and duodenum, is not an easy matter to decide. A resection of the whole ulcer-bearing area, whilst a logical procedure, is rendered difficult in many cases by the fixity of the duodenum. It was only carried out in two cases

TABLE I.—Operative Treatment in 42 Cases of Coincident Gastric and Duodenal Ulcer.

Operation.	No. of Cases.	Result.	Present State.
Posterior gastro-enterostomy ...	7	7 R.	3 perfectly well; 4 still complain of gastric symptoms.
Anterior gastro-enterostomy and lateral anastomosis	3	3 R.	2 very well; 1 still complaining.
Gastro-duodenostomy ...	1	1 D.	Death from pulmonary embolism on tenth day.
Excision of ulcer and posterior gastro-enterostomy	2	2 R.	1 very well; 1 late recurrence of symptoms.
Excision and anterior gastro-enterostomy	1*	1 D.	Death few hours after operation.
Excision and gastro-duodenostomy	1	1 R.	Patient very well.
Cautery and posterior gastro-enterostomy	15	15 R.	All very well.
Cautery and gastro-duodenostomy	1	1 R.	Very well.
Pyloroplasty ...	1	1 R.	Very well.
Double gastro-enterostomy and lateral anastomosis	1	1 R.	Very well.
Gastro-gastrostomy and posterior gastro-enterostomy	2	2 R.	Both very well.
Gastro-gastrostomy and gastro-duodenostomy	1	1 R.	Very well.
Gastro-gastrostomy and gastro-duodenostomy and duodeno-jejunosomy	1	1 R.	Very well.
Pyloric exclusion and gastro-enterostomy	1	1 R.	Very well.
Posterior gastro-enterostomy and duodeno-jejunosomy	1	1 R.	Very well.
Partial gastrectomy ...	2	2 R.	Both very well.
Exploratory operation ...	1†	1 R.	Death some months later.

* Perforated.

† Malignant.

FIG. 3.—Diagrammatic drawings of operations carried out in the 42 cases dealt with. Below each diagram the number of cases so dealt with is stated.

in this series. Simple gastro-enterostomy alone is insufficient, and will be followed by persistent symptoms in 50 per cent. of cases. Burning out the ulcer with the thermo-cautery, followed by invagination and a gastro-enterostomy, was carried out in 15 cases, and with uniform success. I confess to a pleasant surprise on hearing from the

patients in this group of their freedom from all subsequent digestive trouble. So favourable were the reports in this group that I now regard the Balfour operation as that of choice for the early, active cases of coincident gastric and duodenal ulcer.

There were two deaths in this group of 42 cases. In one case death occurred suddenly on the tenth day, from pulmonary embolism. In the second case, that of an elderly lady, the gastric ulcer had perforated eight hours before operation, and death resulted from general peritonitis. A death rate of 4.8 per cent. cannot be regarded as high when it is considered that in many of these cases one is dealing with old and emaciated subjects.

The great variety of operations which were carried out in this series of cases is illustrated in Table I and Fig. 3.

CONCLUSIONS.

1. Coincident ulceration in stomach and duodenum is relatively common.

2. In this series it occurred in 16 per cent. of all duodenal ulcers and in 53 per cent. of all gastric ulcers.

3. Two groups of cases are to be distinguished when considering operative measures: (a) active ulcers without stenosis in relatively young people (below 50); (b) unhealed but cicatrized ulcers with stenosis in elderly subjects.

4. The Balfour operation is recommended for Class (a). Purely anastomotic operations give a lasting symptomatic cure in Class (b).

MAN AS THE INTERMEDIATE HOST OF THE TAENIA SOLIUM.

(With Special Plate.)

BY

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INFECTION by the *Taenia solium* has become extremely rare in this country, and the recognition of the aberrant *Cysticercus cellulosae* stage of this intestinal parasite in man by radiological means is of interest.

The *Taenia solium* used to be commoner, and was described at a period when x radiations were not being employed in medicine, and it has not been found possible to discover a record of appearances which may be seen in radiograms when man becomes the intermediate host. The condition is well recognized, and not of rare occurrence at the present day in many parts of the world, notably in Germany, in some parts of America, and in India, and I hope that the publication of this case will give me access to additional information upon this interesting subject, and that I may receive references to cases which have been seen.

The tapeworm known as the *Taenia solium* is characterized by a scolex bearing four somewhat prominent suckers and hooklets, varying in number from twenty-six to twenty-eight. It is an extremely long parasite, and lies in the intestinal tract of man, who is the host, the intermediate host being the pig. The proglottides contain the ova, and as they ripen are discharged in the faeces, the ova retaining a certain motility, and are swallowed by the pig. The gastric juices of the intermediate host act upon the shell of the ovum and dissolve it, and the oncosphere, which is set free in the stomach, passes into the blood stream, whence it is carried all over the body. It may settle in the brain, either in its substance or in the meninges, in the lungs, in the heart, in the eye, but most commonly in the skeletal muscles. It rarely lodges in the substance of the liver. It soon becomes transformed into a clear elliptical cyst, measuring about a centimetre by half a centimetre, and if lying in muscle substance takes up a position with its long axis parallel to the fibres of the muscle, which it separates. It slowly degenerates and becomes calcified, and may become apparent and give rise to symptoms and signs. Osler reports a case in which hundreds of subcutaneous nodules proved to be calcifications of the *Cysticercus cellulosae*, and many cases in which these bodies

FIG. 1.—Left knee.

FIG. 2.—Right knee—internal lateral.

FIG. 3.—Right ankle—lateral.

FIG. 4.—Left forearm—posterior.

FIG. 5.—Section under low power. ($\times 40$.)

FIG. 6.—Section under high power. ($\times 370$.)

have been seen in the retina have been reported from the German clinics.

It happens, then, that man may become the intermediate host, and because of the consequences the condition is a serious one. There are various theories as to how this may occur. The usual reasoning is that man may eat some vegetables or drink water contaminated with the segments or ova and thus become the intermediate host (or pig), with the same cycle of development of the parasite. It can occur, however, that man is both the host and intermediate at the same period; that is to say, that a man infected with the *Taenia solium* may also be infected with the *Cysticercus cellulosae*. It is thought that this accident may be caused through the regurgitation of the ripe proglottides into the stomach in an act of vomiting, but it is more likely that the irritation of the proglottides passing from the anus, which they may do spontaneously and under their own motility, leads to the soiling of man's fingers and the transference of the ova to the mouth.

A man, aged 44 years, a hairdresser, was sent to me for consultation by his doctor in April, 1926. He complained of pains in the left knee joint of some five years' duration which he described as "rheumatic." A sinus had developed upon the medial surface of the knee some two months before I saw him; it was about a centimetre in diameter and of about the same depth, and there was a purulent discharge from it. For the last ten years the patient had suffered from "fits" of epileptiform type at approximately monthly intervals. He would lose consciousness and fall down in the street. He did not recollect having bitten his tongue during one of the seizures. It was on account of these fits that he was discharged from the army, the condition being thought to be due to neurasthenia following shell-shock. He was in India from 1908 until 1911 in the army, from which he was discharged in 1916 after active service in France. There was no history of infection by intestinal parasites.

The man appeared to be healthy. There was a discharging sinus upon the medial aspect of the left knee. The chest appeared to be normal; special attention was paid to the rhythm of the heart as cases have been reported where it was irregular when the heart muscle contained the *Cysticercus cellulosae*. No abnormality was found in the eyes, and no subcutaneous nodules could be felt.

Radiograms were taken of the left knee-joint and the condition shown in Fig. 1 was discovered. Scattered throughout the muscles around the knee-joint were some eighty opaque, ovoid, disc-like bodies, which were doubtlessly in the nature of calcifications. They measured about 1 cm. by 5 cm., with regular edges. The centre of each mass was less dense than the peripheral margins, where the shading was "ringed" and concentric.

It was decided to examine every other part of the body, and this was done. Radiograms selected from this examination are reproduced in Figs. 2 to 4; some of the others yielded negative results. It will be seen that a similar condition to the one found in the knee exists in nearly every part, but with the main grouping of the calcifications in the extremities, as far down as the ankles and the wrists. The pectoral group of muscles upon each side contained a large number, and they were also found in the muscles of the neck and in the deep muscles around the vertebral column. The lungs were apparently unaffected and no abnormality could be detected in the heart shadow. None was located in the liver substance. Three, at least, of the bodies were seen to be lying in the pia mater of the brain, one of which was localized in the middle of the motor area upon the left side. These cerebral calcifications were similar to those seen in the other parts, and were not irregular, branched, or of undue size, as they have been described as seen in some autopsies. A calcification was localized as lying at the bottom of the sinus in the left knee-joint, which was thus explained.

It was determined to remove one of the bodies for pathological investigation, and a superficial one in the right forearm was localized and taken out under a local anaesthetic. It was creamy white, uniformly regular in consistency, and of stony hardness. Sections were prepared after decalcification, and the photomicrographs which were taken of them are reproduced in Figs. 5 and 6.

Under a low objective the majority of the section was seen to consist of degenerated keratinous material, surrounded by a fibrous capsule in intimate association with the muscle substance in which it was embedded. In the portion of the section which is reproduced an area of specialized tissue was seen, which, under a higher power of magnification, was found to consist of what is doubtlessly a cestode head with its four suckers and its hooklets, representing in every respect the degenerated scolex of the *Taenia solium*. This is well shown in Fig. 6.

It was thus established that the sinus formation in the left knee-joint and the "fits" from which the patient had suffered for so many years were caused by infection by the *Cysticercus cellulosae* stage of the *Taenia solium*, of which he was the intermediate host. It is to be supposed that he became infected whilst in India, and that as the calcification process was completed in the embryonic deposits the manifestations of them began to appear.

The sinus has commenced to heal under appropriate surgical treatment, and between his seizures the patient

is not otherwise inconvenienced by the widespread nature of his lesion.

I should like to acknowledge my indebtedness to Sir Bernard Spilsbury for his kind assistance and advice, and my thanks are also due to Miss Vaughan of the Dunn Laboratories of the Surgical Unit of St. Bartholomew's Hospital for the photo-micrography of the sections.

A CASE OF EXTENSIVE SOMATIC DISSEMINATION OF CYSTICERCUS CELLULOSAE IN MAN.

BY

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As the opportunity seldom arises for observing in a living patient such large numbers and such a wide distribution of *Cysticercus cellulosae* throughout the body tissues, this case is, I think, worthy of record.

Pte. L., aged 24 years, had been a tramway worker in Lancashire before enlistment in April, 1920. After enlistment he had been able to carry out his full duties until October, 1925, when he was admitted to hospital for abdominal pain, vomiting, and fever, and it was then noted that his liver was enlarged to the extent of three fingerbreadths below the right costal margin. In November he had a similar attack, from which he recovered and was able to return to duty. So far as he was aware he had never passed any segments of tapeworm. On November 24th, twelve days after discharge from hospital, he had pain in the calf muscles which he noticed to be swollen. He could not walk far because of pain in the legs and shortness of breath. He reported sick again on November 28th, when it was noted that the muscular enlargement was not confined to the calf muscles, but that the muscles on contraction appeared nodular: certain nodules beneath the skin of the forehead and in the gastrocnemii were noted also. There was no oedema and the urine was normal. There was eosinophilia up to 4 per cent. On December 24th he had a "fit" during which the pulse was irregular and the rate rose to 120. When he came under my care on December 28th, 1925, he was pale and the face appeared puffy, but the two outstanding features were the chain of nodules visible on the forehead and the greatly enlarged, apparently well developed and powerful muscles.

The patient says he noticed the nodules first late in October or early in November. They are found in the subcutaneous tissues of the forehead, scalp, beneath the left eye, in the neck, and in the tissues of the cheek. They occur singly or in groups of two or three of varying sizes. When single they are ovoid, flattened ovoid, or spherical according to the amount of pressure exerted by the surrounding tissues. In size they range downwards from half an inch in the longest diameter. They are found in the aponeuroses of the abdomen, elbow-joints, thighs, and legs. In the muscles they can be felt singly, in groups, and in chains. One cyst is present in the left eye. They have not increased in size during observation. They may be described as fibro-cystic and are not and never have been painful. They are movable and not at all adherent to the skin.

Nearly all muscles are enlarged, especially those of the shoulder girdles, and on contraction the affected muscles present a nodular appearance. He gives the impression of being a powerful man of "Sandow" type development, but the muscle power is in fact very feeble. Enlargement is due to the presence of cysticerci and to the concomitant myositis. The muscles are tender. Vision at first was somewhat impaired in the left eye, but during the period of observation it deteriorated considerably. The heart does not appear to be enlarged, but the heart sounds are distant and not quite clear, and it seems probable that the heart also is invaded. In the central nervous system no localized lesion can be elicited, but during observation he has had five fits. They occur at any time, and on one occasion when he was asleep. They are accompanied by muscular twitching and jerking, sometimes by cyanosis, sometimes pallor, and the pulse becomes irregular and the rate rises to 120. On one occasion the temperature rose to 99.2° F. He remains unconscious for four to five minutes, and this is followed by drowsiness and headache in the frontal region, especially over the left eye. He has no loss of sphincter control. His mental condition is not bright or quickly responsive, but his memory is good. The white cell count shows slight leucopenia, with a relative eosinophilia ranging from 12 to 6.5 per cent.

Vomiting occurred three times during the period of observation; it was not related to food; it occurred after a fit on one occasion, and at other times quite independently. No segments were seen in the vomit. The stools have been carefully searched daily for segments and ova, but without success up to date, even after the administration of anthelmintics. The urine at first contained traces of sugar, but since then has shown no abnormal constituents. The skin has never exhibited any evidence of urticaria.

On January 5th, to confirm my tentative diagnosis of generalized cysticercosis, two cysts were removed—one from the subcutaneous and one from muscle tissue. At the time of removal under local anaesthesia it was observed that the muscle (deltoid) was extensively invaded.

The following report on the removed cysts was received: "After removal of the ectocyst, they are found to be small oval cysts