of Singapore gaol, and the ratio of positives, Chinese to Indians, was 29 to 18. Applying this to the rate for Indians of 10 per cent., the rate for Chinese would be 16.6 per cent. The social conditions of Chinese also favour a higher prevalence of syphilis and gonorrhoea. As to the Malays, there is little evidence at present of widespread venereal disease among them. The fact that their conditions of life are such as to favour a lower prevalence than in the case of Indians or Chinese lends support to this view. Further investigation is, however, required.

Conclusions

Examination of conditions at present in the F.M.S. shows:

1. (a) That social conditions in the population vary from race to race; that these conditions are such in relation to Chinese, Indians, and Malays as to favour, in varying degrees, the prevalence of venereal disease; and that disease probably exists in decreasing amounts among them in that order. (b) That the Medical Department's report of a fall in incidence in venereal diseases in the F.M.S. is not necessarily true if based on the evidence in the Annual Reports of the Medical Department, F.M.S.

2. That the incidence of syphilis among Indian male labourers is in the region of 10 per cent.

3. That enough evidence is available to warrant a survey of the whole question and the closest investigation of it with a view to the control of venereal disease.

I have to thank Dr. H. M. Nevin of the Institute for Medical Research, F.M.S., who carried out the serological tests; Dr. J. G. Reed, medical officer to the estates, for his co-operation; and also the estate managers, who gave me every assistance.

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L. Bordoli (*Minerva med.*, 1939, 30, 54) states that among 205 cases of peptic ulcer treated at the Institute of Clinical Medicine of Milan University, evidence of syphilis was found in seventeen (8.5 per cent.). This is not very different from the incidence of syphilis in the population generally. Of these seventeen syphilitic patients 76 per cent. had duodenal ulcers. The nervous system was involved in 35.3 per cent., the proportion being most marked in cases of gastric ulcer. In 47 per cent. of the cases of peptic ulcer in syphilitic patients simple albuminuria was present without any other renal manifestations, and could be attributed to lesions in the renal vessels. Enlargement of the liver was found in 23 per cent. In 41 per cent. there was a well-marked lymphocytosis. There were no special radiological signs and the symptoms of peptic ulcer in the syphilitic were almost the same as in the non-syphilitic. Tabetic crises were present in only 11 per cent. Investigation of the gastric juice showed that hyperchlorhydria was present in 70 per cent., while in the rest the acidity was normal; in no case was there hypoacidity.

ARTERIAL EMBOLECTOMY

WITH NOTES OF A CASE

BY

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Arterial embolism is not a common condition, and cases which come to operation early enough to be successful are so rare in this country as to make a case of embolectomy worthy of record. Riddell (1937) found that only twenty cases of embolectomy had been reported here, of which eleven had been successful; while in Sweden 382 cases were reported up to 1936 (Key, 1936), and of these eighty-six (22.5 per cent.) were successful, sixty-nine (18.1 per cent.) required subsequent amputation, and 227 patients (59.4 per cent.) died in hospital. Seventeen of the cases were aortic, and three of these (17.7 per cent.) were successful, while of the sixty-six iliac cases ten (15.1 per cent.) were successful. The discrepancy in the number of cases in the two countries is rather striking, and would almost suggest that in Sweden the possibility of such an emergency arising is more often considered in differential diagnosis than in this country, so that a greater number of cases come under the surgeon's care.

In the case recorded below the appearance of three smaller emboli before the large arterial embolism occurred made the diagnosis easy, but one can well imagine that the signs might be somewhat confusing had an embolus not been considered. This case, as the post-mortem report shows, had a multiple pathology, to which the patient succumbed two months after the operation; but the circulation in the legs still remained good when he was last seen alive, six hours before death.

Case History

An asbestos weaver, aged 46, on permanent compensation for asbestosis since February, 1938, was in bed from July 3, 1938, with severe dry bronchitis and auricular fibrillation, partially controlled by digitalis. On July 7 he had a sudden severe pain in the right loin spreading across the abdomen at the level of the umbilicus, and for the next twenty-four hours he passed very little urine, but this, however, was never blood-stained; the right kidney area was exceedingly tender, the pain necessitating the use of morphine. A diagnosis of renal colic was made, which in the light of later events was changed to that of a renal infarct. The pain gradually subsided in the course of two or three days.

On July 12 he had a sudden severe pain over the lower lobe of the right lung in the axillary line; there were physical signs of an infarct. On July 15 he had a similar pain, but less definite signs, over the left lower lobe. (The post-mortem examination disclosed a splenic infarct.) On the morning of July 17 the patient was slightly better, the pains having subsided. At 6.45 p.m. he awoke from sleep with a sudden agonizing pain in the lower abdomen, which spread down the left leg to the toes, and then similarly down the right leg, his legs becoming practically powerless. Seen at 7.15 p.m., he was collapsed: his pulse was 120 and irregular, and he was obviously in severe pain. From the level of the pubes to the toes both legs were dead white and corpse-like, the superficial veins showing as furrows instead of ridges; the skin was cool, but, owing to his shocked condition, not very different from the rest of his body. There was a faint pulsation in both femoral arteries, palpable to about the middle of Scarpa's triangle, but no pulsation in the lower arteries. The right femoral pulse had slightly greater volume than the left. He stated that his legs were useless; he was able to flex

them fully, but could not extend them again. The knee-jerks were absent. A diagnosis of aortic embolus was made, and he was removed to the Rochdale Infirmary for operation.

When seen in hospital at 8.15 p.m. his general condition was unaltered. The pain in the legs was slightly less severe, but the movements were restricted to 20 degrees of flexion of the knees. The femoral pulses were now visible only where the arteries crossed the pubic arch, but could not be palpated at all.

Operation

Operation took place at 8.45 p.m. In view of the situation of the embolus a spinal anaesthetic was administered, the patient being turned on his left side. Five minutes later he was free of pain and the right femoral artery was found to be beating with a normal impulse, the right leg having regained its normal circulation. The left femoral pulse, however, was now neither visible nor palpable. Incisions were made over both femoral arteries just below Poupart's ligament and the arteries exposed and cleared of adventitia down to their division into superficial and deep branches. It was found that on the left (obstructed) side the artery divided into three branches at this point, one deep and two superficial, all of equal size. Temporary ligatures by the Gordon-Taylor method, with tape and a one-inch length of rubber tubing, were applied to both arteries at the lower end of the exposed length. A third incision, five inches long, was made on the left side, one and a half inches above and parallel to Poupart's ligament, dividing all muscles in the line of incision until the peritoneum was exposed. This was then wiped back, and gave a perfect exposure of the iliac vessels right up to the lower end of the aorta. It was seen that the embolus was lodged at the junction of the internal and external iliac vessels, the artery bulging and firm to the touch, the external iliac artery below this point being empty and contracted. About three-quarters of an inch above the junction the common iliac artery was pulsating normally; the lower end of the aorta was normal.

The embolus was broken up by the fingers and gradually milked into the external iliac artery. When the whole had apparently been dislodged, a temporary clamp, consisting of Allis tissue forceps with the blades covered with fine rubber tubing, was applied to the external iliac artery just below the junction with the internal iliac. The wound in the left thigh was then flooded with a 2 per cent. sodium citrate solution and a longitudinal incision made in the common femoral artery just below Poupart's ligament, a fine silk stay suture having been passed through the outer coats of the vessel on each side of the incision. The embolus was then milked down and delivered through the femoral incision, appearing as two pieces of white thrombus $\frac{3}{8}$ inch by $\frac{1}{8}$ inch, and a mass of secondary red thrombus. The lumen of the vessel was washed out with citrate solution and the clamp on the external iliac artery temporarily released, there being an immediate spurt of blood. Temporary release of the lower ligature showed a small retrograde flow from the lower end. The incision in the femoral artery was sutured with mattress sutures of fine silk smeared with petroleum jelly and the clamps removed. There was no pulsation!

Examination disclosed that a further embolus had become impacted at the junction of the internal and external iliac arteries. The incision in the femoral artery was reopened and the embolus milked down and removed as before. This second embolus was also a white thrombus, $\frac{1}{2}$ inch by $\frac{1}{8}$ inch, with a considerable quantity of secondary thrombus. On resuturing the femoral artery and removing the clamps pulsation occurred normally in the limb and was palpable in the popliteal artery. A slight ooze from the suture line in the femoral artery was controlled by a muscle graft from the abdominal incision. The incisions were all rapidly closed and the patient returned to bed in fair condition, with the temperature 98°, pulse 104, and both legs warm and a good colour.

The next day he could move both lower limbs, and knee-jerks had returned. The wounds all showed a slight degree

of sloughing around the sutures, but were completely healed in four weeks in spite of his developing a large lumbar carbuncle in the third week, accompanied by several smaller ones on the scalp. The cardiac condition improved, and the heart became and remained regular on digitaline nativele 1/600 grain daily. He returned home in five weeks, but his general condition kept him in bed. His heart subsequently failed, and he died on September 16, just two months after operation.

Post-mortem Findings

Left lung: A fine generalized fibrosis was present; the pleura was normal except for a few apical adhesions. *Right lung:* This was solid throughout; all fibrous septa were thickened, thick muco-pus was found in the bronchi, and the glands at the hilus were enlarged. At the base there was an old infarct $1\frac{1}{2}$ inches by $\frac{3}{4}$ inch. Small ante-mortem clots were present in the large vessels. The pleura was very thickened, and was completely adherent to the parietal pleura. Microscopically, sections from near the hilus showed an adenocarcinoma apparently derived from a bronchial mucous gland and typical asbestos bodies.

The *heart* was dilated, with thin brown muscle and a large friable ante-mortem clot in the left ventricle. The *spleen* was slightly enlarged, and had an old infarct at the lower pole. The *kidneys* showed much cloudy swelling, with a narrow cortex; an old infarct was observed at the upper pole of the right kidney. There was a large "nutmeg" liver, but no secondary nodules were present in it. From the aortic bifurcation down, both *common iliac* and *common femoral arteries* contained loosely adherent ante-mortem clot; the suture line was healed in the left femoral artery, and the lumen of the artery was apparently normal.

Discussion

The onset, signs, and symptoms of this case appear to have followed the classical lines of *pain, pallor, and paralysis*, but as it was seen and operated on at an earlier stage than most cases of which I have been able to find records a few points would seem worthy of comment. Most authorities agree that, if possible, local anaesthesia should be the method of choice. This is not possible with iliac or aortic emboli, but in the present case the use of a spinal anaesthetic appears to have had definite advantages, as the relaxation of arterial spasm by the anaesthetic permitted the embolus to slip into the left common iliac artery (the patient being on his left side for the spinal injection), rendering any opening of the right femoral artery unnecessary. In this connexion one has to note that the operation began only two hours after the embolus became impacted, and presumably, had it been delayed much longer, increasing damage to the intima would have caused the embolus to become more adherent, thus lessening the possibility of the displacement of the embolus by the relaxation of spasm after anaesthesia, though not necessarily impairing the chances of a good end-result, for most of the successful reported cases have gone as long as four to six hours before operation.

This early case confirms Jefferson's (1934) view that the signs are present immediately the embolus becomes impacted; but an interesting feature was the feeble femoral pulse palpable down to the middle of the thigh in both legs when the case was first seen, half an hour after impaction, and the fact that an hour later the femoral pulses were still present, but this time only where the arteries crossed the bony pelvic ring, and then merely visible and not palpable. Comparing the sizes of the various portions of the embolus with the lumen of the arteries concerned, it is obvious that only a slight degree of mechanical obstruction can be present when the embolus first becomes impacted, and the amount of

arterial spasm which is set up by the impaction must be very great to cause immediate symptoms of such severity.

This disparity in the size of vessel and the embolus obstructing it would suggest that in all cases of arterial emboli in the early stages the obstruction is almost entirely due to arterial spasm, and it is only with the passage of time and the increasing formation of secondary thrombi that the actual mechanical obstruction becomes a potent factor. In this case the gradual weakening of the femoral pulses was no doubt due to the increasing mechanical obstruction from secondary thrombosis. When, however, an embolus does not stop until it reaches a smaller vessel it will naturally act as a mechanical obstruction as soon as it becomes impacted, as no doubt happened with every case of infarction. Key (1936) states that as a rule no pulse is found below an embolus, and, taking into consideration the reduction in volume of the pulse which took place during an hour in the present instance, one can well imagine that in another hour it would have disappeared entirely.

In this case secondary thrombosis began at an early stage. According to Key (1936) the time of its onset varies very greatly; he has seen it start in less than two hours, but he also reports a case, operated on after eleven days, in which no secondary thrombosis was present. It seems to be generally agreed, however, that after about six hours secondary thrombosis will have advanced to such a degree as to render the success of the operation very doubtful, and that after this period more or less gangrene is certain to occur in the affected limb.

The most disconcerting feature of this case was the reblocking of the iliac artery after release of the clamp had shown the lumen to be clear. The probable sequence of events is most easily followed by reference to the

FIG. A.—The original condition.

FIG. B.—After giving the spinal anaesthetic: no spasm.

FIG. C.—Removal of the embolus.

FIG. D.—Release of clamps dislodges the second portion from the bifurcation.

diagrams. In Fig. A the embolus is shown hanging over the bifurcation of the aorta at a period when the arterial spasm was the chief cause of obstruction. By the time the anaesthetic had been given the secondary thrombosis had increased to such a degree that, when the spasm relaxed, the renewed flow of blood into the iliac arteries detached a portion of the embolus and secondary thrombus

and swept it into the left common iliac artery, where it was again held up at the junction of the internal and external iliac arteries, this time causing a definite mechanical obstruction of the arteries of the left side. A small portion of the embolus must have remained adherent to the bifurcation of the aorta (Fig. B). In Fig. C it is shown that while the embolus in the left common iliac artery was being dealt with the secondary thrombosis around the small portion of embolus still at the bifurcation was increasing, so that when the clamp was temporarily released to show the patency of the lumen the sudden flow of blood past this now quite large mass at the bifurcation of the aorta detached it, and it became impacted in the same situation as the main portion was before removal (Fig. D). Had the right femoral artery not had a temporary ligature around it throughout the operation this second portion of embolus would quite possibly have been detached sooner, and have travelled down the right side, necessitating an incision into the right femoral artery for its removal.

The carcinoma of the bronchial glands in the right lung was not discovered during life, and in fact there was such severe bronchitis during the last four months that detailed examination of the lung condition was very difficult. The infarcts in the right kidney and right lung were in the expected situations, but the infarct in the spleen was interesting in that at the time it occurred it was thought to be actually at the base of the left lung. The ante-mortem clot found in the left ventricle was of such a size as to indicate an almost inexhaustible source of further emboli had the patient not succumbed to his other conditions.

A recent paper by Griffiths (1938) describes the first successful British aortic embolectomy. His case occurred in 1935. Although at operation my case was dealt with as a left iliac embolectomy, it can, I think, justifiably be classed as an aortic embolus "riding" the aortic bifurcation in the first instance and being displaced into the iliac vessels during treatment.

Summary

A case of aortic embolus becoming iliac at operation is described, with a full account of a successful embolectomy. The advantages of early diagnosis and operation are stressed.

I have to thank Dr. F. J. Knox for his assistance with the operation and his advice, and for criticism of this paper. Thanks are due also to Dr. C. E. Jenkins of Manchester for his report on the post-mortem findings.

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The fifth International Congress for Life-saving and First Aid to the Injured will be held at Zürich and St. Moritz from July 23 to 28, nearly five years after the last congress in Copenhagen. The programme will include the consideration of international aid in major catastrophes, including rescue work and first aid on the high seas, in the air, on railways, main roads, and such other subjects as the restoration of normal breathing, gas poisoning, and the special training of medical practitioners, lay assistants, and ambulance men. All inquiries should be addressed to the secretary of the Industrial Welfare Society (Mr. G. L. Perry), 14, Hobart Place, Westminster, S.W.1.