it is a not uncommon event, and may account for some of those cases of continual attacks of haemoptysis, with no definite signs of tuberculosis or gross disease, which are met with fairly frequently.

In this communication we have called attention to this triangular shadow, and we have discussed its significance; in our experience the most common lesion with which it is associated is bronchiectasis, and we are in agreement with Sergeant and Wallgreen that the presence of this shadow should always raise the suspicion of a bronchiectasis unless other clinical evidence is forthcoming to clinch the diagnosis of a mediastinal effusion.

Our best thanks are due to Dr. F. G. Chandler for his kind permission to use the notes and skiagram of the case F. R.

REFERENCES.

- ¹ Dieulafoy: *Manuel de Pathol.*, interne 1 (1911).
- ² Wallgreen, A.: *Beit. z. Klin. d. Tuberk.*, 1928, lxxviii, 641.
- ³ Singer and Graham: *Amer. Journ. Roentgenol.*, 1926, xv, 54.
- ⁴ Rist, Frocine, and Jacob: *Annals of Medicine*, 1927, xxi, 144.
- ⁵ Serger and Bodet: *Bull. Soc. Méd. des Hôp. de Paris*, 1927, 742.

EXPERIENCES WITH REGIONAL ANAESTHESIA.

BASED ON 208 CASES IN WHICH IT HAS BEEN USED.

BY

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It is probable, if the discovery of novocain had preceded that of cocaine and of chloroform and ether, regional anaesthesia would by this time have been firmly established as the standard method of averting the pain of operations. Events having occurred as they did, regional anaesthesia has had to struggle against adverse conditions, but has steadily gained ground as safer drugs and improved technique have been evolved. One of the chief obstacles to its wider adoption is the entrenched belief that for major operations general anaesthesia is essential. Early fatalities, due to the use of cocaine, or to technical errors in administration, have done the method much harm. Injections of cocaine or of high titres of novocain (1 or 2 per cent.) have been the greatest errors; death has resulted from intravenous and intraspinal injection. According to Finsterer intravenous injection is easily avoided by adherence to two rules: (1) in regions free from large blood vessels injections should be made only with a moving needle point; (2) in dangerous areas it is necessary to aspirate before injection and repeatedly during injection.

The number of cases (208) here dealt with is too few to suggest conclusions about the relative safety of regional and general anaesthesia, but in this series there has been no death directly attributable to the anaesthetic, and one only in which it is possible that the anaesthetic (spinal) played a part. A survey of the series can, however, give some idea of the value of the method to a general surgeon who is prepared to give some time and trouble to the acquisition of a technique which, though not easy, is fascinating.

Drugs and Solution Strengths.

I have tried novocain, borocain, tutocaine, quinine-urea, and eucupin, and though the first three of these have given satisfactory service, I prefer tutocaine, for the reasons presently to be stated.

Novocain (with Adrenaline).—Novocain has a low toxicity. Solutions of 1 in 400 may be used for infiltration anaesthesia; 1 in 200 is adequate for field-block procedures, and 1 per cent., and in rare instances 2 per cent., for blocking the large nerves. The stronger solutions should be used with extreme caution.

Borocain will give similar results; it is said to be superior for producing surface anaesthesia and to be less toxic than novocain. I can state from personal experience that 10 c.cm. of a 2 per cent. solution may produce toxic symptoms in a patient of lowered resistance. Solutions of borocain have the disadvantage that they are extremely sensitive to slight changes in reaction.

Tutocaine is, strength for strength, more toxic than novocain, but it appears to be much quicker in its action,

and in 1 in 500 solutions has proved a thoroughly reliable anaesthetic. A 1 in 500 solution of tutocaine appears to be as effective for field block as a 1 in 200 solution of novocain.

Quinine-Urea.—I have not given this drug an extensive trial. Used alone it causes initial pain on injection, and it has a tendency to produce oedema, which persists for some time.

All these solutions are made up with normal saline and are sterilized by boiling; adrenaline is added (the synthetic variety will withstand a few seconds' boiling). The solution becomes pinkish; it may be used so long as the colour is not a mahogany; 1 c.cm. of 1 in 1,000 adrenaline is added to each 250 c.cm. of solution.

Classification of Results.

Many difficulties arise in attempting to assess the results of regional anaesthesia, two of the chief being the following: (1) the patients vary greatly in their reaction to a painful, uncomfortable, or an emotional stimulus; (2) it is difficult to assess the quality of anaesthesia where inhalation anaesthesia has been used in combination with regional anaesthesia. All cases in which it has been intended from the first to combine the two methods are classified in the following table as "intended combined." The quality of anaesthesia is classified as "poor" in

Table showing Results in 208 Cases in which Regional Anaesthesia was Employed.

Operations.	No. of Cases.	Intended Combined.	Quality of Anaesthesia.			Technique.
			Good.	Fair.	Poor.	
Major operations on stomach and gall-bladder	26	2	14	—	—	Anterior splanchnic anaesthesia (Braun).
Ditto	5	1	2	1	1	Posterior splanchnic anaesthesia (Kappis).
Ditto	4	—	2	2	—	Mesenteric anaesthesia (Finsterer).
On abdominal wall	15	3	12	—	—	Field block.
Appendicectomy ...	6	—	4	2	—	Field block and mesenteric (Finsterer).
Hernia: radical cure ...	15	—	14	—	1	Field block.
Jejunostomy and caecostomy	5	—	5	—	—	Field block.
Various abdominal operations	50	1	31	12	6	Spinal anaesthesia.
Suprapubic cystotomy	11	—	11	—	—	Field block.
Perineal prostatectomy...	4	—	4	—	—	Trans-sacral.
Suprapubic prostatectomy	3	—	—	3	—	Field block and epidural.
Operations on testicles ...	2	—	2	—	—	Field block.
Urethrotomy	3	—	3	—	—	Epidural 30 c.cm. 1/5% tutocaine.
Cystoscopy in males ...	15	—	14	—	1	Ditto
Excision of breast ...	3	—	3	—	—	Field block.
Empyema	4	—	1	3	—	Field block.
Thyroidectomy: excision of glands of neck	5	—	5	—	—	Paravertebral cervical block.
Perineorrhaphy repair of cervix (D. and C.)	4	—	4	—	—	Field block; broad ligament block.
Haemorrhoids	5	—	4	1	—	Field block.
Operations on upper extremity	6	—	4	1	1	Brachial plexus block (Kulen-kamp).
Hallux valgus; Mayo's operation	3	—	3	—	—	Field block.
Sympathectomy, femoral	1	—	1	—	—	Field block.
Excision of tongue ...	1	—	1	—	—	Field block.
Operations on foot ...	2	—	—	1	1	Anterior tibial and posterior tibial block.
Saphenous varix	1	—	1	—	—	Field block.
Circumcision	3	—	2	1	—	Field block.
Varicocele	2	—	2	—	—	Field block.
Amputation of penis ...	1	—	1	—	—	Field block.
Hydrocele	2	—	2	—	—	Field block.
Operations on hand ...	1	—	1	—	—	Median and ulnar block.

all cases where the administration of inhalation anaesthesia was not intended but became obligatory; in some of these cases the patient's emotional attitude rather than pain was the cause of failure. Under the heading "fair" are included the cases of patients who preferred to endure discomfort rather than to accept the proffered ether, or of patients who accepted ether anaesthesia too light to abolish consciousness. A preliminary explanatory talk was given to each of the patients, and then, as a routine, each patient received, one hour before operation, and again half an hour before operation, an injection of omnopon 1/6 grain, and scopolamine 1/400 grain.

It will be seen that in 163 of the 208 patients the results were completely satisfactory; in 27 they were adequate; and in 11 they were poor. In 7 cases anaesthesia was "intended combined."

Abdominal Operations.

The outstanding advantage of regional anaesthesia is that it facilitates the more difficult upper abdominal operations by securing an immobile abdominal wall and permitting exact suturing. This advantage is more apparent in cachectic patients, who, under regional anaesthesia, will withstand a severe operation better than they would a palliative operation under general anaesthesia.

For operations involving no traction on the viscera—for example, gastrotomy, repair of ventral hernia, cholecyst-gastrotomy, gastro-jejunostomy in patients with ptosis, and cholecystostomy—block anaesthesia of the abdominal wall is entirely adequate; for operations such as gastrectomy splanchnic anaesthesia by Braun's method is sufficient, but when for any reason, such as aspiration of blood, the application of Braun's method is impossible, mesenteric anaesthesia is usually adequate. When dense adhesions are anticipated, as in secondary operations on the stomach or biliary tract, the posterior route of Kappis is chosen, but with the precautions suggested by Finsterer—namely, putting the patient in a sitting position and using a weak solution. There is no objection to adding light ether anaesthesia during a difficult stage; but any approach to the state of excitation results in a loss of many of the advantages of regional anaesthesia. I find that the majority of patients decline ether when it is offered to them, or after they have taken a few breaths; but this applies only to patients who have been efficiently injected, and affords evidence that their pain is not very severe. Of 50 patients who had operations on the upper abdomen, 6 were kept under very light ether anaesthesia; 40 of the remainder required no ether, and 3 accepted small inhalations during the stage when traction was severe. In one case only was full ether anaesthesia called for. The method of regional anaesthesia is advocated in upper abdominal surgery because it gives the surgeon greater freedom in choosing appropriate operative measures, offers him certain facilities during operation, and helps to ensure to the patient a smooth convalescence.

Appendicectomy.—The interval appendix and the early acute appendix may be removed with less discomfort to the patient than he would experience if the operation were carried out under ether anaesthesia. The technique of administration described by Finsterer has been used. In certain cases of retrocaecal appendix the patient will require a little ether or gas during the brief stage when the appendix is being separated. In six cases such additional anaesthesia was required twice.

Inguinal and Femoral Hernia.—In these operations regional anaesthesia gives full relaxation, a bloodless field, and absence of post-operative straining; for these reasons it is certainly the method of choice. The one patient in whom it proved inadequate was a nervous man who, through an oversight, did not receive the preliminary sedative; he reacted so violently to a needle puncture that ether was started at once, and the operation was carried out without further injection.

Jejunostomy and Caeceostomy.—A patient suffering from intestinal obstruction who needs simple drainage of the intestine may be operated on painlessly and with ease by the field-block procedure.

Genito-urinary Operations.

Suprapubic cystotomy for drainage, more especially in uraemic subjects, may be carried out under regional anaesthesia. If the surgeon wishes to explore the bladder with the finger it is more comfortable for the patient, though not necessary, to add epidural anaesthesia (caudal block) with 1/5 per cent. tutocaine.

Prostatectomy, by either the perineal or suprapubic route, may be carried out with trans-sacral anaesthesia, using 1/5 per cent. novocain. If the suprapubic route is to be used a field block will be needed as well. The administration of trans-sacral anaesthesia is one of the more difficult procedures, but the technique fully repays the trouble taken in acquiring it. Even if the procedure is only partially successful it is surprising how little disturbance the operation of prostatectomy causes the patient.

For cystoscopy in patients who, without anaesthesia, tolerate examination badly, caudal anaesthesia has proved ideal, and operations on the urethra may be carried out by the same method. By using 20 to 40 c.cm. of 1/5 per cent. tutocaine I have had no failures.

Miscellaneous Operative Procedures.

Recently I have been using field block combined with injections into the broad ligaments for operations on the vulva, vagina, and uterus by the vaginal route, with very encouraging results. Relaxation and a bloodless field make a perineorrhaphy by this method much easier.

Anaesthesia of the neck by paravertebral injection has proved completely satisfactory. I use the modified lateral approach to the transverse processes of the cervical vertebrae. In this method, devised by Meeker, the needle approaches from above downwards, and from without inwards, so as to mask the vertebral vessels by the transverse processes.

I have induced brachial plexus block six times. For this purpose 1/5 per cent. tutocaine appears to be too weak, but I have had no failures with 2 per cent. novocain. I have used the method for screwing a fractured olecranon, excision of the elbow, bone graft for radius and ulna, and reduction of fracture. Where 2 per cent. novocain is used extreme care must be taken to avoid intravenous injection.

Spinal Anaesthesia.

I have left spinal anaesthesia to the end because, although it represents the largest single item, I am using it less and less frequently. Experience shows that more reliable procedures are available for upper abdominal surgery. A great drawback of spinal anaesthesia is that one cannot be certain of the level of anaesthesia. In four cases out of fifty in my own series the level was too low. Moreover, in all cases there is a fall of blood pressure which is partially controllable by ephedrine; in six cases, however, the fall was severe, and in two, in spite of ephedrine, it was really alarming; in one of the latter it probably contributed to the death of the patient. I now use spinal anaesthesia in one type of case only—namely, in intestinal obstruction, where, I believe, its risks are outweighed by its advantages.

Conclusion.

Post-operative bronchitis and pneumonia are not eliminated, but it appears to be less common where regional anaesthesia has been used. Patients may vomit once, but the cause is probably post-operative medication and nervousness. Post-operative distension is very rare except in cases of organic obstruction or when the patient is uraemic. Wounds heal as well after regional as after general anaesthesia, except when drugs, such as quinine-urea or eucupin, are added to secure for the patient post-operative freedom from pain or ability to cough; in these circumstances tight suturing produces a small slough. In bronchitic patients this minor defect is compensated by the benefit to the patient of being able to cough freely.

The beginner should not start with the more difficult procedures. Even the technique of injecting the abdominal wall can be acquired only after practice.