THE CHOICE OF AN ANAESTHETIC FOR ABDOMINAL SURGERY*

BY

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Professor Finsterer said that the invitation to read an opening paper on the choice of an anaesthetic for abdominal surgery at the Centenary of the British Medical Association was the greatest honour ever conferred upon him.

He had sent a questionnaire to 200 members of the German Surgical Society, asking for their views and experiences, and had received 120 answers. His own experiences referred to 5,172 abdominal operations performed by him within twenty-five years under various methods of anaesthesia, and worked out statistically. In abdominal operations anaesthesia was of much higher importance than in any other operation, for in all acute diseases of the abdomen, as well as in chronic diseases of the gall-bladder and the stomach, the parenchymatous organs—most of all the liver—were already injured, so that further damage caused by general anaesthesia might be followed by death from insufficiency of the organs. As the protective ferments had been diminished, the danger of post-operative peritonitis and of consequent death was greater. Generally anaesthesia was regarded as dangerous only if the patient died during the operation. The frequency of these deaths from narcosis depended on whether all the fatalities during narcosis—even if they might have been caused by the grave disease itself—as well as all the cases where death occurred several hours after the operation when the patient did not awake from the narcosis, were still considered as being due to narcosis or not. By paying strict regard to the contraindications (severe heart or pulmonary diseases and other conditions) and by improving the technique of narcosis, the number of deaths from it had greatly decreased, so that they were scarcely to be feared. Of greater importance were the fatalities from late injury, which were connected more with the duration and depth of the narcosis than with its technique.

NARCOSIS

Chloroform caused most of the immediate deaths, even in small operations, especially at the beginning of the narcosis. It injured the parenchymatous organs, particularly the liver; it regularly induced gastro-intestinal atony with frequent vomiting, often leading to death. Narcosis with ether was the most commonly used anaesthetic, administered either by the open or by the re-breathing method. To diminish the quantity of ether and to avoid the mucous secretion, as a pre-operative measure the patients received morphine or pantopon, together with atropine or scopolamine. Statistics from Austrian and German clinics showed that the immediate risks of ether were very slight. Of much greater importance were the so-called deaths from operative shock occurring three to five days after the operation, which were nearly always delayed anaesthetic deaths, as they did not occur when deep narcosis was avoided. They were caused by primary circulatory weakness with a poor distribution of blood due to injury by the anaesthetic and operative trauma (histamine effect). According to his experience the narcosis was of the highest importance, the operation itself, when delicately done, was of minor influence,

because the weakness of circulation was absent when one operated under local anaesthesia. Some of the deaths were caused by injury to the liver, kidney, and the suprarenal gland. The researches of Bourne, Crile, and others had shown that prolonged ether narcosis produced injuries similar to those caused by chloroform. The liver was the most important regulative centre in metabolism, so that if it had been injured by acute or chronic disease the addition of ether narcosis resulted in a diminution of the alkali reserve and an increase of acidosis, owing to an insufficiency of the liver. Clinical tests of the liver function after ether narcosis demonstrated liver damage. In the material collected by him eighteen deaths from this cause were reported.

In his series of 610 operations under narcosis there were thirteen deaths from circulatory failure during the first five days. Of 122 stomach resections for ulcer seven patients died from this cause. Deaths from atony of the stomach after ether narcosis were rarer than after chloroform narcosis. They were due to a central paralysis of a common innervation centre for stomach and upper jejunum. Necropsy always showed that the stomach, duodenum, and upper jejunum were dilated to the utmost, and filled with liquid contents; peritonitis was not present. Thirteen surgeons had reported thirty-four deaths from this cause, and he had observed five in 610 operations. He had had no deaths from atony after 4,562 operations under local anaesthesia.

Prolonged ether narcosis injured or destroyed the normal powers of resistance, especially phagocytosis, so that the smallest infection, insignificant in operations under local anaesthesia, led to death from peritonitis. In his clinic the mortality from peritonitis following gastric resection for ulcer was 4.4 per cent. under narcosis compared with 1.4 per cent. under local anaesthesia. Ether also favoured pneumonia by diminishing the resistance of the lungs, by chilling, by preventing expectoration, and by embolism. It was remarkable that in Nordmann's clinic the frequency of death from embolism rose from 1.4 per cent. to 4.4 per cent. when ether replaced chloroform. On the other hand, Sudeck had found that the substitution of nitrous oxide anaesthesia for ether anaesthesia diminished the frequency to one-tenth of the previous number. An increase of the coagulation of the blood had been observed after ether narcosis. The frequency of death from embolism in Professor Finsterer's clinic was higher after ether narcosis (0.98 per cent.) than after local anaesthesia (0.24 per cent.). Narcosis with nitrous oxide did not injure the parenchymatous organs, and was therefore the least dangerous. Fatalities were caused by technical mistakes. In protracted narcosis injuries of circulation seemed to be possible.

Avertin was being used by forty-five surgeons out of 120, mostly in selected cases. Its greatest advantage over general and local anaesthesia was that the mind of the patient was absolutely excluded. Specht calculated the frequency of unavoidable deaths from avertin as 1 in 10,000; deaths from gastro-intestinal atony were excluded, and the fatal cases were classified as avertin deaths by the authors themselves. The number of deaths could be restricted by using avertin as a basal hypnotic and by individual dosage, but unfortunately it could not quite be avoided. For this reason he did not use avertin as a basal hypnotic. Moreover, in many cases of basal hypnosis the amount of ether required was greater than when local anaesthesia of the abdominal walls and mesenteric anaesthesia were combined with ether narcosis.

Pernocton had been recommended for basal hypnosis, but the statistics of Bumm and others showed that this narcotic could not be called a harmless one. Seventeen surgeons had reported to him five deaths from pernocton.

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LOCAL ANAESTHESIA

Choice of Method

The sensibility of the patient was reduced by pantopon one hour before, and by morphine and atropine a quarter of an hour before, the operation. Professor Finsterer performed a regional or conductive anaesthesia by which the sensitive nerves were blocked within the abdominal wall, or in the mesenteries, or near the spinal column, or within the dural sac. In every laparotomy an exactly performed anaesthesia of the abdominal walls was most important. This applied also to paravertebral anaesthesia. It might also be added to spinal anaesthesia, for when the efficiency of the spinal anaesthetic had ceased the abdominal walls were still insensible. Anaesthesia of the abdominal walls was sufficient for gastrostomy, jejunostomy, colostomy, and also for gastro-enterostomy. In all other operations at least mesenteric anaesthesia procured by novocain was essential. This was absolutely without danger, prevented shock, and should therefore be applied to spare the general narcosis, even if this had been administered. When the organ was fixed the peritoneum of the posterior abdominal wall had also to be anaesthetized by paravertebral or splanchnic anaesthesia, or there might be a short general narcosis.

Posterior splanchnic anaesthesia might be applied in every case, even in the presence of adhesions; fatalities due to intravenous or intraspinal injection could be avoided if the patient were in the sitting position. Kappis had no deaths in over 1,500 cases, and the results of other surgeons were equally favourable. Takats, however, reported from the literature 2,475 cases with eight deaths. Applying the criterion of Specht, previously mentioned, the mortality was 1 in 5,895. Professor Finsterer was now using anterior splanchnic anaesthesia if he planned to do a radical operation after exploratory laparotomy, injecting not more than 70 c.cm. of 1/2 per cent. novocain solution, with 1/4 per cent. solution in cachectic patients. In 115 out of 1,324 cases, general narcosis was used either to avoid pain during the introduction of the needle, or from the beginning at the request of the patient (the anaesthetic being withdrawn after the injection had been made), or for the separation of adhesions. He had collected 2,373 cases of anterior splanchnic anaesthesia without any fatality (British Medical Association Meeting, 1926); the number must now have reached at least 9,992. He had had one fatality due to injection of pantocaine which had been erroneously prepared (0.5 per cent. instead of 0.5 per thousand). This method procured in more than 90 per cent. of all his cases absolute anaesthesia for operations in the upper abdomen. It might be possible to obtain safe anaesthesia of the whole abdominal cavity by filling it with pantocaine.

Paravertebral anaesthesia had been used by him 174 times, mostly in resections of the large intestine, to mobilize the fixed colon; for the resection, mesenteric anaesthesia was added. Parasacral anaesthesia was only sufficient for operations on the rectum and the perineum. Combined with a block of the hypogastric plexus it was sufficient for all hypogastric operations. Bürgkhardt reported over 1,000 cases without fatality; Frigyesi 1,745. Professor Finsterer had had one death in 126 cases (due to severe haemorrhage).

Epidural (sacral) anaesthesia was sufficient for pelvic operations. By using the high Trendelenburg position and larger doses of novocain the anaesthesia could be extended as far as the dorsal segments. This method was not harmless.

Spinal anaesthesia had the great advantages of simple execution, of absolute painlessness, and of muscular relaxation. Its principal danger lay in the fall of blood pressure and in the endangering of the respiratory centre

either by direct paralysis from the anaesthetic or probably in consequence of the lack of blood supply because of the depression of blood pressure. The higher the anaesthesia the greater the danger; therefore few German surgeons (only fourteen out of 120) used high spinal anaesthesia. Pitkin declared that high anaesthesia with spino-cain was the safest method, but his claims had not been substantiated. In operations below the umbilicus spinal anaesthesia was used by only forty-four of these surgeons. In order to prolong duration of anaesthesia percaine had been used. He had given up spinal anaesthesia fifteen years ago, and introduced combined parasacral anaesthesia, which was not only more safe but efficient for a longer time (two to three hours). If further experience should demonstrate that the efficiency of spinal anaesthesia could be protracted without increasing its risks—perhaps by employing pantocaine—he would again use spinal anaesthesia in operations on the lower abdomen.

Drugs and Comparative Mortality

The most commonly used drug for local anaesthesia was novocain in 1/2 to 1 per cent. solution combined with adrenaline. On the average 1 gram of novocain in 1/2 per cent. solution could be used without injury. Of the 1/4 per cent. solution much larger quantities (up to 500 c.cm.) could be applied without any symptoms of poisoning. In cachectic and anaemic patients 1/4 per cent. solution was absolutely sufficient. In aged patients with extreme arteriosclerosis it was advantageous to add pituitrin instead of adrenaline to the solution of novocain. Percaine was more poisonous and caused necrosis of the tissues; he had had two deaths within twenty-four hours following its use. Local anaesthesia was almost without any immediate danger. In his series of 4,562 operations he had had only five deaths during operation or shortly after in spite of the high number of cases with bad risk. Two deaths were connected with the anaesthetic; one had been already mentioned, the second was a real death from shock. Deaths within the first three to five days were exceedingly rare (0.08 per cent. compared with 2.2 per cent. in operation under narcosis); there were none from gastro-intestinal atony.

The mortality from pneumonia had been considerably reduced. In 610 operations under general narcosis it was 1.31 per cent.; in 4,562 operations with local anaesthesia only 0.24 per cent. In 843 patients from 60 to 88 years of age, mortality was 0.94 per cent. only. In stomach resection for gastric or duodenal ulcer the death rate was, in 1,408 cases, 0.07 per cent. (one death in ninety cases under ether). In 510 operations for gall-stones he had had no death at all. As all cases, even those suffering from pulmonary disease, were operated on, a careful after-treatment (regular deep breathing, sufficient expectoration, injections of camphor oil, transpulmin) was important to avoid a fatal pneumonia. Serious disease of heart or lungs, extreme cachexia, old age, were no contraindication to an absolutely indicated operation. Nervousness, extreme adiposity, as well as infancy, were generally looked upon as contraindications to the use of local anaesthesia. In nervous patients the operation could be begun with general narcosis. In the adipose, local anaesthesia was very necessary, and because of the fatty heart it was essential to reduce general narcosis as much as possible. Combined anaesthesia was the safest method for them. In children local anaesthesia might also be used with success if narcosis had to be avoided owing to the presence of some general disease. In all cases of bad risk general narcosis meant high dangers.

Use in Particular Diseases

In 170 acute appendix operations under narcosis, including cases with diffuse peritonitis, the mortality was

10 per cent. ; in 346 operations with local anaesthesia it was only 2 per cent.

In operations on the gall-bladder general narcosis was still preferred by most surgeons ; if the patient demanded narcosis the operation was begun under nitrous oxide, while a regional anaesthesia of the abdominal wall and an injection of the hepato-duodenal ligament was made, or splanchnic anaesthesia was used. In all other patients the operation was begun under local anaesthesia of the abdominal wall and paravertebral or splanchnic anaesthesia added. In eighty-nine plain cholecystectomies under general narcosis there were seven fatalities (two from gastro-intestinal atony), whereas in 333 under local anaesthesia the mortality was 0.6 per cent. Cases of common duct obstruction were always operated on under local anaesthesia. There was no death from liver insufficiency.

In cases of acute intestinal obstruction deep narcosis lowered the blood pressure, and therefore easily caused collapse, while the intestinal paralysis was increased. Spinal anaesthesia counteracted intestinal paralysis, and had been recommended for the treatment of ileus, but it produced a dangerous fall in blood pressure. In every case he opened the abdomen under local anaesthesia and used a short ether narcosis at the moment of searching for the obstruction ; the further operation was done under local anaesthesia. In all cases the blood pressure was raised by pituitrin and intravenous saline infusion immediately before operation. The mortality was much less (116 cases, 16.3 per cent.) than in hospitals where general narcosis was the method of choice. The statistics he had collected proved this statement.

In resection of the stomach local anaesthesia and mesenteric anaesthesia, splanchnic anaesthesia, or basal hypnosis, were replacing general narcosis. In resection for cancer he had used splanchnic anaesthesia in 273 cases, mesenteric anaesthesia in 148. In some of these

cases small quantities of ether were given besides. The mortality was much less under local anaesthesia ; this was true also of resections of the stomach for ulcer, and of the radical operation for gastro-jejunal ulcer. In 134 patients between 60 and 78 years of age operated on under local anaesthesia three had died (2.2 per cent.), whilst in 1,196 younger patients the mortality was 4.1 per cent.

In resection of the colon general narcosis was still regarded as the method of choice ; some surgeons operated under spinal anaesthesia. He himself operated exclusively with local anaesthesia, and applied, when mobilizing the colon, either a short ether narcosis or paravertebral anaesthesia. No post-anaesthetic atony had been observed which would cause leakage of the suture by over-dilatation. With local anaesthesia the results of the operation could be considerably improved. If the bowel were sufficiently evacuated one-stage resection of the left colon could be performed. In resection of the colon for tuberculosis, megacolon, colitis, etc., results of the one-stage resection were good (ninety-seven resections with three fatalities). Also in the operation for cancer the one-stage resection, even of the left side of the colon, might be done if the bowel were empty. His mortality in forty-one one-stage resections was 11.9 per cent., whilst Nordmann reported a mortality of 28 per cent. with general narcosis. By using local anaesthesia he could operate with success on highly advanced cases which had already been refused operation by other surgeons who preferred general anaesthesia.

Abdomino-sacral resections of a high cancer of the rectum had a high mortality from shock and infection. Up till 1922 he performed that operation under general narcosis with a mortality of 31 per cent. Since then he had operated under combined parasacral anaesthesia. Mortality was reduced to 15.7 per cent. in fifty-seven cases.

ORAL CHOLECYSTOGRAPHY: THE CUMULATIVE METHOD

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Cholecystography has now taken its place as a routine method of examination in cases where the biliary system is thought to be at fault. The test consists in the giving, either by the mouth or by intravenous injection, of a medium, generally known as "the dye," which is opaque to x rays when concentrated in the gall-bladder.

SOME FALLACIES

Inability to obtain a shadow is, as a rule, a sign of improper function, the most usual cause of which is gall-bladder disease, past or present. Most radiologists will agree, however, "that the gall-bladder may not be visualized even after the intravenous injection of the dye in certain conditions in which there is no reason to suppose that the organ is actually the seat of disease."¹ Simple enlargement of the liver, malignant growth in the right upper quadrant of the abdomen, pregnancy in its later months, perforated duodenal ulcer, acute disease (general or abdominal), and temporary kinking of the cystic duct are some of the conditions likely to produce this somewhat contradictory result. Again, the gall-bladder shadow may be late in appearing, and in conse-

quence may be missed. Graham regards this as being due to any parenchymatous condition of the liver which retards the excretion of dye.¹ Further, in 1928, W. W. Boardman² pointed out that it was possible for a gall-bladder not to fill at a first test, and to give a good shadow some weeks or months later although conditions had remained unchanged in the interval. This observation has been noted by others.

The position is, then, that a gall-bladder which is not producing symptoms may fail to fill or may give no shadow at one time and show a normal one later. "Non-filling" is generally recognized as the most important indication of gall-bladder disease, but it is also a sign which presents a definite margin of error, and, unless this point is borne in mind, mistakes in interpretation may arise. It is for this reason that one of us (J. H. A.) has advocated persistently the consideration of the case as a whole before surgery is advised, together with the repetition of the test in all doubtful cases,^{3,4} a contention strongly supported by B. R. Kirklin in a recent paper.⁵ How and when should the test be repeated? Rolleston and McNee⁶ hold that "failure to fill" after oral administration of the dye "indicates merely the . . . necessity of an intravenous test." With this we cannot agree.

ADVANTAGES OF CUMULATIVE TEST

Early in 1929, when testing keraphen (the form of dye used at Ruthin Castle), it was found, in a supposedly normal case, that the gall-bladder did not fill at the first attempt. When the test was repeated forty-eight hours later a good shadow resulted. Last year Sandström⁷ described a new method for giving the dye in oral cholecystography. He argued that as the contrast medium,