PERITONEOSCOPY

By RICHARD HANDLEY, O.B.E., F.R.C.S.

Surgeon, The Middlesex Hospital

Peritoneoscopy is the examination of parts of the peritoneal cavity and some of its contained organs by means of a light and telescope similar to those of a cystoscope. Access is gained by means of a large trocar and cannula, pushed through the abdominal parietes into the peritoneal cavity. The procedure has been the subject of violent fluctuations in popularity. Though never as widely practised as it deserves, its periodic and almost total eclipse has been due to its limitations not being understood and, more being expected of it than it could give, it has been discarded in disappointment. Yet in suitable circumstances it has a great deal to offer, both to clinician and patient at very small inconvenience, danger and discomfort.

The possibility of satisfactory peritoneoscopy, like cystoscopy, had to await the perfecting of small electric light bulbs, towards the close of the last century. The optical principles and manufacturing difficulties of the telescope were already well understood. It was not therefore until 1901 that a German surgeon, Kelling, did the first peritoneoscopy on a living dog. He used a cystoscope for the manoeuvre and introduced a quantity of air into the peritoneum in order to push the intestines away from the window of his telescope and give it the 'elbow room' which is needed by the optical system in all forms of endoscope. Kelling's original procedure has remained identical in everything except refinements to the present day. He did not apply his work to the human abdomen until 1910, but since then papers have appeared at intervals describing the method, perhaps the best known and most comprehensive being those of Ruddock (1937, 1939, 1949).

The Theoretical Basis and Limitations of Peritoneoscopy

The abdominal cavity is occupied by certain viscera which are relatively fixed and by the intestines which are mobile and behave like a semi-fluid mass. The fixed viscera and intestines completely occupy the peritoneal cavity. The

first step in performing a peritoneoscopy is to get 'elbow room' for the telescope, and air is introduced into the peritoneal cavity for this purpose. This air forms a large 'bubble,' a litre or more in size, in the peritoneum and into this 'bubble' certain of the fixed viscera, notably the liver, project when the patient is lying on his back. The intestines, by reason of their consistency, sink to the inferior surface of the 'bubble.' The position of the 'bubble' can be varied by altering the patient's position. If he is tilted head up, the air will rise towards the diaphragm and more of the liver will become visible. If he is tilted into a Trendelenburg position, the air will rise into the pelvis, and in women the relatively fixed uterus, tubes and ovaries may be seen, while the liver becomes obscured by a mass of intestines in the lower hemisphere of the 'bubble.' It would theoretically be possible to use saline or water instead of air to obtain 'elbow room' for the telescope, but this is unsatisfactory because gas-containing intestine would float and the telescope be surrounded by a maze of mesentery; if any degree of ascites was present the limpidity of the fluid medium would be impaired and vision again limited.

It follows from these considerations that peritoneoscopy can yield a useful view only of the anterior part of the liver, the tip of an enlarged spleen, the anterior wall of the stomach, the gall bladder, the parietal peritoneum of the anterior abdominal wall, the front of the omentum, the uterus, the Fallopian tubes and often the ovaries. Adhesions may make even these organs invisible and, particularly when there is an inflammatory lesion present in any of them, the omentum may have become adherent and obscure from view the only lesion present, while leaving a clear view of what is normal. Peritoneoscopy is particularly unsatisfactory in lesions of the intestine. Various coils of the latter are always seen, but it is only those which lie at the surface of the air bubble that are visible; it is impossible to inspect in systematic fashion the more numerous coils of bowel which lie below.

The Peritoneoscope

The instrument consists of the same fundamental parts as the cystoscope with the addition of a trocar and cannula. The cannula is of such a size as to admit snugly the sheath of the peritoneoscope which, unlike most cystoscopes, is straight. The sheath is of the same length and calibre as a cystoscope and carries a light. Inside it there fits a telescope which usually has a fore-oblique window, and not a right-angled view. Direct vision telescopes are also often used but require modifications of the sheath to offset the light, so that it does not obstruct the field of view. The more elaborate peritoneoscopes have provision for introducing punch-forceps, diathermy electrodes, etc., so that biopsies may be done or adhesions divided. A peritoneoscope is also a thorascopes, there being no difference in design between the two instruments.

Cystoscopes may quite well be used as peritoneoscopes though their introduction into the peritoneal cavity is slightly more difficult, in that a short incision is needed if the usual angled sheath prevents their introduction through a cannula. My colleague, Mr. O. V. Lloyd Davies, has done many peritoneoscopies with a sigmoidoscope—its chief disadvantage would seem to be its size. It goes almost without saying that any extemporized peritoneoscope, which has been used in infected cavities, should be boiled before being used in the peritoneum. For sterilization of my own peritoneoscope, which is used only as such and does not become heavily contaminated, I use 2 per cent. lysol, the instrument being totally immersed for 20 minutes, and washed very thoroughly in water before use.

Technique

Peritoneoscopy is most conveniently done under a general anaesthetic. This should be sufficiently deep to relax the abdominal muscles and facilitate the introduction of air. Local anaesthesia may also be used, but it has the disadvantage that it does not give general muscular relaxation and the patient may feel pain if unaesthetized portions of the peritoneum are touched. The examination must be done in an operating theatre, whatever the anaesthetic, with full aseptic technique, and the patient prepared as for an abdominal operation.

The patient is anchored appropriately to the table so that he may be tipped into Trendelenberg or anti-Trendelenberg positions without slipping. After the skin has been prepared and towels placed, an incision $\frac{1}{4}$ in. long is made in the skin in the midline, 1 in. below the umbilicus. If there are old surgical scars in the neighbourhood, another site must be chosen, preferably in the

midline and not too close to the liver. To attempt peritoneoscopy through or very near previous incisions is to risk trouble from adhesions to the abdominal wall. A small trocar and cannula are now pushed through the linea alba, directed slightly laterally so that the trocar shall not impale the aorta against the spine if it inadvertently enters more swiftly than is intended. The trocar is withdrawn and the cannula pushed further in and moved about, to see that its tip is free in the peritoneal cavity. This step is of importance because the peritoneum may sometimes be lifted away from the abdominal wall without being pierced, and the subsequent air injection is then subperitoneal. The cannula is connected up with a pneumothorax apparatus and 1 litre of air introduced into the peritoneum. The small cannula is withdrawn, and the large trocar and cannula pushed through the skin incision into the 'air bubble,' again in a slightly lateral direction. After withdrawal of the trocar all is ready for the introduction of the peritoneoscope.

Many peritoneoscopists push the large trocar and cannula into the peritoneum before introducing air. A cushion of air between the abdominal wall and the gut seems, however, an added safety factor, particularly as introduction of the large trocar requires a certain amount of force. The use of a Higginson syringe to put in air is also sometimes advocated, but it gives much less control than a pneumothorax apparatus. In addition the manometer of the latter indicates whether the air is entering easily and therefore whether it is entering the peritoneum or the tissues of the abdominal wall.

The actual inspection of the peritoneal cavity must be done systematically, tipping the patient first into a slight anti-Trendelenberg position, to inspect the liver and upper abdomen, and then head down if inspection of the pelvis is indicated. A very steep Trendelenberg position is needed for a full inspection of the female pelvis. It is common on the first introduction of the telescope to see nothing because a piece of omentum is looped over the instrument, but a little juggling of the sheath, with partial withdrawal, will soon shake it clear. It is often necessary to put in more air during the inspection and up to 2 litres *in toto* is a usual volume. After inspection is finished, the peritoneoscope is withdrawn, the air evacuated and the cannula withdrawn. A single stitch closes the skin incision. The patient can leave the hospital, so far as the peritoneoscopy is concerned, as soon as he has recovered from the anaesthetic.

Dangers

The only danger to be feared in a straight

peritoneoscopy is perforation of a loop of bowel anchored by adhesions. Normal bowel appears invulnerable to a needle pushed through the parietes. Fortunately, the adhesion which causes a bowel perforation also seals the wound from the general peritoneal cavity. Air embolus does not seem to have been reported after peritoneoscopy though it has occurred after the pneumoperitoneum treatment of pulmonary tuberculosis. Surgical emphysema of the abdominal wall is occasionally seen and haematomata around the abdominal puncture also; but these do not give rise to serious trouble.

Biopsy

Biopsies of the liver or of subperitoneal nodules may be taken through some peritoneoscopes. It is more convenient, however, to do a biopsy through a separate cannula, introduced through a separate stab wound above the peritoneoscope. This allows of a satisfactory punch-forceps being used instead of a spidery instrument which must fit into the same sheath as the telescope. Bleeding may be checked with a diathermy electrode. Nevertheless, biopsy is not particularly easy and only those with some experience of the straight examination should attempt it. If there is much bleeding the whole field is obscured by blood which cannot be mopped away and the use of a sucker would draw out the intraperitoneal air on which vision depends. The very small mortality in the large reported series of peritoneoscopies is due largely to haemorrhage after biopsy, and it is of great importance, particularly in jaundiced patients, to know whether the prothrombin time is normal before a biopsy is done.

The advantages which peritoneoscopic biopsy can claim over needle biopsy are that the exact piece of tissue can be selected, a piece of adequate size can be taken, and, if the situation gets out of hand, it can actually be seen to be doing so, and appropriate measures taken. For the same reason, needle biopsy under peritoneoscopic control is more accurate and safer than when it is done blindly.

The Information to be Obtained

The majority of peritoneoscopies are done to elucidate the nature of a large liver or the cause of ascites. This the peritoneoscope can do with a good deal of certainty. The view obtained through a good telescope is equal to that of inspection of a museum specimen in a glass jar. Thus cirrhosis, secondary deposits of growth in the liver, dilated veins in the portal circulation, and peritoneal carcinomatosis are all conclusively demonstrable in the large majority of cases without the need to do a laparotomy. Perhaps the

most dramatic case of this nature I have encountered was a lady with one eye and hepatomegaly where the peritoneoscope revealed a liver filled with the coal-black deposits of melanoma, whose presence the physicians had ridiculed in their eagerness for a laparotomy. Tuberculous peritonitis, particularly where miliary tubercles are present without much plastic reaction, are well seen, though their differentiation from peritoneal carcinomatosis may need a biopsy. In carcinoma of the stomach peritoneoscopy is sometimes useful in deciding operability in a patient with hepatomegaly and few gastric symptoms. Though the presence of hepatic metastasis should not necessarily preclude the removal of the primary tumour, the latter is best left if it causes little distress in a patient whose liver is full of growth, and in these circumstances peritoneoscopy saves a laparotomy. A view of the gall bladder, though not usually saving the patient from a laparotomy, allows a much more accurate interpretation of Courvoisier's law than abdominal palpation, and may in addition reveal hepatic deposits in a case of carcinoma of the pancreas.

In 69 cases of a personal series falling into the categories of disease so far mentioned, peritoneoscopy made the diagnosis in 17 patients and confirmed a provisional diagnosis in 30 cases; it was of help in 7 and it altered a firm but faulty diagnosis in 2. It was unhelpful or unsuccessful in 12 patients and misleading in 1. In a further 21 miscellaneous abdominal conditions for which it was done, a diagnosis was made only in 1 case of carcinoma of the ovary; the examination was unhelpful or unsuccessful in 12 and actually misleading in 2 of the patients. In particular we have found the peritoneoscope of little use in cases of splenomegaly—the surface of the spleen is obscured by adherent omentum in just those cases where a view of it might assist diagnosis, and where it can be seen it merely confirms the presence of a large spleen of undiagnostic appearance. Anyone who undertook a peritoneoscopic biopsy of the spleen would deserve the disciplinary attentions of the General Medical Council.

The literature on peritoneoscopy, which is considerable, has described uses for and manoeuvres through the peritoneoscope which are outside my experience. Its gynaecological uses have been referred to by Playfair, who reported a series of 140 cases. He found it of use in estimating the operability of malignant pelvic conditions and for diagnosis of disease of the tubes and ovaries, particularly for ectopic gestation, tuberculosis, salpingitis and to a lesser degree for distinguishing right-sided salpingitis from appendicitis. Hegstrom and his associates consider peritoneoscopy of

greatest value in biliary disease. In some 800 cases they did 871 liver biopsies and 57 direct cholangiograms by injecting dye into the gall bladder under peritoneoscopic control; they lost only one patient from haemorrhage after a biopsy. Others have divided peritoneal adhesions by diathermy and even sterilization in the female has been attempted through the peritoneoscope. An ingenious technique has been described whereby the stomach is distended with air, during peritoneoscopy, by means of a gastric tube which also carries a light, and the stomach walls then inspected from outside by intragastric illumination—a sight (as seen through the peritoneoscope) which has been likened to the appearance of a Chinese lantern! By this means it is claimed that thickening of the stomach wall, particularly by carcinoma, may be discovered.

A Note on the Large Reported Series

Ruddock has done more peritoneoscopies than any other writer. His series totals over 2,500. He has punctured a viscus on 8 occasions without fatality, and has had 3 deaths—2 from bleeding and 1 from peritonitis. He is justly considered the doyen of peritoneoscopy. Benedict has reported a mortality of 5 patients in 914 examinations, 1 due to improper selection, 2 to haemorrhage, 1 to perforation of the large bowel in tuberculous peritonitis, and 1 to biliary peritonitis after liver biopsy in biliary cirrhosis. Hegstrom and his associates' 800 examinations, with 1 death from bleeding, have already been referred to.

Anderson, Dockerty and Waugh have had 1 death in 392 patients, from bleeding after a biopsy. It thus appears that more than half the small number of deaths (0.2 per cent. in the four papers mentioned) is due to haemorrhage after biopsy. To set against this mortality all these authors point to the considerable value of peritoneoscopy in arriving at a diagnosis without the danger and discomfort of a laparotomy.

Conclusion

Ruddock has written that 'peritoneoscopy should not be done without a definite purpose and the procedure should not be expected to accomplish more than the purpose for which it is done.' My own small series shows the truth of this. Peritoneoscopy, as a further procedure in a case of obscure abdominal symptoms which have defied elucidation, is likely to fail. But if it is done to discover why a patient has a large liver or ascites, it is very likely to yield the answer. It is not widely indicated, but it is sometimes exceedingly helpful in making a diagnosis with a minimum of suffering to the patient and a great saving of time in a hospital bed.

BIBLIOGRAPHY

- ANDERSON, J. R., DOCKERTY, M. B. and WAUGH, J. M. (1950), *Proc. Staff Meetings of the Mayo Clinic*, 25, 601.
 BENEDICT, E. B. (1951), *Endoscopy*, p. 337, London, Baillière, Tindall and Cox.
 HEGSTROM, G. J., ZOEKLER, S. J. and KEIL, P. G. (1953), *Gastroenterology*, 25, 243.
 MILNES WALKER, R., COOKE, A. M., and PLAYFAIR, P. L. (1943), *Proc. Roy. Soc. Med.*, 36, 445.
 RUDDOCK, J. C. (1949), *California Medicine*, 71, 110.

HOW TO GET THERE

An Address Book for the Medical profession, showing how to reach the various Colleges, Societies, Institutes and Hospitals in or near London

New (Fourth) Edition: 1954

Price 2s. 6d. (2s. 9d., post free)

Published by the

FELLOWSHIP OF POSTGRADUATE MEDICINE

60 Portland Place, London, W.1