gout. He cannot, of course, tell us whether the leukaemia began before or after that. The breathlessness of the advanced stage certainly came on later.

If we look on the kidney trouble, the gout, and the leukaemia as all following upon the malaria, there would on Garrod's theory be reason to consider the gout as the result of the failure of the kidneys to excrete the enormous amount of uric acid produced by the leukaemia. It is certain that xanthin bodies are found in great quantity in the blood of leukaemics, and their urine, which is generally free from albumen, shows a great excretion of the purin bodies, and a notable excess of uric acid, even $1\frac{1}{2}$ gram daily and upwards, while the urea is little altered. This patient's excretion is very scanty for a leukaemic.

It is open to us to say that the essence of gout does not consist in the retention of uric acid and its deposition in the joints when it is in excess. In short, we may call this process a uratosis, and think of gout as a toxæmia together with an inflammatory reaction which causes the precipitation of uric acid, or shows in some cases no arthritic symptoms. This is after all akin to the old idea of "suppressed gout," but in the present case we have an excess of urates in the blood together with damaged kidneys. Why, then, were they not deposited quietly without inflammatory symptoms, or what was the cause of the inflammation which, according to the toxin theory, preceded and led to their deposition?

We know that in some forms of kidney disease uric acid is found in excess in the blood. Von Jaksch found this was the case in nine patients out of twelve, and the effect of lead in southern England in producing both kidney disease and gout is well known. I say in southern England⁴ for, as Ewart and others point out, lead does not produce gout in Scotland and the north, so that the gout of lead workers must include some other factor. It may be said, too, that retention of uric acid cannot be the sole cause, otherwise gout would be far more frequent in ordinary Bright's disease; and, again, in typical gout the kidney trouble is not always that of advanced or even of definite structural disease. Still, the fact remains that in gouty persons the excretion of the endogenous purin bodies is distinctly low, and when a diet rich in purins is given the excretion does not rise to the extent it does in the healthy, while in an attack of acute gout it fails still more. We know that renal impermeability is not always the same as structural disease, though they coincide in some cases.

If a case of leukaemia, with their huge excess of endogenous purins, can be shown to produce the symptoms of gout when some forms of kidney disease are present, and only then, there is much reason to think that gout depends in some degree on renal failure. On the other hand, there may be in gout some peculiarity of the purin bodies which renders them difficult of excretion. In that case we may yet meet with gout and leukaemia in the presence of healthy kidneys, and the present patient's condition will then be held to be merely accidental. Without attaching too much weight to an isolated case, it is still significant that no one appears to have met with gout or uratosis combined with leukaemia when the kidneys were healthy.

For the careful blood enumerations I am indebted to Messrs. Fred. Leighton and Short.

LOCAL ANAESTHESIA BY NOVOCAIN.

By J. W. PARE, M.D., C.M., L.D.S.,

LECTURER ON DENTAL ANATOMY, NATIONAL DENTAL HOSPITAL, W.

EVERY year the sphere of local anaesthesia is widening. Its use is no longer confined to minor surgery, and general anaesthesia has ceased to be an essential for major operations. Recently great advances have been made in the technique of injection of local anaesthetics; much has been done to ensure their purity, and we have learned the value of combining them with drugs which have a vaso-constrictor influence. Chemists are constantly endeavouring to produce a substance which is anaesthetic but yet non-irritant and non-toxic. Cocaine is an excellent anaesthetic, but it is not safe. There is always an element of uncertainty in its action; with some patients it produces a condition of painful or pleasurable excitement, with others a dangerous degree of respiratory and cardiac

depression. Moreover, it often causes destructive changes in the tissues at the seat of injection. Eucaine is more constant in its action, but it is much less potent. Stovaine was an advance on the older anaesthetics, but it, also, is not without general toxic and local irritant action.

In dentistry the use of drugs which are liable to exert a general toxic action is greatly to be deprecated. It is also most undesirable to introduce irritating substances into the gums for the purpose of ensuring painless extraction, for the mouth is a very septic cavity and any lowering of the tissue vitality may determine sloughing. Twenty years' experience did not give me either certainty or confidence in the older local anaesthetics, for failures sometimes occurred in a most unexpected and disconcerting fashion. Since December 5th, 1906, I have made extensive use of a new synthetic compound called novocain, a combination of an ethyl ester of para-amido-benzoyl with the active principle of suprarenal extract.

I first administered it to a clergyman who preferred not to take nitrous oxide gas, and who wished me to use cocaine. As I thought he was not a suitable patient for that drug I explained to him that I had a new substance which I had been told was safer and more efficacious. The tooth was a left superior wisdom, very much broken down, and quite firm; as the position was not an easy one, I had to use the mouth mirror to enable me accurately to insert the needle. The patient was delighted with the result, and declared the pain of extraction was very slight. Considering the difficulty of the injection, I was encouraged to proceed to an exhaustive trial of the drug. I did not specially select my cases. They were all either unsuited or unwilling for general anaesthesia. The following are a few of my most interesting experiences:

CASE XIV.

A medical man with a fractured left superior first molar declined "gas," and I am very glad he did, for I could not have extracted his tooth within the time one gets with a "gas" anaesthesia. I believe this was the most difficult extraction I have ever done. The crown broke off level with the gum in such a way that the palatine blade had to impinge on an inclined plane, with the result that I could not move the tooth outwards owing to slipping of the inner blade. I tried several times; between each attempt I expressed my regret, while he smilingly reassured me that he felt nothing. Eventually the roots separated, but even then I had difficulty owing to their curves. Afterwards he said he had felt nothing till the last root was being extracted. One injection of $\frac{1}{4}$ grain had ensured complete anaesthesia for almost twenty minutes.

CASE XII.

This patient was very neurotic and her teeth were very firmly fixed. In 1894, when she first came under my care, the futility of "gas" anaesthesia in such cases was distressingly borne in upon me. I subsequently removed the remaining teeth then requiring extraction under ether, but the patient was considerably collapsed for some hours after the anaesthetic. In February, 1907, I painlessly extracted at three sittings all her superior premolars, canines, and incisors with the aid of novocain. There were no untoward after-effects whatsoever.

CASE XXI.

This patient was a surgeon who, in the hard palate, had, arising from a first left superior molar, an abscess which was extremely sensitive to the slightest touch. A 10 per cent. solution of novocain was kept for six minutes in apposition to the surface of the abscess, which was then incised. There was absolutely no pain; the patient said the sensation of the knife cutting the abscess wall was distinctly pleasant. This case indicates the value of novocain for other than purely dental operations.

CASE XLII.

This patient was a medical man, whose left superior wisdom tooth presented the following condition: In the buccal roots the nerve was alive and hypersensitive; in the palatal root the nerve was dead and septic. I used novocain pressure anaesthesia, and painlessly drilled out the live nerve. Thus I was able painlessly to perform one of the most agonizing operations in dentistry. Sometimes I have applied novocain by pressure to live nerves and then immediately removed them without pain, but, owing to the position of the cavity, the application may be very difficult, and the procedure is not always possible.

As I gained experience my initial diffidence in the use of the drug gave way to complete confidence. Standing before a mirror, I have injected novocain into my own gum and painlessly removed a firm and offending right inferior incisor.

As my further experience of this drug has been consistently satisfactory, and as most of my 70 cases, mainly uncomplicated extractions, were uniformly successful, I need not enter into their details; but I had two very instructive failures:

CASE XVII.

This patient had an alveolar abscess in connexion with a somewhat loose tooth. I could not inject much of the fluid without causing considerable discomfort. This was an early case. I have since improved my technique. Under similar circumstances, I would first anaesthetize the gum by applying to it a 10 per cent. solution of novocain before I began the injection.

CASE VIII.

This patient, aged about 55, had always hitherto had nitrous oxide gas. I injected novocain around the left inferior first molar, which I then extracted absolutely without pain. Two days later he wished to have a left inferior second bicuspid root removed in the same way. I injected novocain into the gum around it. The tissues were loose from inflammatory changes, and fluid penetrated easily and some escaped by the adjacent empty socket. The patient wished he had had "gas."

I had previously observed that on injection with novocain the gum became blanched and of a cheesy consistency. Neither of these changes were observed in Case VIII. I consider them to be the index of successful application, for they show that the drug has concentrated its action at the site of injection, and has not become diffused through the tissues or absorbed into the lymphatics. I would never now attempt an extraction in absence of blanching of the gum.

In no case in which I have used novocain have I had the slightest anxiety about the condition of the patient; there has been no shock, fainting, perspiration, nor collapse, and the patients have felt no after ill-effects. Where possible I advise the patients to take food before the extraction, because I think that after food they are in a condition better able to resist shock. From my experience, I am of opinion that where novocain fails to anaesthetize a part it is owing to imperfect application of the drug. When the gum is swollen from inflammatory exudation, it is most difficult to get the blanching and cheese-like consistency. The same difficulty may be experienced where the gum over the alveolus is unusually thin. My procedure is as follows:

1. I give the patient half a pint of warm carbolic lotion with which vigorously to wash out the mouth so as to reduce its septicity.
2. The all-metal hypodermic syringe (with vulcanized "vela" rubber packing), needle, glass measure, glass mortar, glass mixer, are all placed in hot water to raise the temperature to that of the patient.
3. If the patient is neurotic, a swab containing a 5 per cent. solution of novocain is put on the gum for five minutes, so as to render the latter insensitive to the insertion of the needle.
4. One or two novocain suprarenin tablets, each containing $\frac{1}{4}$ grain of novocain, are dissolved in 33 minims of hot water to make either a 1 or 2 per cent. solution respectively.
5. Hot water is passed through the syringe and needle, the novocain solution is drawn up into the syringe, and the syringe inverted to allow the air bubbles to rise into the needle, from which they are easily displaced by pressing the piston.
6. If an upper tooth, for example, is to be extracted, the needle is inserted into the gum $\frac{1}{4}$ in. above the cervical margin, and a drop or two of the novocain solution is forced in; I keep the needle in position a few seconds to allow the anaesthetic to act before forcing any more fluid into the tissue. After forcing in the solution the needle should not be immediately removed, because if this is done then, owing to the pressure being greater in the gum than outside, some of the fluid will escape. If the position selected is a good one (between the roots is better than over them), the gum will gradually blanch and become the consistency of cheese; the needle should then be removed and again inserted just inside the periphery of the blanching, and so on, till the whole of the gum on both sides of the tooth is anaesthetized. I do not hurry the injection, but take about three to five minutes for the process. The tooth can then be extracted. I have so far

never used more than three tablets (1 grain novocain) at one sitting.

I use an all-metal syringe with a solid piston of uniform diameter throughout its length. It is called the Imperial syringe, and can be obtained at the dépôts. The packing should be vulcanized "vela" rubber, not leather. The needles are boiled immediately after using, and kept in absolute alcohol till again required. They are screwed on to the nozzle of the syringe with a wrench, so that the junction is very tight; by this means fluid cannot escape at the junction of needle and syringe, as it usually does in most of the other syringes. For painless injection a Schimmel needle is almost a necessity. It is as superior to the ordinary hypodermic needle as the new tooth forceps are to the old. I make up my solutions fresh for each patient; there is no safety in a stock solution.

In conclusion I might summarize the advantages of novocain as follows:

1. It produces a perfect local anaesthesia.
2. The duration of the anaesthesia is longer than that of cocaine.
3. Even in strong solutions it does not irritate the tissues.
4. It is at least equal to cocaine in anaesthetic power.
5. It is many times less toxic than cocaine, in comparison with which it can be used in larger doses with perfect safety.
6. It is very constant in its action.
7. It does not produce shock, cardiac or respiratory failure, after-pain, nor sloughing of the gum.
8. It can be given immediately after food.
9. It is not a secret preparation, but a substance of known and definite chemical composition.
10. It is cheaper than most proprietary anaesthetic preparations.

I do not say that novocain should always be used in preference to "gas"—in children and in hypersensitive patients "gas" has obvious advantages; but on the other hand where patients are afraid of "gas," where from the physical condition of the patient or from any other cause "gas" is contraindicated, or where the extraction is likely to be prolonged, and the solution can be perfectly injected, I think that the safest and most perfect of known local anaesthetics should be used, and that drug, in my opinion, is novocain.

REGENERATION OF NERVES WITH REGARD TO THE SURGICAL TREATMENT OF CERTAIN PARALYSES.

By C. J. BOND, F.R.C.S.,

SURGEON TO THE LEICESTER INFIRMARY.

I HAVE read with much interest the report in the BRITISH MEDICAL JOURNAL of April 27th by Mr. Basil Kilvington on an investigation on the regeneration of nerves with regard to the surgical treatment of certain paralyses, in which, after describing experiments on animals, he refers to the surgical possibilities of intraspinal nerve crossing, and records an attempt to carry out intraspinal anastomosis in the human subject, which unfortunately, owing to the presence of cicatricial tissue, had to be abandoned.

Mr. Kilvington's observations, founded on experimental work, appear to me to be a valuable attempt to open up a new line of treatment, and one affording further possibilities of benefit in cases of a hitherto peculiarly hopeless character; and in connexion with this subject I wish to record the following facts:

On March 29th, 1904, I performed the following operation on a patient at the Leicester Infirmary. A man, aged 46, had been struck in the back by the buffer of an engine twenty days previously, and sustained a fracture dislocation of the lowest dorsal and first lumbar vertebrae, with crushing of the cord and complete paraplegia. Laminectomy was performed, the neural arches of the last two dorsal and first two lumbar vertebrae being removed, and the dura mater laid freely open. Finding that (as was expected) the cord was completely divided, and acting on a previously-considered plan, I divided the last dorsal nerve-roots intact above the crush on the right side as low down as possible before their exit through the theca, and also similarly divided the first lumbar nerve roots intact below the disorganized portion of cord, also within the thecal canal, and turning these latter upwards I united the cut