treated by ordinary methods, approximate to its normal level as the disease diminishes, but Donald (1938) found that relative lymphocytosis persisted even to the ninth week of disease in 50% of cases. This observation would account for those cases which were not in agreement with the "decline" form of graph.

In the second method of examination of the lymphocyte percentage, the average lymphocytosis during the course of the disease was calculated for both antigen and control cases. The figures were 64% for the former and 68% for the latter. Here again no appreciable difference existed between the two groups.

Sauer (1933) and Daughtry-Denmark (1936), as a result of lymphocyte percentage counts taken during prophylaxis of children with pertussis vaccine, found that the figures were raised as in cases of pertussis. The antigen in the present investigation does not appear to have affected the course of the lymphocytosis either quantitatively or qualitatively, and it is reasonable to expect that the former, at least, should have occurred.

Discussion

From the foregoing results it is apparent that the antigen employed as a therapeutic agent in this investigation did not shorten the duration of the disease, render it less severe, or reduce the incidence of complications. Space does not permit a detailed comparison of results with those obtained by Joslin and Christensen, but it may be noted that the dose of antigen we gave was that advocated by them, and the average ages of patients in both experiments are comparable. As those workers did not include the criteria by which they assessed their cures a reliable comparison of the average duration of the two series is not possible. Among their list of complications they included bronchitis, which is not generally accepted as such but is considered an accompaniment of pertussis. By omitting these cases their complication rate can be revised, as follows:

Original percentage :	Revised percentage :
Antigen, 0.6% ;	Antigen, 0.4% ;
Control, 18.0% .	Control, 8.0% .

Thus the complication rate of their control cases appears less serious.

In the present investigation 17 out of 20 cases which received antigen were in the paroxysmal stage when admitted. It has been suggested by some workers that vaccines used in the treatment of pertussis must be given in the catarrhal stage to be effective. This remains to be proved for the antigen, and certainly merits attention.

The three cases in the catarrhal stage when injected were in hospital for 76, 60, and 33 days respectively, which figures do not suggest that any amelioration of the disease resulted from use of the antigen.

Summary

Twenty cases of pertussis treated with an antigen are compared with a similar number of controls.

Duration of the disease, complication rate, and lymphocyte percentage were not appreciably affected.

The results of this investigation are briefly compared with those of a similar experiment and discussed.

I wish to acknowledge the permission of the Medical Officer of Health of the London County Council to publish these results, and to thank Chas. F. Thackray Ltd., Leeds, for a generous supply of Lederle's detoxified pertussis antigen.

REFERENCES

- Daughtry-Denmark, Leila (1936). *Amer. J. Dis. Child.* **52**, 587.
Donald, A. B. (1938). *British Medical Journal*, **2**, 613.
Joslin, C. L., and Christensen, T. A. (1940). *Amer. J. Dis. Child.*, **60**, 1269.
Sauer, L. (1933). *J. Amer. med. Ass.*, **100**, 239.

Sarsaparilla has been used as a remedy for over 300 years, and since the earliest colonial settlement in America it has found favour there as a tonic drink. During the past 50 years there has been an extensive literature on the saponins of sarsaparilla, and according to F. M. Thurmon (*New Engl. J. Med.*, 1942, **227**, 128) only one definite saponin—sarsasaponin—has been isolated from any of the varieties of sarsaparilla. Thurmon has used sarsasaponin in the treatment of psoriasis, and found that it had a beneficial effect on 62% of the 75 patients he treated.

GASTRO-DUODENAL SURGERY IN THE AGED

BY

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With the ever-increasing progress made—perhaps even more along the lines of pre-operative preparation, anaesthesia, and post-operative care than in actual technique—certain major procedures can now be undertaken at an age which in the past would have been considered prohibitively high. Needless to say, with age and its increased incidence of respiratory infections, cardiovascular degeneration, prostatic obstruction, and so forth, one does not perform major operations without strong indications, but when those indications are present it may be unfair to the patient to make the number of his years the sole factor which denies him the benefits of surgery.

Chronic and frequently relapsing gastric or duodenal ulcers, both of which heal less readily in the aged, and carcinoma of the stomach, or their complications, all form occasional indications for surgery in the later years of life.

Gastro-duodenal Perforation

Acute perforation of peptic ulcer or carcinoma is an absolute indication for surgery. Of 83 such operations performed by me since 1936, 18 were on patients over the age of 60, and 6 over 75. In a series of 5,740 gastro-duodenal perforations taken from the literature by Sandell (1936) only 57 patients were over the age of 60, and the oldest was aged 77. In the same communication Sandell recorded the recovery of a patient of his own, aged 82, after suture of a juxta-pyloric perforation.

In my series of 18 patients of 60 and over, two were cases of perforated carcinoma of the stomach. One of these, aged 70, died after simple closure of the perforation; the other, aged 61, made an excellent recovery after an emergency gastrectomy—an operation which seemed advisable because the carcinoma was also causing obstruction. Of the remaining 16 patients with simple perforation three were aged 79 and two 77. One 79-year-old lady with a duodenal perforation of 4½ hours' duration recovered after closure of the perforation under local anaesthesia (this being the second oldest case of perforated ulcer on record to recover). One of the 77-year-old patients also made a good recovery. Of the whole 16 patients with simple perforation 10 died. On closer investigation it becomes apparent that failure to send the patient to the surgeon early, rather than age, was the factor which caused the high mortality. Of the 8 seen and operated on under twelve hours from the time of perforation six made a complete recovery and two died, four weeks and six weeks after operation, from bronchopneumonia and cerebral thrombosis respectively. With such delay the figures could hardly have been much better in youthful patients. It is obviously well worth while to operate on these aged patients if they are presented in reasonably early hours after perforation. No doubt the possibility of peptic perforation does not suggest itself so readily to the practitioner when he is confronted with an aged patient, often with intercurrent ailments and a long history of pain.

Another case—the oldest case of duodenal perforation, and possibly of duodenal ulcer, on record—came to my notice for the first time in the post-mortem room.

A feeble lady aged 91 was admitted to a "chronic ward" on June 8, 1936, complaining of general weakness and occasional lower abdominal pain, with loss of weight. Her abdomen was rather guarded, but presented no other abnormal physical sign. There were pressure sores on the heels and moist crepitations at the bases of both lungs. She became steadily weaker, and had occasional abdominal discomfort until June 17, 1936, when she complained of pain in her chest just before midnight. She collapsed later, and died at 8.15 a.m. the next day.

Post-mortem examination, performed by Dr. Allen B. Bratten, disclosed a general sero-fibrinous peritonitis with two pints of free fluid. On the anterior wall of the duodenum 1.5 cm. beyond the pylorus was an ulcer 1 cm. in diameter, perforated in its centre. Another larger ulcer was present on the posterior wall of the duodenum.

Ante-mortem thrombosis of the left common iliac vein was present, with a recent embolus at the bifurcation of the pulmonary artery and an older adherent thrombus in the left branch. There was generalized arterial atheroma.

Histological examination showed the typical appearance of a chronic duodenal ulcer.

Gastric Carcinoma

Carcinoma of the stomach affords the commonest indication for gastric surgery in the aged. During the past three and a half years I have explored 61 cases of carcinoma of the stomach apart from the two perforated ones described. Of these a radical partial or total gastrectomy was performed in 30, of whom 21 were over the age of 60 and 9 were 70 or over. Of the 9 patients under 60 all but one (a case of palliative total gastrectomy) recovered. Of the 12 between 60 and 70, 10 recovered; and of the 9 over 70, 6 recovered. The 3 over 70 that died were a lady aged 71 who had undergone total gastrectomy (she had carcinoma of 2 cm. of the lower oesophagus and cardia), a patient aged 75 with syphilitic aortitis who had undergone partial gastrectomy, and a man of 70 who developed a cerebral thrombosis.

Among patients whose growths were found irremovable, and on whom only a palliative gastric transection or short-circuit or nothing at all was done, the mortality was higher than in those who had had a gastrectomy—a feature which makes even a palliative gastrectomy justifiable from the patient's point of view.

An 80-year-old partial-gastrectomy patient merits a short note, as he must be one of the oldest patients to survive this operation.

This 80-year-old man was admitted to St. James Hospital on Aug. 5, 1941, complaining of abdominal pain in the evenings, accompanied by vomiting, with anorexia and loss of weight for two months. He was pale and wasted, and had visible gastric peristalsis. Barium-meal radiographs and gastroscopy confirmed the pyloric stenosis, though its actual pathology could not be determined. His condition was improved a little by rest and gastric lavage, though he still had a 48-hours gastric residue of barium. On Sept. 11, under local anaesthesia, a mid-epigastric incision was made. A carcinomatous ulcer of the pyloric canal with infiltration of the right and left gastric and subpyloric glands was discovered, and was treated by radical retrocolic partial gastrectomy—well wide of the tumour and including all the obviously infected glands. Subsequent histological examination showed a trabecular polygonal-celled scirrhus carcinoma of the stomach ("leather-bottle" type). The patient made a good recovery apart from an attack of prostatic obstruction which was treated by suprapubic cystostomy. In Dec., 1942, he still remained active and well, with no sign of recurrent growth.

According to the recent survey of the operations of total gastrectomy by Joll and Adler (1942), the oldest patient to survive this procedure was a man aged 72, recorded by Waugh and Giffin (1941). A description of my successful total gastrectomy for a patient aged 74 may be of interest.

A moderately well nourished man of 74 was admitted to St. James Hospital on Sept. 6, 1942, with a history of two years' periodic mid-epigastric pain two or three hours after meals. His appetite was good. Barium-meal examination on Sept. 8 suggested a duodenal ulcer, and the patient was sent home for three weeks' bed-rest and ulcer diet. On his return he felt much improved and radiography revealed a normal duodenum, but in view of an inconsistent fractional-test-meal curve, which showed a very low free and a high total acidity, I gastroscopied him. An ulcer was revealed, extending from as high as could be seen on the lesser curvature, with a slightly raised and "gelatinous"-looking margin, and a base which appeared to be alternately fibrotic and superficially ulcerated, reminding one of a rodent ulcer. The diagnosis was carcinoma of the superficial spreading type (Stout, 1942).

On Oct. 20, under local anaesthesia, a long mid-epigastric incision was made. A rather flat carcinomatous ulcer was felt on the lesser curvature of the stomach extending as high as the cardia. There were a few hard glands on the upper part of the greater and lesser curvatures. A radical total gastrectomy was performed, removing lesser omentum, right and left gastric vessels and glands, and gastro-epiploic arch. The resection included 2.5 cm. of duodenum and 3 cm. of oesophagus. Termino-lateral oesophago-jejunostomy was performed, using two rows of continuous catgut suture, with a few extra stitches from adjacent diaphragmatic peritoneum to jejunum to give support. The long jejunal loop was short-circuited to prevent distension of the duodenum, and a feeding jejunostomy was made. The patient's condition was good, and it remained so throughout the whole post-operative period. Jejunostomy feeds were given from the day of operation, but mouth-feeding was not begun until the

fifth day, when the jejunostomy tube was removed. On his discharge on Nov. 21 he could take porridge, an egg, two slices of bread-and-butter, and a cup of tea for breakfast with no discomfort.

Histological examination of the specimen showed a solid acinar polygonal-celled and tubular cuboidal-celled mucous carcinoma of the stomach.

Chronic Peptic Ulceration

In comparison with the frequency with which advanced lesions are found to require surgery in the young and middle-aged, uncomplicated gastric or duodenal ulcers do not often need it at great ages. No doubt this is in part due to the fact that the possession of a chronic peptic ulcer is not conducive to longevity. Of 266 operations personally performed for benign non-perforated ulcer during the last three and a half years, 40 were on patients between the ages of 60 and 76. Generally speaking, with the natural tendency to thinning of the gastric mucosa and diminution of gastric acidity with advancing years, which is accelerated by the retention gastritis associated with duodenal stenosis or pylorospasm and the correspondingly diminished risk of anastomotic ulceration, it is usually safe to perform short-circuiting operations in patients in this age group. Of these 40 operations, 15 were for duodenal ulcer, of which only two were gastrectomies. One other patient, aged 68, had a gastro-jejunal ulcer: this is always best treated by gastrectomy, which was done. The remaining 24 had gastric ulcers, most of them complicated by complete penetration, stenosis, or multiple ulceration; 17 were treated by gastrectomy and 7 by gastro-jejunostomy. Although gastrectomy, after adequate preparation, is the ideal operative solution for gastric ulcer at any age, some of the aged and feeble patients, whose ulcers are associated with marked delay in emptying, may improve greatly in comfort and nutrition after a gastro-jejunostomy.

Of the 20 (aged from 60 to 74) undergoing gastrectomy 17 recovered. Of the 20 (aged from 60 to 76) who had short-circuiting operations 16 recovered. The 7 deaths were due to cerebral thrombosis (1 case), pneumonia (2 cases), anaemic necrosis of colon from caecum to rectum—due to a combination of post-operative colonic distension and atheroma of the mesenteric vessels—(1 case), obstruction from adhesion to the cut end of the ligamentum teres (1 case), and repeated vomiting after anterior gastro-jejunostomy (2 cases).

The mortality from gastro-jejunostomy is high, but it must be remembered that all these lesions were the worst of their type, incompatible with any further span of comfortable existence; nearly all were completely penetrating ulcers associated in most cases with varying degrees of gastric retention in very aged patients, and all had had a very prolonged trial of medical treatment. The anterior gastro-jejunostomies, which were done because of severe destruction and adhesion of the posterior wall of the stomach, gave great anxiety from the tendency to recurrent vomiting, and, though I have occasionally found the operation give an excellent result, on the whole would strongly advise against it. The aged patient will not often stand a convalescence associated with too much vomiting or too prolonged continuous gastric aspiration, which the vomiting necessitates.

Preparation for Operation

The success or failure of a gastro-duodenal operation is largely decided before the patient reaches the operating theatre. It has been demonstrated that there is a direct relation between the prognosis of peptic ulcer operations and the antecedent loss of weight (Studley, 1936).

Patients with an ulcer of such severity as to require surgery often have a background of months or years of undernutrition resulting from fear of pain after food, vomiting, self-inflicted diets, or actual obstruction. On admission they are fatigued and depressed by their latest relapse. They require a preliminary course of feeding on a high-quality diet and rest in bed, partly to increase their resistance to infection and their powers of wound healing (Whipple, 1940), partly to bring the ulcer into as quiescent a stage as possible; also to diminish the gastritis associated with incomplete emptying of the stomach. A high-protein diet diminishes the time-lag before healing of the wound begins (Waugh, 1941). Adequate amounts of ascorbic acid are essential for the formation of collagen fibres and for wound repair (Hunt, 1941). Intravenous saline

may be required if dehydration cannot be corrected by the oral route. Bed-rest is essential to produce quiescence of the ulcer and so enable the patient to absorb the food he is given. When there is delay in emptying, daily gastric lavage will often considerably reduce the emptying time, with consequent nutritional improvement.

Anaemia as a result of occult or obvious bleeding from the lesion, or of nutritional deficiencies, is often present, and can usually be corrected by the oral administration of ferrous salts. If this fails, or in the more urgent carcinoma cases, blood transfusion may be required.

The mouth should be cleaned by washes, tooth-cleaning, and scaling—extensive dental extractions should be undertaken only in the more quiescent cases in which there will be time to regain a comfortable and clean mouth well before operation. Breathing and regular limb exercises should be carried out before and after operation. The patient should refrain from smoking for 48 hours before operation.

Prophylactic Sulphapyridine

In May, 1941, I decided to try the use of sulphapyridine by mouth as a prophylactic against pulmonary and peritoneal infection in all gastrectomy cases. The effect was striking. In the 18 months prior to that time there were four fatal primary infections in under a hundred gastrectomies—one case of peritonitis in a completely penetrating ulcer case which was shown at necropsy to have watertight suture lines, two lobar pneumonias, and one confluent bronchopneumonia. In 18 months since then I performed 120 partial gastrectomies for simple ulcer with only one death. These were not selected cases: 6 of the patients had gastro-jejunal ulcers; 20 had multiple ulceration; 42 had complete penetration with the ulcer base in pancreas, liver, or colon; many were stenosed; and their ages ranged up to 74. There were some chest infections in the series, mostly moderate degrees of bronchitis in old bronchitic subjects, and one basal collapse.

Among 14 gastrectomies for carcinoma in the same period there were three deaths—syphilitic aortitis (aged 75), post-operative collapse (aged 68), and leak from a feeding jejunostomy in a total gastrectomy—but none from primary infection. The only severe wound infection occurred in a patient who required colonic resection as well, but he recovered from it. There were a number of minor wound infections.

Anaesthesia

The anaesthetic is of paramount importance. The elderly patient is usually co-operative and not very apprehensive, and forms the ideal type for local anaesthesia. He certainly appears and feels less exhausted after a local than after a deep ether anaesthesia. High spinal anaesthesia is often contraindicated by the presence or suspicion of cardiovascular degeneration. Of all general anaesthetics cyclopropane seems to cause the aged patient the least distress. My preference, however, is for local anaesthesia, and I use either a combination of rectus-sheath block and anterior splanchnic anaesthesia (Braun) or intercostal block with posterior (Kappis) splanchnic anaesthesia. When injecting the splanchnic plexus by the anterior route in the aged care should be taken not to press on an atheromatous aorta or displace it too roughly.

Post-operative Period

For 24 hours after operation the aim is to rest the temporarily paralysed intestine, and so we give by mouth only the little water or fruit juice necessary to enable the patient to take the sulphapyridine comfortably. Fluid is administered by slow rectal drip—tap-water or saline-and-glucose solution. High-quality protein is given in the form of skim-milk, egg, etc., as soon as possible. Boiled sweets to suck or sugar with drinks supply the carbohydrate requirements. Blood transfusion is not given as a routine during or after the operation, though it may be required in rare cases.

Breathing and leg exercises are restarted as soon as the patients recover from their post-operative sleep. When necessary they are instructed to clear their air passages by coughing.

Summary

A case of duodenal ulcer perforation at the age of 91, and cases of recovery from duodenal perforation at 79, from total gastrectomy at 74, and from partial gastrectomy at 80, are recorded.

A series of 120 partial gastrectomies for gastric, duodenal, and gastro-jejunal ulcers with one death is recorded, a result which is attributed in part to the use of prophylactic sulphapyridine.

The causes of death in aged patients after major gastro-duodenal procedures are recorded.

My thanks are due to Dr. W. Allen Daley, Medical Officer of Health to the County of London, and Dr. Norman S. Craig, medical superintendent of St. James Hospital, for permission to publish this paper. Dr. E. W. Glennie has given me great help in anaesthetic problems. I must also acknowledge the great nursing skill displayed by Sister B. Dodsworth and Sister M. Ridgeway while these fragile patients were under their care.

REFERENCES

- Hunt, Alan H. (1941). *Brit. J. Surg.*, **28**, 436.
Joll, Cecil A., and Adler, D. I. (1942). *British Medical Journal*, **2**, 632.
Sandell, David H. (1936). *Ibid.*, **1**, 210.
Stout, A. P. (1942). *Arch. Surg.*, Chicago, **44**, 651.
Studley, H. O. (1936). *J. Amer. med. Ass.*, **106**, 458.
Waugh, J. M., and Giffin, L. A. (1941). *Proc. Mayo Clin.*, **16**, 363.
Waugh, W. G. (1941). *British Medical Journal*, **1**, 236.
Whipple, A. O. (1940). *Ann. Surg.*, **112**, 481.

INCIDENCE OF PULMONARY TUBERCULOSIS OF ADULT TYPE IN THE R.A.F.

RESULTS OF MASS RADIOGRAPHY OF 75,000 CASES

BY

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The object of this article is to give a detailed analysis of the age incidence and types of case discovered by mass radiography and to discuss the problems which will arise in dealing with these and other cases so discovered in the future. The work of the tuberculosis and health services generally will be considerably increased when mass chest radiology becomes a national undertaking, but it is only by utilizing to the full this recent and valuable addition to our methods of investigation that we can hope to get a real and lasting improvement in the incidence of pulmonary tuberculosis in this country.

As might be expected in a first examination there are wide variations in the extent and degree of activity in the cases discovered, and when running a mass chest x-ray unit one is impressed by finding how far advanced some of the active sputum-positive cases have become without any complaint having been made to the medical officer by the airman or airwoman. It may be that to a certain extent a young man who is keen to serve his country conceals his symptoms; but this in itself makes it all the more necessary that men and women in the Services, and the public generally, should have a periodic routine chest x-ray examination. It is wishful thinking to expect a majority of early cases at once, before the more advanced cases have been discovered in the preliminary surveys.

Active Cases

Let us first consider the active cases of pulmonary tuberculosis discovered in 75,000 cases, 65,000 of which are airmen

Airmen (65,000) : Unilateral Pulmonary Tuberculosis

Age Group:		18-19	20-24	25-29	30-34	35-39	40-45	Total
Sputum positive	With symptoms	6	6	2	1	6	1	22
	Without symptoms ..	2	1	2	0	1	0	6
Sputum negative	With symptoms	13	18	1	4	3	1	40
	Without symptoms ..	14	16	1	3	0	0	34

Airmen (65,000) : Bilateral Pulmonary Tuberculosis

Age Group:		18-19	20-24	25-29	30-34	35-39	40-45	Total
Sputum positive	With symptoms	14	7	2	1	4	2	30
	Without symptoms ..	1	1	1	0	1	0	4
Sputum negative	With symptoms	7	14	3	7	5	1	37
	Without symptoms ..	12	7	1	1	2	0	23