passes off without giving rise to symptoms. It may, however, be attended with real danger, as the following case shows, for the notes of which I am indebted to the House-Surgeon, Mr. Tatlow:

V. S., aged 19; 1,350 c.cm. of 0.75 per cent. solution injected. The patient was operated upon in the morning for inguinal hernia, the administration of the anaesthetic ceasing at about 10 a.m. On his return to the ward from the theatre it was noticed by the nurse in charge that the patient seemed very "chesty." Between noon and 1 p.m. the patient was pale and the extremities cold. At 3 p.m. the temperature was 100.2°, the pulse 120, and the respirations 35. At 5 p.m. the breathing became more laboured, and the patient was distinctly cyanosed. The throat was full of frothy blood-stained mucus, and was swabbed out. Vomiting was induced by mechanical means, and $\frac{1}{15}$ grain of atropine sulphate injected. The patient soon became relieved; consciousness returned at about 9 p.m., and next morning he was practically free from symptoms. The subsequent progress of the case was uneventful.

(b) *Pneumonia*.—In preanaesthetic days pneumonia was a well-recognized complication of surgical injuries and operations. With inhalation anaesthesia the risk is considerable, especially after the administration of ether. In my series of cases after the injection of hedonal there have been several in which there has been slight bronchitis for a day or two, and others where a severe attack of pneumonia has followed. There have been three fatal results from this complication.

T. W., aged 20. The patient was a well-built young man accustomed to active out-of-door life. Operation on May 9th for recurrent appendicitis; 1,400 c.cm. of 0.75 per cent. solution used. Almost immediately on his return from the theatre the breathing became embarrassed. The pulse was poor and frequent and there was some cyanosis. The patient came round about twelve hours after operation and soon began to complain of pain in his chest. The temperature was raised, the respirations were 40 per minute, and the pulse continued frequent. For a few days the symptoms persisted with little or no abatement. On May 15th the patient began to expectorate with difficulty. The next day the sputum became offensive, and on May 17th I was asked by Sir Berkeley Moynihan to see the case. The patient was extremely ill and presented the anxious cyanosed aspect of a sufferer from pneumonia. On examination a pleural friction rub was detected over the greater part of the left chest, whilst there was dullness at the base behind on the same side with tubular breathing. There were also signs of a commencing bronchopneumonia in the right lung. During the next few days there was some improvement in the patient's condition and the sputum became less offensive, though the temperature, respirations, and pulse-rate still continued high. At the end of a week the patient again became gravely ill. Physical examination at this time showed that the lower lobe of the right lung was extensively involved. The sputum again became extremely offensive and there was a brisk haemoptysis. For several days the condition of the patient caused considerable anxiety, but subsequently he began to improve, and finally became convalescent. He is now quite well.

A. T., aged 31. Cholecystotomy and choledochotomy; 1,300 c.cm. injected; 3 gr. of hedonal were given two hours before operation. As in the previous case, pulmonary symptoms soon developed, and death ensued on the twelfth day. *Post mortem*: Site of operation healthy. The lungs were in an advanced state of confluent bronchopneumonia and honeycombed with small abscesses. No other noteworthy abnormality was found.

(c) *Infarction*.—I have not personally seen this complication, but I have had information of an undoubted case where the embolus was considered to have originated from a thrombus in the vein which was used for the purpose of injection. The complication occurred fourteen days after operation. The patient made a good recovery.

3. Venous.

(a) *Thrombosis at the Site of Injection*.—In the majority of the cases there has been thrombosis in the vein selected for the infusion, usually the median basilic or median cephalic. In many instances this has been shown by a linear staining of the skin along the course of the vein, which could itself be felt as a thick fibrous cord. The thrombosis apparently extended as far as the junction of the vein with the axillary. With the exception of the case of pulmonary infarction already referred to, this thrombosis does not appear to have had any untoward result. The risk of suppuration is, of course, with the usual antiseptic precautions, infinitesimal.

(b) *Thrombosis of the Femoral Vein*.—This is not infrequently met with as a complication of severe illness, and it sometimes follows surgical operation. Thrombosis of the femoral vein has occurred in five of the cases in my series subsequent to the administration of hedonal. I cannot but think that the proportion is too high to be

otherwise than in direct causal relationship to this method of inducing anaesthesia. I quote two examples:

K. D., aged 30. Operation for excision of gastric ulcer; 1,610 c.cm. used. This patient was an unusually long time before coming round. Thrombosis of the left femoral appeared on the fourth day. It should be stated that this patient was very anaemic.

A. E. W., aged 34. Appendicectomy; 1,130 c.cm. injected. Thrombosis appeared on the fourteenth day.

(c) *Cerebral Thrombosis*.—In one of the cases of severe bronchopneumonia a right-sided hemiplegia with aphasia appeared on the sixth day. The symptoms, however, were only slight and after a few days gradually passed off.

SUMMARY.

The technique employed in all the cases has been substantially the same as that described by Mr. Page in his paper read before the Royal Society of Medicine. The usual rate of flow is from 80 to 150 c.cm. per minute until anaesthesia is produced, when the fluid is allowed to run in drop by drop. The best results have been obtained where anaesthesia has been induced fairly rapidly, and it is found that in these cases less of the solution is required.

There is no doubt that hedonal is a very pleasant anaesthetic. Patients with whom I have discussed the matter who have had experience of ether or chloroform much prefer the newer method. Indeed, I have heard of one who, on being told that he was to have ether, declined operation and left the hospital. There is an absence of the feeling of suffocation which patients naturally dread so much, whilst vomiting as consciousness returns is only exceptionally present. Hedonal also provides an excellent surgical anaesthesia.

On the other hand, it is clear that the injection of a powerful drug in large quantities of fluid is not without a very considerable element of risk. When 1,100 to 1,200 c.cm. have been administered the danger zone has been reached. Practically no complications have occurred where a lesser amount has been employed. The oedema of the lungs which results from an overdosage renders them especially liable to infection from the micro-organisms which are constantly present in the mouth and which may readily be inhaled during the period of unconsciousness. Especial care should therefore be given to antiseptic treatment of the mouth and teeth before operation, whilst subsequently, if a large amount of fluid has been given, the upright position is to be recommended. On the slightest symptom of pulmonary oedema vigorous measures should be taken to secure the clearing of the air passages.

In cases in which there has been severe shock or much previous loss of blood—in those cases, that is, in which treatment by venous infusion might be considered—this method of anaesthesia is clearly of advantage.

That especial directions should be given to the nurses in charge of patients who have been anaesthetized with hedonal follows from what I have already said.

Finally, I wish to express my thanks to the members of the surgical staff for kindly granting me access to their cases.

CONGENITAL SYPHILITIC DEAFNESS TREATED BY SALVARSAN.

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THE following case is, I think, of interest, as this form of deafness usually progresses very rapidly in spite of any form of treatment, and usually when the patient has once become deaf no treatment will produce any improvement at all.

A woman aged 22 presented herself on June 8th, 1911, at my out-patient department at the Seamen's Hospital complaining of deafness of five days' duration. Its onset had been sudden, the patient becoming completely deaf within forty-eight hours of the onset of the symptoms. She was brought to the hospital by her mother as she was unable to hear anything herself. Severe tinnitus was present in both ears, but there was no history of vertigo, sickness, or headache. Both tympanic membranes were slightly indrawn and thickened, but there was no fixation of the malleus or impaired mobility of the membrane. Both the nose and throat were normal and no other intracranial nerves were involved. As the patient was

obviously suffering from eye trouble she was seen by my colleague Mr. Bickerton, who reported that old interstitial keratitis was present in both eyes. Bone conduction to all the tuning-forks from C (128 d.v.) to C⁸ (1024 d.v.) on both sides was absent, as also was the hearing by air conduction for all the forks from 3 C 16 to C⁴ (2048 d.v.). Hearing for the very loud voice, the whisper and acoumeter were absent. A Wassermann reaction was immediately performed, and gave a positive reaction. On June 12th an intravenous injection of 0.6 gram of salvarsan was administered by Mr. Porter, the resident medical officer at the hospital. On June 15th the tinnitus was better, and the hearing tests gave the following results: On the left side the conversational voice was just heard, as was also the acoumeter, whilst the C tuning-fork (128 d.v.) could just be heard by bone and air conduction. On the right side the acoumeter and voice could just be heard, and the C fork by bone conduction only. She remained in the same condition on the left side for about four weeks, but the hearing for the acoumeter, voice, and the C fork (128 d.v.) by bone conduction on the right side was lost and never returned.

On July 1st the patient received a second intravenous injection of the same amount of salvarsan, and on July 17th the hearing on the left side was found to be the same as on June 15th.

The patient still continued to improve on the left side, and on September 9th the conversational voice could be heard at 3 in., the acoumeter was just heard, and the patient's bone conduction to the C fork (128 d.v.) was only -20 seconds as compared with the normal, whilst by air conduction it was -40 seconds as compared with the normal. The 1 C 64 and the C¹ C² and C³ forks could just be heard by air conduction.

On September 18th she received a third injection of the same amount of salvarsan intravenously, after which she again improved slightly on the left side, and on October 17th the acoumeter was found to be heard at half an inch and the voice at 5 in., whilst the hearing for the C fork (128 d.v.) by air conduction was now found to be -30 seconds as compared with the normal, that is, an improvement of 10 seconds. The bone conduction for this fork, however, remained the same, that is -20 seconds.

The Wassermann reaction still remains positive in spite of the three injections, and my experience is that it always does so, unless mercurial treatment is administered at the same time.

Unfortunately the right ear fell back after the first injection, but the left ear, as shown by the tests, improved markedly.

Since writing the above notes the patient has had a relapse, the hearing in the left ear completely disappearing again, the patient passing into the same state as when first seen. With inunctions of mercury and large doses of potassium iodide internally the hearing has returned in the left ear, which is now in the same condition as when tested on October 17th. This case, with other cases which I have had under my charge, proves without a possibility of doubt that salvarsan by itself will not cure syphilis, but only the local manifestations of the disease.

LOCAL APPLICATION OF SALVARSAN IN CHRONIC SUPERFICIAL GLOSSITIS.

BY

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PROBABLY the most notable and rapid improvement effected by the intravenous injection of salvarsan is seen in severe or in old-standing ulcerations in the mouth. The following case is instructive in showing that the same may possibly be true of the local application of salvarsan to the mouth, and more especially as it is a case in which there was no history of syphilis, and which got worse under the administration of iodides and mercury.

A. W. D., aged 50, with no history or suspicion of syphilis, suffered with a sore tongue, due to excessive smoking, on and off for twenty years. He had been under occasional medical treatment for his tongue for twelve years.

He came to me on February 15th, 1912, with chronic superficial glossitis, the tongue was fissured and was bald of papillae on most of the left side. Just to the left of the middle line of the dorsum there was a raised circular growth $\frac{3}{4}$ in. in diameter surrounded by a sulcus. The growth and substance of the tongue round about were hard. The left margin of the tongue was ulcerated, and there was an ulcer on the dorsum the size of a threepenny-bit. The tongue was so sore and painful that the patient had great difficulty in eating. For two years he had not been able to eat any fruit owing to the pain. His dietary was restricted to the blandest of foods, and those he took with discomfort, but he was still continuing to smoke. Since he came to me he has given up tobacco completely.

I painted the growth with cocaine and snipped it off, and received the following report on it from the Laboratories of Pathology and Public Health: "This small nodule shows thickening of the squamous epithelium, and the processes

which dip into the underlying tissue are hypertrophied. Some of these processes give rise to some suspicion. Their outline is indefinite, and in one instance at least there is an appearance of the cells having spread out from the base of the process and they appear to be invading the surrounding tissues. The latter are infiltrated with the small round cells. While entertaining grave suspicions of this growth we cannot say there is conclusive evidence of malignancy." A Wassermann reaction was not done on the score of expense.

The patient was put on potassium iodide and liq. hydrarg. perchlor., working up to 12 grains and 1 drachm respectively three times a day. The places were painted judiciously with chromic acid, picric acid, and once with the acid nitrate of mercury, and an alkaline mouth wash was used frequently every day. By the beginning of April the tongue was worse, the ulcers had increased in size, bled readily, and the patient had great difficulty in eating, and was losing weight and becoming anaemic. I then stopped the biniodide of mercury, and gave him a tonic. The pain became somewhat easier, but the central ulcer, where the growth had been removed, began to proliferate, and became again raised above the surface.

I sent him to Guy's Hospital, where he was seen by Sir Alfred Fripp, with a view to removing the diseased area. I had read in McDonagh's book on *Salvarsan in Syphilis* that salvarsan had been used locally in cases of stomatitis, which is usually due to spirochaetes of all sorts, and that another mouth organism, the fusiform bacillus, disappears with salvarsan. I asked Mr. McDonagh's advice as to how to apply salvarsan locally, and he recommended a strong solution in glycerine. With Sir Alfred Fripp's concurrence, I proposed to give the tongue a short trial with local applications of salvarsan before finally deciding to have it operated on. I dissolved 0.1 gram of salvarsan (this is the smallest quantity made up, and costs 2s. a tube) in half a drachm of water, and added half an ounce of glycerine. On May 7th I swabbed the whole tongue with this, and more especially rubbed it into the ulcers. I gave the bottle of solution to the patient, with some cotton-wool, and instructed him to do the same every hour for ten hours, and under no circumstances to use it next day, but to come back for a fresh dose in three days' time. In three days' time the ulcers were 25 per cent. smaller, and the whole tongue was much improved.

The same treatment was renewed on May 10th, 14th, and 21st. A week later, after these four days of painting with salvarsan, and at the end of three weeks from the commencement of the treatment with salvarsan, all the ulcers were completely healed, the fissures had largely disappeared, and the tongue was moderately healthy looking, completely different from its condition three weeks previously. There was, and still is, some hardness to be felt about the site of the original nodule. A few days later the patient had some slight tenderness and smarting along the left margin of the tongue, and there were two small and very shallow ulcers. On June 1st I gave him another dose of salvarsan to paint his tongue with, and on June 4th they had cleared.

This is the only case in which I have had an opportunity of trying the action of salvarsan locally, and I record it so that others may be induced to try it. There is one point on which I would like specific information, and that is as to how long it takes for salvarsan to oxidize into a poisonous salt of arsenic, and whether the amount used in swabbing the tongue would be deleterious to the patient after oxidization had taken place. The amount used in the above case was roughly $1\frac{1}{2}$ grains, dissolved in $\frac{1}{2}$ ounce of glycerine, and of that quantity only about a half was used in hourly swabbings over ten hours. I was nervous of allowing the patient to use the same solution on the following day. He had no symptoms whatever of arsenical poisoning.

The points to emphasize in the case are:

1. The long standing of the glossitis and the rapid proliferation of the ulcer which had been formed by the removal of the nodule.

2. The condition of the tongue became more acute and painful under the administration of iodide and mercury, although the patient had given up all tobacco for over two months.

3. The patient had been under careful medical treatment on and off for seven years before I saw him, and had given up smoking for short periods. He had improved under these treatments temporarily, but his own confident assertion is that his tongue has never been so comfortable or looked so well for ten years as it is at the present time.

4. The extraordinary rapidity of the improvement of the whole tongue. At the end of one week, and after only two days of salvarsan, the ulcers had diminished to one-quarter their size.

There may possibly be a field for similar treatment of chronic inflammations of the nose as well as the mouth, such as old-standing antrum trouble, and it would be useful to hear the opinion of bacteriologists on this subject.