reason of the greater wealth of ultra-violet rays in the solar spectrum at those heights. Unfortunately, even this mechanism fails to explain all the clinical phenomena. For example, Case I, during his asthmatic attack, was apparently suffering from acute suprarenal dysfunction; which means either that there was an inadequacy of dopa-substance, or else that the suprarenals were failing to convert it to adrenaline. The fact that he did not pigment in an Addisonian manner does not necessarily indicate the latter; it may have been too slight to be noticeable. He was given suprarenal extract (empirically) by mouth, and this was followed by improvement. But we do not know the real effect of suprarenal extract given by mouth. It may be the adrenaline content that is absorbed, or a ferment—in which the suprarenals are temporarily deficient—for converting dopa-substance into adrenaline. Whichever it may be, the whole scheme breaks down when the patient—on regaining his suprarenal function and normal blood pressure—develops an attack of asthma. One would have expected him to do this earlier, when his adrenaline production was at a low ebb. The only possible (and to my mind rather weak) plea is that he may not have had the allergic provocation

during that time. Then the coma by which Case II distinguished himself cannot be explained by this mechanism.

Summary

1. The beneficial effects of actinotherapy in cases of asthma cannot be attributed alone to the suggestibility of the patient.
2. At present no theory can be propounded which covers all the clinical observations.
3. The most striking clinical observation—that is, the relation between immunity and pigmentation—leads me to propound a theory involving the relation of adrenaline and melanin.
4. It is perhaps noteworthy that in none of these twelve asthmatic patients or in any of the fifty to sixty patients treated by ultra-violet rays for other conditions has pulmonary tuberculosis manifested itself either during treatment or subsequently.

REFERENCES

- ¹ Cumberbatch, E. P.: *British Medical Journal*, July 14th, 1928.
- ² Woods, Sir R. Stanton: *Practitioner*, February, 1934.
- ³ Dale, Sir H. H.: *Control of Circulation in Capillary Blood Vessels*.
- ⁴ Hindley-Smith, J. D.: *Brit. Journ. Actinotherapy*, April, 1929.
- ⁵ Bloch, Bruno: *Arch. f. Derm. u. Syph.*, August, 1917.

SPINAL ANAESTHESIA*

BY

LEO DOYLE, M.B., M.S.MELB., F.R.A.C.S.
HONORARY SURGEON, ST. VINCENT'S HOSPITAL, MELBOURNE

What are the advantages of spinal anaesthesia that we are here discussing it when we have so many other anaesthetic methods? Its main advantage, in addition to analgesia of the operative field, is that it provides a complete relaxation of the abdominal muscles and blocks all passage of nervous impulses from the operation area to the cerebrum. Thus it allows an operation to take place painlessly and without shock, and facilitates the work of the operator by eliminating any possible trouble from straining muscles and from bowel intruding into the area.

This argument in favour of spinal anaesthesia is really sounder than it appears. We are all aware that the patient is the person of first importance in an operating theatre, and that everything done there should be for his benefit alone. It is a perversion of this reasoning that makes many say that spinal anaesthesia is for the benefit of the surgeon alone, and that his convenience has not to be studied before that of the patient. If this train of thought were complete the argument would be unanswerable, for statistics (reliability not guaranteed) can be produced to prove that spinal anaesthesia is a slightly more dangerous form of anaesthesia than gas or ether. However, the extent to which the surgeon's work is facilitated is the extent to which the performance of the operation is rendered easier, and the patient is the one who gets the most benefit out of this.

If a major operation with a definite mortality is rendered easier to an extent which can be measured in fractions of a hundred by the use of an anaesthetic, the danger of which can only be measured in fractions of a thousand, the percentage increase in safety of the operation more than offsets any decimal percentage increase in the danger of the anaesthetic. My argument is that one should not consider the mortality rates of the anaesthetic and the operation separately, but rather in combination.

* Read in opening a discussion in the Section of Pharmacology, Therapeutics, and Anaesthesia at the Annual Meeting of the British Medical Association, Melbourne, 1935.

I am quite sure that in any two series of one major operation performed by one surgeon, one under spinal anaesthesia and the other under general anaesthesia, the spinal anaesthesia series would be better, both as regards immediate and late mortality and as regards smoothness of post-operative course. When it is realized that, in addition to this, there is a complete abolition of the flow of painful shock producing stimuli from the operation area to the cerebrum, then it must be concluded that the use of spinal anaesthesia has much to commend it.

Contraindications

It is convenient to recall first that the contraindications may be classified under the following headings: (1) *cardio-vascular*, low blood pressure and anaemia, angina, and coronary thrombosis; (2) *nervous*, whether organic or functional; and (3) *general*, including septic conditions of the spine and the height of the operative field.

In the presence of some of the above-mentioned conditions—for example, coronary thrombosis, spinal sepsis, and vascular or inflammatory disease of the spinal cord—spinal anaesthesia is absolutely contraindicated. In the presence of the other conditions mentioned it must be used only after the closest consideration, and only if the use of the other forms of anaesthesia available would seem to be fraught with more danger than spinal anaesthesia.

General Indications

The general indications for spinal anaesthesia are any operation below the umbilicus which, by reason of its severity, is likely to produce a condition of surgical shock in the patient, or any such operation in a patient to whom, for any reason, the administration of general anaesthesia of any sort is likely to lead to pulmonary, cardiac, or renal complications. The absolute indication for spinal anaesthesia is an operation taking place below the umbilicus and being of such nature as to involve the possibility of surgical shock or a long operation which would threaten pulmonary complications from protracted inhalation anaesthesia.

Optional Indications

The absolute indications for spinal anaesthesia practically make themselves, and most thinking surgeons will

not have to use any mental effort. It is, however, in the group of what I have, for the sake of argument (argument—for I fear many will disagree with me), called the "optional" indications that there may be room for differing opinions. Some cases are quite suitable for inhalation anaesthesia, but can also be undertaken under spinal anaesthesia; gynaecological cases are typical examples, also inguinal herniotomy, prostatectomy, and haemorrhoidectomy. To switch over this large group of cases from the usual methods of anaesthesia requires much confidence in the safety of this method of anaesthesia. By its gradual introduction to this group of cases I have acquired that confidence. Most of my cases in this category have spinal anaesthesia unless there is some reason why it should not be used.

Another experience that parallels my own may with profit be related here. After some persistent persuading by me Mr. R. F. O'Sullivan, senior gynaecologist to St. Vincent's Hospital, agreed to try spinal anaesthesia in some of his cases. Fortunately there were some good results at the beginning of his series. He continued, therefore, to use the method more and more, without any further persuasion, until now he has reached the stage where spinal anaesthesia is the anaesthetic of choice, and is given unless there are contraindications.

I consider this a most valuable argument, for here we have a series of operations of a very similar type, performed by a surgeon with an established technique. Thus we cut out two of the varying factors which influence the results in my series of cases. Mr. O'Sullivan has continued the method, for he feels that it gives him greater ease of operating, and that this operating gain is reflected in the after-history of the patients whilst in hospital. He is of the opinion that there is much less post-operative vomiting and hardly any distension, and that the hospital stay is definitely shorter.

With this in mind you will wonder how it is that spinal anaesthesia has such an atmosphere of danger around it. I believe that it arose from the days when surgeons used it only for their bad and risky cases. They knew of its earlier and bad reputation, but heard that nowadays, with improved technique and better drugs, it was safer, and so, though they would not try it in routine cases, they used it in their bad and desperate risk cases. It had to be associated, consequently, with a large mortality on account of the type of cases for which it was used, and so the surgeon came to have a feeling that spinal anaesthesia was associated with deaths.

My own practice at present is to use it in all operations for which it is suitable and for which there does not exist any shadow of contraindication—for example, the case for which previously ether was employed. I believe that it has improved my immediate results immensely: there has been only one death which could be ascribed to the anaesthetic. This occurred some years ago, and the post-mortem examination disclosed coronary sclerosis. I have seen exactly the same thing in an inhalation anaesthesia death.

• Herniotomy

There is no doubt that in some cases where muscle plastics are required on the abdominal wall its use, if possible, is a necessity. I refer to those large incisional hernias which with the usual technique are impossible to repair. Spinal anaesthesia renders repair possible and occasionally easy.

It is sometimes my custom to use spinal anaesthesia in operating on the ordinary hernia cases. Needless to say, in incisional hernia, owing to the complete relaxation, the repair is easier and therefore more certain. In direct hernia, again, where a careful muscle plastic is so neces-

sary, the use of spinal anaesthesia allows this to be easily performed. A strangulated hernia is also a very favourable case for spinal anaesthesia, because the relaxation facilitates reduction of the gut, and if necessary the abdomen can be opened without any trouble.

For the ordinary run of inguinal herniotomies the employment of spinal anaesthesia may be described as using a steam hammer to crack a walnut. This is quite justifiable criticism, except that it is usually uttered by the man who, instead of anaesthetizing the lower half of his patient with intraspinal novocain, anaesthetizes the whole of him by inhalation ether. The ideal anaesthetic for this patient is local infiltration, and this I frequently use, but it is a little time-consuming, and not so easy when there is a bilateral hernia. Again, the patients with this complaint are usually healthy young adults, who will take all forms of anaesthesia, including spinal anaesthesia, without any risk at all. Hence I consider the use of spinal anaesthesia is quite legitimate.

Appendicectomy

In acute appendicitis the indications are to remove an appendix, generally swollen and sometimes very friable, without soiling the adjacent bowel and without causing it to rupture. In this connexion I have seen it stated by surgeons of some renown that, rather than struggle with tight muscles, they cut right through all muscle layers to the peritoneum. Their reasoning is right so far as it goes, but by using spinal anaesthesia they would obtain the same excellent view of the appendix without incurring this risk of post-operative hernia.

The relaxation and quiet abdomen of spinal anaesthesia creates the ideal state of affairs for the safe removal of an inflamed appendix. An argument against the use of spinal anaesthesia is that the increased peristalsis produced by it is likely to cause the appendix to rupture. I have never seen this happen, and I believe that the number of appendices ruptured by this means will be far less than the number ruptured by the attempt to deliver it whilst the patient's abdominal muscles are tense.

Prostatectomy

Prostatectomy supplies us with cases where opinions differ. Harris of Sydney has definitely given up spinal anaesthesia, as he felt that he had more post-operative trouble when he was using it than before and since. Devine of Melbourne has expressed to me the opinion that cases of prostatectomy in which he had tried spinal anaesthesia had healed more slowly than others in which he had used ether or gas.

For my own part I like the use of spinal anaesthesia with these cases. I do not use it as a routine, for there are many of these cases which are unsuitable for a spinal anaesthetic, and others are better anaesthetized with gas or ether.

Intestinal Obstruction

This is another condition in which there is divided opinion about the advisability of using spinal anaesthesia. Some say that in very sick people suffering from this disease the risk is too great. To my mind this argument is not valid. I think that this condition provides an excellent example of the advantages to be gained by facilitating the work of the operator. The anaesthesia is so perfect and so quickly obtained that the exploration for the cause of the obstruction proceeds very quickly the necessary operation is performed without having bowel constantly forcing itself over the field; and the wound is sewn up quickly and well, for again one is freed from the worry of intestines forcing themselves into the field.

Pre-medication

Pre-medication is like the telephone or the talkies. One did without it for years and apparently did not miss it; but now it is here—here to stay, and everybody wonders how we got on without it in the past! It fulfils two purposes: first, and to my mind most important, it serves to allay the fears of the patient. I suppose that even the strongest patient in the hands of the best surgeon, and certainly the sick patient who does not know anything about surgery or his surgeon, must feel the fear of death, for it is common knowledge that patients do die on the operating table. Generally also there is the fear of the unknown, which I should say is common to all patients.

The fear of being operated on whilst still conscious is another very frequently expressed fear. All or some of these, not to mention others, are more or less the experience of all patients; some express their fears, others do not, but feel them just as definitely. These fears arise at different times with all patients, but probably begin earlier than most of us suppose. I think that the sooner treatment for them is begun the better and happier will they be. It is my custom to require patients to stay in hospital for two or three days before any operation of any consequence; they are given a bromide mixture during this time. The night before the operation they receive some barbiturate in addition, as this is probably the worst time for the nervous ones.

On the morning of the operation the patient is given morphine and hyoscine in varying amounts, and in divided doses. The hyoscine is injected about three hours before operation time, and the amount varies from 1/100 to 1/300 of a grain. The morphine is injected about one hour before, and the dose ranges from 1/8 to 1/3 of a grain. The smaller doses are for sick or feeble people, and the larger for strong, healthy adults. The average doses given would be: hyoscine 1/150 and morphine 1/6 of a grain. Paraldehyde, with morphine and hyoscine as a preliminary, is given occasionally per rectum. The other idea of pre-medication is to lessen the amount of anaesthetic used in case of inhalation anaesthesia, but in spinal anaesthesia we wish the patient to be definitely sleepy, and not to be alarmed by the noises of the operating theatre.

One feature of spinal anaesthesia which is not good is the spasm of vomiting; it occurs some ten to fifteen minutes after the induction of the anaesthesia. It is doubtless due to the fall in blood pressure occurring and producing a feeling of nausea. A patient who has been well pre-medicated will not be conscious of this nausea, and will probably not vomit.

The case for pre-medication is that it allays the pre-operative fear of the patient, reduces the mental strain of the operation, and makes him impervious to the nausea that accompanies the lowered blood pressure of spinal anaesthesia. I am aware that there is a school which has a decided opinion against pre-medication, but I think all patients should have some pre-medication. If there is any danger of pulmonary complications ensuing as the result of a long period of quiet breathing I like to make the dosage as light as possible.

Technique

My own experience started with tropacocaine, but this has long been dropped in favour of novocain, which is supplied in dried sterile crystals contained in a sterile glass ampoule by the Anglo-French Drug Co., and labelled "neocaine." It is put up in amounts of 10, 12, 15, and 20 cg. My practice is to select a spot for puncture

between the vertebral spines and to anaesthetize the skin with a very fine needle and 2 per cent. novocain solution. The track into the spine is then further anaesthetized with the same solution. A fine-bore lumbar puncture needle is then passed through this area until it is estimated to be close to the dura. The stylet of the needle is then withdrawn and the needle is pushed on gently until it perforates the dura. This perforation can generally be heard.

When the fluid starts to flow a 5 c.cm. syringe is attached to the needle, and 2 c.cm. of spinal fluid is withdrawn. A plug is placed on the needle to prevent the further flow of fluid, and the crystals in the ampoule are dissolved in the spinal fluid by sucking and ejecting it from the syringe. When solution is complete, the fluid is injected back into the dura, and a little barbotage is done. As a rule 1 c.cm. is injected, the cerebro-spinal fluid is again withdrawn into the syringe to 3 c.cm., and the whole is finally injected. Before injecting it is necessary to be quite certain that the end of the needle is lying definitely in the cerebro-spinal fluid. Sometimes the fluid will drip slowly from the needle, but cannot be sucked. In these cases it is better to inject the whole of the solution at one attempt, rather than to try any barbotage. In my experience this has never made any difference to the depth of the anaesthesia.

The lumbar puncture needle is withdrawn, and through the same skin spot some ephedrine (up to 0.5 grain) is injected into the lumbar muscles. The patient is then made to lie down (if he has been sitting), and is turned over on to his back, if he were injected lying on his side, and is immediately placed in a slight or moderate Trendelenburg position. The operation may begin after about five minutes. Occasionally the patient will be able to feel touch but not pain; if he states that he can feel, he should be put to a pain test; towel-clip squeezing generally affords proof that the operation may start.

For perineal operations, haemorrhoids, and cytoscropy I use 10 cg. injected quite slowly below the fifth lumbar spine. For operations on the inguinal region I give 12 cg. into the fourth space; for appendicectomies, 12 cg. into the third space; and, when I desire complete anaesthesia, 15 cg. into the second space.

Post-operative Complications

I have had an occasional case of headache. Such cases are rare, and can generally be cured by placing the patient in the Trendelenburg position for a few hours. I have also had a couple of cases of neck pain; this was rather hard to treat, but passed off fairly quickly. I have seen no cases of eye muscle paralysis or any spinal complications.

I consider spinal anaesthesia to be a method of anaesthesia with a definite field of usefulness, which I think will be found to be more and more extensive with practice. I have presented to you perhaps the more or less biased viewpoint of the enthusiast, and I expect that some will disagree with me.

At the annual meeting of the governors of the Doncaster Royal Infirmary it was pointed out that during the year some ninety-nine patients were treated at the hospital after road accidents, though payment was received in only thirty-six cases. The total expenditure on the new Royal Infirmary in the last nine years had been £198,000 and the total debt at present was £33,000. Nevertheless it was proposed that the scheme for extension of the hospital should be continued. Members of the Board of Management were elected and thanks were expressed to the Board, subscribers, and all supporters of the institution.