MAJOR SURGERY UNDER MINOR ANÆSTHESIA*

BY JOSEPH WIENER, M.D.

OF NEW YORK

ASSOCIATE SURGEON, MOUNT SINAI HOSPITAL

Much of the danger from every major operation is the danger of the anæsthetic. Much of the post-operative morbidity, many of the post-operative complications, and many of the post-operative deaths are due to the anæsthetic. In intra-abdominal operations, most of the post-operative distention, both gastric and intestinal, much of the vomiting, much of the pain, of the inability to move the bowels, of the shock, cardiac depression and many of the other so-called post-operative complications, are in reality post-anæsthetic sequelæ. With some operations the mortality is appreciably higher if a general anæsthetic is used. Take, for example, gastrostomy for malignant stricture of the oesophagus. This comparatively simple operation has a relatively high mortality when done under ether. I can recall numerous deaths after this operation done under ether, some at my own hands, some at the hands of colleagues. Some of these patients were in comparatively good condition, and I was on several occasions struck by the fact that death was probably due to ether pneumonia. Of late I have been doing gastrostomy and jejunostomy under novocaine, and there is a striking difference in the post-operative course; and, moreover, the operations can be done painlessly. Twice in the past few months I have done a Kader gastrostomy and once a Witzel jejunostomy under local anæsthesia. In each case I had an anæsthetist present and in each case the patient declined to take ether during any stage of the operation; and all these patients, run down by inoperable carcinoma, assured me that the procedure was quite painless.

How often are we confronted by patients who we say are bad operative risks, when we mean they are bad anæsthetic risks. Take some of these patients and give them ether for forty-five minutes or longer, and do no operation on them at all, and they will have a stormy time for several days, and some of them might even die as a result of the anæsthesia. Very recently I had a trying experience of this kind. A man of fifty-two fell and a radiograph taken four days later, when I first saw him, showed a fracture of the neck of the femur with outward rotation of the foot. There was no previous history of diabetes but

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we found albumin, casts and glucose in the urine. He was given anaesthesia just long enough to put the fragments in good position, and apply the Whitman plaster-of-Paris splint in abduction. Immediately following the anaesthesia he developed a marked acidosis, and in spite of all treatment died in coma a week later.

It is a well-known fact that patients are much less uncomfortable and have less post-operative complications after a short than after a long operation. This means they have had less ether and therefore are less sick. If we take away the ether altogether, or do only a small part of the operation under ether, is it not natural to expect a much smoother convalescence? Some years ago I looked up all the operations on the gall-bladder and ducts, done during the same period of time by several surgeons working at the same hospital. I found that there were seldom any complications after short operations, whereas the patient who had received ether for more than an hour frequently had a stormy convalescence. A full dose of morphine should precede operations under local anaesthesia. In prostate cases I give morphine by hypo and an opium suppository a half hour before operation. In appendix cases of late I have been giving two injections of morphine, one an hour before operation and one fifteen minutes before operation. I gave up spinal anaesthesia some years ago because the last patient upon whom I used it had complete incontinence of faeces and retention of urine lasting six weeks. In former years I used cocaine, stovaine, eucaine, and alypin, but have given them all up on account of the great advantages of novocaine. It does not irritate the tissues, even in strong solutions; and even in large doses it has no depressing effect on the heart. I have repeatedly used as much as 240 minims of a 1 per cent. solution and have never seen any bad effects therefrom. Others have reported using 20 c.c. of a 2 per cent. solution, while Braun goes so far as to say that 250 c.c. of a 1 per cent. solution can be used with safety in adults. Personally I have never used more than a quarter of that amount. In very vascular tissues, such as the gums, smaller amounts should be used.

But novocaine alone is not nearly as satisfactory as the combination of adrenalin and novocaine. This combination is what I prefer to use in all operations under local anaesthesia, and in my experience it is the most safe and satisfactory local anaesthetic that we to-day possess. The adrenalin not only increases the action of the novocaine but it appreciably prolongs the time it acts. On mucous membranes, however, novocaine is not nearly as efficacious as cocaine.

Novocaine can be sterilized, either by boiling, or by placing the solu-
tion contained in a bottle in the sterilizer with the dressings and leaving it there fifty minutes. The mouth of the bottle should be stopped with absorbent cotton to prevent excessive evaporation of the solution. To prevent its decomposition the ordinary solution of adrenalin usually has added to it hydrochloric acid and some antiseptic such as thymol. In this form the adrenalin solution can be sterilized by heat, and, if placed in a dark bottle, can be kept a long time; the addition of any alkali will tend to cause decomposition of the adrenalin. But in the tablet form both adrenalin and novocaine keep very much better than in solution. It is difficult to sterilize the tablets; they should be dissolved in water and sterilized just before use. I usually make up enough for each operation separately.

Lennander has shown both at operations and experimentally that the principal parts of the abdomen that are sensitive are the anterior and the posterior parietal peritoneum, pelvic peritoneum, and the peritoneum covering the diaphragm as far as it is innervated by the spinal nerves. The visceral peritoneum, stomach, intestines and omentum, even in the presence of acute peritonitis, and the peritoneal covering of the gall-bladder, liver and kidneys, are quite insensitive. This does not mean that pulling on these organs may not cause pain, and even other sensations such as nausea or a feeling of faintness. I have not always found the omentum free from sensation and prefer always to anaesthetize it before dividing it. The stomach and intestines are not sensitive, but I usually prefer to anaesthetize the mesentery before ligating it, just as I always inject novocaine into the mesenteriolum of the appendix before ligating it and cutting across the appendix. But I have always found the wall of the stomach and of the intestines entirely free from sensation; neither have I ever noticed any pain in cutting across the base of the appendix. The mesentery is often very sensitive, although in doing intestinal resections in strangulated herniae it is not necessary to anaesthetize the mesentery. But the reason for this is that the mesentery has lost its sensation as a result of the prolonged strangulation. The sensations caused by pulling on any of the abdominal organs or by clamping or tying off the mesentery are very different from the sensations of pain. Some patients cannot localize these sensations, and some say they are almost unbearable unless the mesentery is anaesthetized; some patients complain of nausea and faintness. Lennander and Braun both found that the fundus of the gall-bladder can be clamped and cut without causing any pain, but if an attempt is made to pull the gall-bladder forward, or if the ducts are probed, pain will be elicited. Tying off the cystic artery or the cystic duct causes pain. Incising the
liver is not at all painful. Introducing and removing large gauze pack-
ings is distinctly painful. But I can say from personal experience that
the opening and closing of the abdomen and the removal of the appendix
or ovary, gastrostomy, cholecystostomy, and intestinal resections can
be done painlessly under local anaesthesia.

Hernia.—For years I have occasionally been operating on inguinal,
femoral as well as umbilical herniae, under local anaesthesia, but of late,
especially with my private cases, I am offering local anaesthesia to all
of them, and most of them accept it. I have repeatedly operated on
umbilical herniae without ether, several times in very nervous patients,
and have had no difficulty whatever. Some of these patients have had
previous operations under ether, and they all noticed the remarkable
increase in post-operative comfort. In inguinal herniae it is advisable
to block the iliohypogastric and ilioinguinal nerves near the upper end
of the skin incision. Each layer should be anaesthetized separately, and
novocaine should be injected into the neck of the sac, and also into the
omentum if it is to be resected. That an extensive intestinal resection
can be painlessly done under novocaine, the following case will clearly
show:

Frieda N., sixty-nine years old, was admitted to the First Sur-
gical Service of Mount Sinai Hospital, January 12, 1916. Twenty-
four hours before admission, after taking a cathartic, she had had
a sudden cutting pain in the hypogastrium, and a mass appeared
on the left inguinal region. She had vomited three times, the
pain had persisted, and she was unable to move her bowels. On
admission a very tender swelling, the size of a hen’s egg, was
found in the left inguinal and femoral region. Attempts at reduc-
tion, both before and after admission to the hospital, proved ine-
effectual. I undertook the operation shortly after admission. On
opening the sac it was found to contain some bloody fluid and a
loop of necrotic small intestine. There was no pulsation in the
mesentery, and to ascertain the viability of the gut the mesentery
was cut at right angle to its vessels. The mesentery was incised
two inches to one side of the necrotic gut and four inches to the
other side before active bleeding was encountered. Ten inches of
gut were removed, the ends of the gut crushed and ligated, and
each stump buried with two rows of linen sutures. A typical
side-to-side anastomosis with Connell linen sutures was done.
The typical Bassini operation for femoral hernia was then carried
out. The operation consumed one hour and fifteen minutes and
had been preceded by a full dose of morphine. Novocaine and
adrenalin made the operation entirely painless, and at no time
did the patient complain of any pain. She made an uneventful recovery. In view of her advanced years and the extensive operation that was necessary, a general anaesthetic would have been associated with considerable danger.

Appendix.—During the past year I have been developing a technic for removing the appendix under local anaesthesia and have had eighteen cases which I have reported in the Jour. A. M. A. of April 8, 1916. To quote: “The first great objection will be the difficulty in dealing with adhesions. The adhesions we find are of two classes, fibrous and omental. The fibrous adhesions are not sensitive and can be readily divided. The omental adhesions can be readily anaesthetized by injecting into them a few drops of local anaesthetic. In a few minutes the adhesions can be ligated and divided without any pain. A few of my cases have been acute, one an empyema of the appendix; the remaining cases have been subacute or chronic. The right tube and ovary can be drawn into the wound and can be resected or excised if necessary. I hope in the near future to use this method in more and more acute cases, even in the presence of peritonitis. In fact, a peritonitis, far from being a contraindication to doing the operation under local anaesthesia, will, I hope, soon be an indication for this operation. When we consider that the system is already struggling to throw off a peritoneal infection and that the organs of excretion are doing a large part of this defensive work, the danger of handicapping these organs still further by giving an anaesthetic is apparent to us all. And if we can remove an offending appendix in the presence of a peritonitis under local anaesthesia, we are giving our patient a far better chance for a rapid recovery.

There is another important point. We all know how peristalsis is inhibited after abdominal operations under ether, and how serious a complication tympanites may become. In the cases in which I have operated under local anaesthesia, there has been very little or no tympanites, and peristalsis has been little, or not at all, inhibited. In a recent case of empyema of the appendix in a young woman, gas began to be passed fifteen hours after operation, and at no time was there any abdominal discomfort; nausea, vomiting and tympanites were entirely absent. In another recent subacute case the patient was reading the newspaper on the day after operation.

Three of my cases were intelligent private patients, and the remaining cases were from the First Surgical Service of Mount Sinai Hospital. Each patient was asked if he or she was willing to have the operation done under local anaesthesia. Some of the patients were neurotic women, but most of them were fairly intelligent. Of course, the coöper-
ation of an intelligent patient is an advantage, and I would hesitate to do the operation on a young child.

"I was led to do this work by the following case:

"Mrs. W. M. R., a patient of Dr. Alfred Schwab, had an acute attack of appendicitis in March, 1915. She had a bad heart, with pulse up to 120, a marked nephritis, enlargement of the liver and ascites. When I first saw this patient with her doctor I refused to operate on her. On the following day the symptoms of acute appendicitis became more severe, and I decided to try to remove the appendix under local anaesthesia. The patient, a very intelligent woman, kept up a running conversation with us during the operation; and, when it was completed, she assured us that the pain had been trifling. I saw this patient recently and she was in a very good condition. Had the operation been done under ether I fear we would have had a far different result.

"With increasing experience I have modified the technic somewhat. In my earlier cases I used the local anaesthetic only in the abdominal wall. But we found that most patients complained, either when the appendix was being drawn into the wound, or when its mesentery was being ligated.

"The technic which I now employ is as follows:

"Half an hour before the operation the patient receives a quarter of a grain of morphine hypodermically. I usually use a 1 per cent. solution of novocaine, to an ounce of which 20 drops of 1:1000 solution of epinephrin are added. As much as 240 minims of this solution can be safely used for an adult, which would correspond to about 2½ grains of novocaine. As a matter of fact, I have never found it necessary to use anything like that amount to do a painless appendectomy.

"I have for years had a personal preference for the muscle-splitting McBurney incision, and use it in most of my cases, acute as well as chronic. This incision lends itself particularly well for the operation under local anaesthesia. The skin near the anterior superior spine is not very sensitive; but by far the greatest advantage of an incision in this location is the fact that it comes right down on the cæcum. Rarely is it necessary to pack away the small intestines (although this can readily be done without causing pain), and there is thus less handling of the intestines. I first inject the novocaine solution into the skin along the line of proposed incision. In doing this I try to blanch the skin with the injected solution. Then I inject under the skin, along the same line.

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"After a wait of three minutes, the skin and subcutaneous tissues are painlessly incised down to the aponeurosis of the external oblique. A sharp scalpel is used for dividing all layers, as scissors, being blunter than a knife, are more apt to cause pain. I next inject novocaine under the external oblique aponeurosis, and after two minutes divide it. The solution is next injected into the internal oblique muscle, parallel to the fibres of the muscle.

"After another wait of a few minutes the internal oblique is cut parallel to its fibres. We then inject a little novocaine under the peritoneum and wait fully three minutes before dividing it. If done in this way, there will be no pain up to this point. All manipulations should be as gentle as possible, on the part of the operator and of the assistants. Only a sharp scalpel should be used in dividing the various layers of the abdominal wall. It is rarely necessary to apply artery forceps in opening the abdomen through this incision, which is an additional advantage, as the crushing of the blood-vessel with forceps may cause some pain, unless the novocaine is injected around the vessel. If necessary a packing can be introduced to keep the small intestines out of the way, although it is rarely necessary with this incision.

"As soon as the caecum with the appendix is exposed, the novocaine is injected into the mesenteriolum. If this is not done, and I omitted to do it in my earlier cases, the patient will complain of cramp-like abdominal pain referred to the navel or pit of the stomach. By anaesthetizing the mesenteriolum this pain is obviated. After a wait of three minutes the appendix can be pulled out of the abdomen, the mesentery ligated and divided and the appendix removed with almost no pain. It is not necessary to inject novocaine into the base of the appendix before ligating and removing it. If the mesentriolum is properly anaesthetized, there will be no pain during the removal of the appendix. It is perfectly feasible to draw the right tube and ovary into the wound and do any operation on them that may be indicated. The abdomen is closed layer by layer in the usual manner, and, if the technic has been correct, the closure of the wound is entirely painless.

"I have kept a record of the statements of the patients concerning the amount of pain they felt during the operation. Most hospital patients will say that they felt some pain, but much less than they expected. My three private patients have all assured me that the operation was quite painless.

"The post-operative course is of much interest. A few hours after operation there is a little wound pain which is readily controlled by codeine or morphine. Peristalsis is regularly established early, in from
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fifteen to twenty-four hours, so that the troublesome and painful post- operative distention is completely absent. I have recently had an acute case in which, during the entire convalescence, no rectal tube was inserted and no enema or cathartic was given. This patient had not the slightest sign of nausea, had fluids up to a few hours of the operation, and continued to take fluids after operation; yet the operation was done in the acute stage, and pus was found inside the appendix. Almost all of the patients have been able to take and retain fluids within a few hours after the operation. The post-operative depression so common with ether is entirely absent. Most patients are reading on the day after operation, and are sitting up in bed on the third or fourth day; in short, smooth and rapid convalescence, even in the acute cases, is a most striking phenomenon. The patients are usually able to get out of bed on the fourth or fifth day, and are ready to leave the hospital between the seventh and ninth days.

"I have described the operation as done through an intermuscular incision, but the operation can also be done under local anaesthesia through any other incisions for removing the appendix. For the reasons stated above, I believe the incision I have used to be the most desirable."

Prostate.—I believe I was the first to advocate and to practise the removal of the prostate gland through a suprapubic incision without ether or chloroform. In my original paper on "Suprapubic Prostatectomy under Nitrous Oxide Anaesthesia," published in 1904, I stated, "The chief contra-indications to the performance of prostatectomy have until recently been the dangers resulting from, first, the general anæsthetic; second, hemorrhage; third, shock. By the use of laughing-gas, the great objection of a general anaesthetic is at once removed. If, in addition, we do rapid work, then all three of the objections are removed. A prostatectomy, done under nitrous oxide in from eight to fifteen minutes, is not accompanied by any danger from the anaesthetic; the hemorrhage in those few minutes is very moderate and there is no shock. Many surgeons have held that a man unfit for general anaesthesia is unfit for prostatectomy. In view of our experience with laughing-gas are we not justified in asserting that view is erroneous?"

In 1903 I did my first two-stage prostatectomy, using laughing-gas for the first as well as for the second stage. Since then I have been gradually increasing the percentage of cases in which I do the two-stage operation, until in the past few years I carry it out in every case, using local anaesthesia for the first stage, and nitrous oxide for the second. There cannot be any doubt in the mind of any surgeon who has done the operation repeatedly in one stage and in two stages that the mortality
in a series of cases will be lower with the two-stage operation. I cannot bring myself to agree with those surgeons who do the operation in one stage if the patient is in good condition. After a moderately large experience in these cases, and from what I have observed of them at the hands of others, I have come to the conclusion that we are rarely in a position to say that any of these old patients is in "good" condition. And no matter how carefully we examine these cases before operation, no matter how many tests we make to determine the functional capacity of the kidneys, we are never in a position to state with assurance which one of these patients will be able to overcome the shock of operation. So to my mind the only safe thing we can do is to lessen the shock as much as possible in each and every case, whether the patient appears to be in good condition or not. And the shock of operation can certainly be lessened by doing the operation in two stages, using novocaine for the first stage, and laughing-gas for the second. I am glad to be able to say that I have never used ether or chloroform in any prostatectomy, and it goes without saying that I have never had an ether pneumonia in this class of cases. It has been my experience that some of these patients who seem the poorest risks will go through the operation, done in this way, with the most surprisingly smooth convalescence, while some who seem excellent risks are often badly shocked by a simple cystotomy. I know of no other safe rule than to consider all these old men bad risks and to give them the benefit of every possible safeguard, they need them all. As I said in a former paper, "Few surgeons will deny that in desperate cases the two-stage operation is safer; but they will tell you in good cases it is not necessary. And that is where the danger to the patient lies, that he will be taken for one of the "good" cases. And unfortunately some of these good cases, after a prostatectomy, turn out to be anything but good."

Empyema.—Simple incisions, even extensive resections of the ribs, can be done under local anaesthesia. The parietal pleura is sensitive but is readily anaesthetized. The pulmonary pleura, like the visceral peritoneum, is not sensitive, and the same can be said of lung tissue. Even in children one or more ribs can be readily removed under novocaine.

Subphrenic Abscess.—I have repeatedly opened such abscesses under local anaesthesia. The most recent case I have had was that of an old lady who had many of the symptoms of subphrenic abscess, but repeated aspirations by various men failed to show pus. The radiograph showed a large shadow in the region of the right subphrenic space. Under local anaesthesia, I resected the eighth rib in the axillary line and sewed the two layers of pleura together. I then aspirated through the diaphragm,
found pus, and opened an abscess containing at least eight ounces. The operation, done under local anæsthesia, presented no difficulties, and the patient made a good recovery.

**Bones.**—Periosteal and bone sensibility varies greatly with different individuals; thorough anaesthetizing of the periosteum very much lessens this sensibility. I recently had an old gentleman of sixty-two referred to me who had a marked endocarditis not well compensated, and both his physician and his children were very much opposed to his taking ether. He had an infected bunion which had been opened, and resulted in an extensive infection of both the adjoining phalanx and the metatarsus, and there was also extensive cellulitis of the foot. I did not think I could do a painless operation under novocaine, but as the family was insistent, I undertook it. I made incisions on the dorsal and plantar aspects of the foot to drain the cellulitis, excised the infected bursa, resected the base on the phalanx of the big toe and also the head of the metatarsus, which was badly infected. I used novocaine freely in the soft parts, after applying a Martin bandage to the leg, and I was careful to inject novocaine under the periosteum of the phalanx and of the metatarsus. At no time during the rather extensive operation did this old gentleman complain of pain.

**Varicose Veins.**—I have repeatedly removed even extensive varicose veins under novocaine. If a Martin bandage is applied, the action of the local anæsthetic is even more efficacious. The following case was a most unusual one:

Miss K., a trained nurse, after lifting a heavy patient, had suddenly noticed a swelling in her left groin. Immediately thereafter she had vomited and fainted. She was employed at that time in one of the German University clinics. The attending surgeon diagnosed femoral hernia, and she was given ether preparatory to having it operated on. Before the operation had been started she collapsed, and was resuscitated only with great difficulty. No operation was attempted and she was told that she should never try to take ether again. For ten years following this experience a small swelling remained in the groin but did not cause much discomfort. She then began to have pain in the left leg and thigh at frequent intervals, with occasional swelling of the foot and leg. During all this time the diagnosis of femoral hernia was adhered to. I first examined this case eighteen years after the onset of the trouble. I found a small elastic swelling in the left groin just below Poupart’s ligament. It was quite tender and not reducible. There was no evidence of any varicose veins and I concurred in the diagnosis of irreducible femoral hernia. At the operation done under local anesthesia I was very much sur-
prised to find that the swelling consisted of the enormously distended common femoral vein which was filled with a firmly organized clot. I resected the vein and the patient made a good recovery, and has had no further trouble.

**Combined Local and General Anaesthesia.**—How often are we confronted by the question whether a given patient can stand an operation, whereas the question really is, can this patient stand a prolonged anaesthetic? Many patients of advanced years, many cases of cardiac and renal disease, fall into this class. And there can be no denying that the amount of ether that is given in one of these cases bears a very important relation to the prognosis. The following case is a striking example:

Mr. K., forty-nine years old, had had several attacks of cholecystitis. He had had two attacks of angina pectoris, had albumin and casts in the urine, a blood-pressure up to 190, and he had been told by several physicians of his various organic lesions. One consultant advised him not to be operated on, chiefly on account of the danger of an anaesthetic. After a rather severe attack of cholecystitis, I obtained his consent to operation on condition that I would do as much of the operation as possible under local anaesthesia. With novocaine I made a ten-inch cross-incision below the free border of the ribs, divided the rectus and oblique muscles, and opened the peritoneum without causing the patient the slightest pain. He testified to this at the time and also later. When I began to put in packings to wall off the very much enlarged and thickened gall-bladder, he began to complain of pain. A skilled anaesthetist then gave him gas and ether for about 15 minutes, during which time I separated and removed an adherent gall-bladder with stones, and sewed up the end of the cystic duct. The anaesthesia was then stopped and the abdomen closed. This patient did not vomit once during the first 48 hours after operation, there was no sign of shock, and he required no heart stimulants. His kidneys caused us no concern at any time. In spite of all the handicaps this man was laboring under, he made a prompt and good recovery. All of the gentlemen associated in this case believe that the patient owed his recovery, at least in large measure, to the short time he was under ether.

Does not such a case open a wide field of usefulness for combined local and general anaesthesia? Have we not all had operative deaths in this class of cases that could have been avoided?

I have made no attempt to cover the entire field of operations under local anaesthesia, but have rather tried to show some of the work that can
be satisfactorily done. The advantages of this kind of work will, I think, be apparent, from what has been said above. There can be no doubt that since major operations under local anaesthesia are still in their infancy the future holds a wide field for their development. Personally, I look forward to doing more and more operative work in this manner; and I am looking forward with considerable enthusiasm to doing more work with the combined local and general anaesthesia. Who will deny that it is a great advantage to do a difficult cholecystectomy with only fifteen minutes of ether? And how much ether we can save in a pylorectomy case that often takes one and one-half hours or even longer to perform. All of the sutured of the stomach and intestine, the opening and closing of the abdomen can be done painlessly under novocaine. And will we not have an appreciably lower mortality with many complicated abdominal operations if we reduce the time of anaesthesia to a small fraction of what it now is? We will often be able to get along with a short gas and oxygen anaesthesia, combined with local anaesthesia, in cases where we now use ether for forty-five minutes or longer.

Are there any inherent objections to operations under local anaesthesia? Surely there are. First, is the fear of causing pain. With increasing experience, with proper technic, with proper selection of cases, by combining local with brief general anaesthesia, pain will in large measure be eliminated. And even if pain were not entirely eliminated in some cases, the lessened danger of the operation, the fewer post-operative complications, the wonderful difference in post-operative comfort, would weigh heavily in favor of such procedure. That operation under local anaesthesia takes more time is true; but if we figure ten or fifteen minutes to get the patient under ether, the difference in time for many operations will not be marked. I have several times done a double inguinal hernia operation under local anaesthesia in an hour. One objection is a real one. It is more trying for the surgeon to operate under local than under general anaesthesia. There is the additional mental strain of encouraging the patient to keep quiet and to keep up his courage. The coöperation of an intelligent patient is a great help. In any case we can arrange our day's work so that not too many operations under local anaesthesia are done at one sitting. Even if it is much more trying to do major operations without general anaesthesia, should we not sacrifice our personal comfort for the great advantages that accrue to the patient? The answer to that question will in large measure determine the field of usefulness of this procedure at the hands of each individual surgeon.