to normal, and the pulse improved.

Other routine treatment was carried out. The bubo suppurated. The patient recovered.

*Case No. 11.*—Gurra, sepoy, 1st Guides, aged 25. *Not inoculated against plague.* Bubo in the right groin. The general condition of the patient on admission was fairly good. The first injection of the sensitised vaccine brought the temperature down and it ultimately came down by lysis, and the pulse improved. The bubo suppurated. Other routine treatment was given as well. The patient recovered.

*Case No. 12.*—Wife of Karm Chand, private case, aged 20. *Not inoculated against plague.* Bubo in the left groin. On admission the pulse was 120, temperature 105° F., drowsy. Was first seen on the third day of illness.

16th November 1923.—Tongue was black with fur, but the patient was feeling a little better.

17th November 1923.—Condition the same, has developed another bubo in the left femoral space.

18th November 1923.—Temperature came down to normal, and patient feeling better.

21st November 1923.—On the night of the 20th an abortion took place, no one was attending the case properly and she fell from her charpoy. She died at noon.

*Case No. 13.*—Tara Chand, private case, aged 10. *Not inoculated against plague.* Two buboes in the groin (left). On admission the pulse was 105, temperature 103° F., drowsy.

15th November 1923.—Was feeling better and complaining of great thirst.

17th November 1923.—This evening the temperature came down to normal.

21st November 1923.—The patient was feeling better, no pain in the buboes, but complained of a little pain in the arm where the vaccine was injected.

The patient recovered.

*Corrigendum.*—In the list of contributors in the index to volume lviii, for Stoker, C. J., please read Stocker, C. J.

### THE USE OF INTRAVENOUS INJECTIONS OF IODINE IN THE TREATMENT OF SEPTICÆMIA AND OTHER SEPTIC CONDITIONS.\*

By F. P. CONNOR, D.S.O.,

LIEUT.-COLONEL, I.M.S.

My first experience of the value of intravenous injections of iodine in the treatment of certain pathological conditions dates back

\* Being part of a paper on "Some Surgical Points of Interest" read at the meeting of the Medical Section of the Asiatic Society of Bengal on the 12th of December 1923.

to the winter of 1910 to 1911. The report of my early cases is contained in the *Journal of the London School of Tropical Medicine*, Vol. II, 1912-1913, page 148. These early experiences were confined to bubonic plague, which was then prevalent in epidemic form in the Gaya District of Bihar and Orissa.

The first case treated was an Indian police constable, who was admitted into the police hospital at Gaya suffering from plague. Plague bacilli were found in smears made from the fluid drawn from the enlarged femoral glands and were also present in the peripheral blood. The patient was semi-conscious and had a temperature of 104° F. My previous experience of cases as far advanced as this was that they all died.

An intravenous injection of tincture of iodine, m. vii, diluted with distilled water, one drachm, was given and repeated twice the same evening. An improvement in the patient's condition having followed, three more injections were given on the following day. The crisis was passed, and though extremely weak and ill for some days, the convalescent stage was reached, and after suppurating of the femoral bubo the patient recovered.

This case impressed me very much and other cases were treated similarly and are recorded in the article referred to above. Outside the hospital it was found that some cases died a few days after the acute attack had subsided, apparently from sudden heart failure. This is the case in all very acute specific fevers when the patient attempts to get up too soon.

My conclusions at that time were that, firstly, iodine employed in this way had no prejudicial effects on human beings, and, secondly, that it had a distinct effect in helping to save the lives of cases of bubonic plague.

I had at that time no previous knowledge of the effects of intravenous injections of iodine in man or animals, but I was able to ascertain (through the kindness of the late Sir Lauder Brunton, Bart.) that experiments with large doses of iodine, on direct injection into the blood stream, had been made by Boehm and Berg, and had resulted in œdema of the lungs, much hæmorrhagic exudation into the pleura and great engorgement of the kidneys. Also that Davaine had found that, when added to septicæmic blood, iodine destroyed its infective quality in the proportion of 1 in 10,000. Somewhat similar results were obtained by Krajewsky with the blood of anthrax cases.

It was rather hard to believe that less than one drachm of tincture of iodine, injected intravenously in such small doses could combat so severe an infection as plague. But one knows of the enormous value of the

minute amount of iodine present in the thyroid secretion and the results of the above-mentioned experimental work were encouraging.

Ever since 1913 the use of intravenous iodine has become one of the routine methods of treatment of surgical cases of sepsis in my wards, and particularly of such grave cases as gas gangrene, severe streptococcal infections, etc. It is very hard to build up statistics of any value in dealing with such cases. Some of the worst cases recover under any ordinary method of treatment, while some will die in spite of all the methods at our command. At the same time my clinical experience has confirmed my conviction that the intravenous injection of iodine is of value in the treatment of these cases.

During the year following my initial experience of the iodine treatment for plague, the beneficial effects of very small and frequently repeated doses of tincture of iodine by the mouth were widely circulated in the newspapers. This was done, if I am not mistaken, at the instance of some of the workers in the Salvation Army. What the results of this treatment were, I am not in a position to say.

In my own experience of the last ten years, I have not been tempted to increase to any extent the amount of iodine injected at one dose. I have on many occasions increased the number of doses per day and have continued the treatment for several days at a time. It has always seemed to me that even small doses had a considerable effect, and this is intelligible, considering the powerful stimulus which iodine exerts on the thyroid mechanism and probably on other less well-understood mechanisms of the body. Further experimental work is badly needed, as also an investigation into the actual bactericidal power of iodine in the blood of human beings suffering from septicæmic conditions, such as infectious fevers, pneumonia, anthrax, syphilis and many more. My own experience has been almost entirely clinical and has been confined for the most part to so-called surgical cases of grave sepsis.

I was extremely interested to read the results of a great deal of independent work done by Lt.-Colonel W. W. Jeudwine, C.M.G., I.M.S., on this identical subject (*Indian Medical Gazette*, December 1923). We badly need more clinical work of this kind and work in the pathological laboratory also.

Jeudwine has employed intravenous iodine for a large number of affections, most of which have been what would be described clinically as of "septic" origin. He is evidently much impressed with the value of the treatment. He describes some of the

details of his technique in administration and mentions certain difficulties, such as local thrombosis, pain, reaction, iodism. He tells us how most of these can be avoided. I can find no mention of the effects of this method of treatment on syphilis in any of its stages. Considering the marvellous effects of potassium iodide on some of the manifestations of syphilis, intravenous iodine may well be worthy of a trial.

I am informed that no beneficial effects have so far been obtained in cases of kala-azar and of malaria by employing this method of treatment. The long-continued leucocytosis, referred to by Jeudwine, was not observed in these cases.

My object in writing this paper is to draw the attention of other workers to the possibilities of iodine, used in this direct manner, in the treatment of disease. My own knowledge and experience are insignificant and are offered only as a small contribution to the subject.

In the discussion on Colonel Connor's paper Major H. W. Acton, I.M.S., pointed out that one grain of iodine diluted in 5 litres of blood could not possibly act as an antiseptic. He considered that Colonel Jeudwine's results were largely hit and miss. Where hypothyroidism was present, the iodine injected supplemented a deficiency, stimulated the production of thyrotoxin, and was thus of great benefit. The types of appendicitis, for instance, could be classified into (a), those with hyperthyroidism, where there ensued a hyper-leucocytosis and abscess formation; and (b) those with hypothyroidism, where there was no such leucocytosis, and where gangrene often set in. He had recently been studying the action of pressor bases in animals who had been deprived of the thyroid gland, and the results were of great interest. Thus some bases which often acted for only 3 to 4 minutes in the presence of the thyroid, might act potentially for from 10 to 15 minutes in its absence. Probably the intravenous iodine action was related to the thyroid mechanism.

Dr. Bepin Gupta would substitute "endocrinism" for other treatments, try iodine intravenously in kala-azar, and considered that the Mount Everest expedition owed its success—or want of it—to the fact that its members wore beards which protected their thyroid glands!

Dr. U. N. Brahmachari said that he had tried iodine (Iodo-injectule, Robin) intravenously in kala-azar with complete failure. On the other hand he had had encouraging results with it in influenzal septicæmia and in post-influenzal pneumonia. Also with Crook's colloidal iodine intravenously.

Major R. Knowles, I.M.S., stated that intravenous iodine had been tried in cases of kala-azar and of malaria at the Calcutta School of Tropical Medicine, with completely disappointing results. There was no evidence of the hyper-leucocytosis mentioned by Colonel Jeudwine, as a result.

Lieutenant-Colonel J. W. D. Megaw, I.M.S., pointed out that the doses used at the School in these cases had been only 10 to 20 minims of the tincture, and considerably smaller than those advocated by Colonel Jeudwine.

In summing up the discussion, Colonel Connor said that the claims for the drug in septic conditions were very interesting; but obviously much further study was needed. For instance, if its activity depended upon the thyroid mechanism, small doses might be better than large ones.