operatives often become infected during working hours, and that in factories with large workshops carriers have actually caused local epidemics of tuberculosis.

Since there also seems to be some relation between rate of infection and factory size in the clothing industry (see Table IV) it is likely that the high death rate from pulmonary

TABLE IV.—Incidence of Pulmonary Tuberculosis in Large and Small Clothing Factories

Factory Size (Working Population)	No. Examined (Mass Radiography)		Pulmonary Tuberculosis (Rate per 1,000)	
	Males	Females	Males	Females
1-100	103	636	—	4.7
101-500	60	810	—	6.2
Over 500	166	1,312	—	9.2
Total	329	2,758	—	7.3

tuberculosis in other occupational groups (Registrar-General's Decennial Supplements, 1890-1932) is also due to spread of infection from carriers to fellow workers, and that there is nothing fundamentally different between the working arrangements in boot and shoe factories and those in other industrial communities. There can also be no doubt that mass radiography statistics contain valuable material for studying disease incidence in various occupational groups and that there is an urgent need for a more detailed study of these records.

Summary

An investigation has been made in Northamptonshire in which mass radiography records and other statistics have been explored. The investigation is still incomplete, but the findings to date suggest that the death rate from pulmonary tuberculosis in the shoe industry, which is high compared with all occupied and retired males but not much higher than other industrial communities, is due partly to selective recruitment and partly to working conditions.

There seem to be three aspects to selective recruitment: first, boot and shoe factories employ more men with chronic pulmonary tuberculosis than most other trades; secondly, the physique of the men is slightly subnormal; and, thirdly, there is a strong family tradition in the shoe trade, so that the workers are often interrelated.

There is no evidence of a specific industrial hazard in boot and shoe factories, and the death rate for diseases other than tuberculosis is below average.

Although workers with poor physique and chronic tuberculosis are found throughout the shoe industry, the incidence of active tuberculosis is not uniformly distributed, men and women employed in factories with large workshops contracting the disease more often than those who work in factories with small workshops.

In the clothing industry there is also more pulmonary tuberculosis in large factories than in small ones, so that it may yet be shown that size of working unit is an important factor in determining disease incidence in any occupation.

We are deeply indebted to Dr. Smith, medical officer of health for Northamptonshire, who was chiefly responsible for initiating the investigation and who allowed us free access to the records of the Northampton Mass Radiography Unit; also to the Incorporated Federated Associations of Boot and Shoe Manufacturers, the National Union of Boot and Shoe Operatives, the British Boot and Shoe and Allied Trades Research Association, H.M. Inspector of Factories, and owners of individual boot and shoe factories, who have provided us with invaluable assistance at every stage of the investigation.

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SOME ASPECTS OF PARTIAL GASTRECTOMY

BY

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Although a number of series containing several hundred cases of partial gastrectomy have been reported in detail from time to time in this country there are still some points which worry the occasional gastrectomist and about which gastric experts differ—points that have only been lightly touched upon. In the hope of understanding certain things more fully I have reviewed my own cases again recently, but the truth is very elusive.

The material under review is the first 200 consecutive cases of my own upon which a partial gastrectomy has been performed for a peptic ulcer at St. Bartholomew's or Hill End Hospitals. The first was in 1936 and the last at the end of 1947. The number is not large, but the cases have been carefully considered. They were not treated and operated on in any special wards or gastric clinic, but were simply included in the ordinary run of cases in a general surgical ward of a teaching hospital. The sex incidence is shown in Table I.

TABLE I.—Sex Incidence

	Males	Females	Total
Duodenal ulcer ..	99	8	107
Gastric ulcer ..	55	28	83
Anastomotic ulcer ..	9	1	10
Total	163	37	200

The proportion of duodenal to gastric ulcers is not nearly so high as in some reported series, probably owing to the fact that the former were not so readily accepted for operation, and certainly not until medical treatment had been given a very fair trial. The average age of the patients at the time of operation is shown in Table II. The youngest was a girl of 16 with a very tough adherent duodenal ulcer of seven years' standing which had resisted several courses of strict medical treatment. The oldest was a man of 69 with a duodenal ulcer.

TABLE II.—Average Age of Patients

	Males	Females
Duodenal ulcer	44 years	36 years
Gastric ulcer	48 "	49 "
Anastomotic ulcer	45 "	25 " *

* One case only.

Twenty years ago the position of partial gastrectomy as a treatment for gastric ulcer was not fully recognized; ten years ago the same applied to duodenal ulcer. The operation is now fully acknowledged by physicians as well as surgeons, but it is still uncertain whether it will be replaced, at any rate for duodenal ulcer, by vagotomy before the true and whole cause of peptic ulceration is revealed and operations finally give way to a certain and easy cure by some balm, wave, atom, or other undreamed-of agent.

In an endeavour to obtain the best results from a procedure such as partial gastrectomy attention must primarily be given to the causes of post-operative mortality, and, secondly, to planning of the operation so that the type of gastrectomy chosen is that which will give the best results after weeks, months, and years. This paper is devoted to these two aspects of partial gastrectomy.

Cause of Death

In 1935 an investigation of post-mortem findings after partial gastrectomy (Payne, 1936) showed that the commonest causes of death in order of frequency were: general peritonitis, including infection around the duodenal stump; pulmonary infection; shock; and haemorrhage.

It is interesting to note that the causes of death after partial gastrectomy are still very similar. In three series of gastrectomies for peptic ulcer published in this country in 1948, giving details of 1,068 cases in which the operations had been done within the last ten years, the causes of death in order of frequency were: pulmonary infections; peritonitis from leakage; uraemia; embolus; and haemorrhage. It is worth while analysing each of these causes of death in turn and the steps taken to guard against them. In my present series, in which there was only one death (mortality 0.5%), every effort was made to guard against a fatality.

Pulmonary Infections

This was the commonest and most serious complication in the series. At least 20% of the cases had some degree of atelectasis after the operation and there was usually some superadded infection. In the earlier cases the diagnosis of atelectasis was rarely made, but I feel sure that this was because the condition was not so well appreciated or so carefully looked for. This applies to many conditions in medicine which appear to be occurring more commonly but are really only being recognized more frequently.

The treatment of atelectasis with infection can be divided into prophylaxis and treatment of the established condition. Under the former heading may be mentioned careful training in correct breathing, abstention from smoking, and treatment of any cough or bronchitis. The treatment of an atelectasis is to remove the plug of mucus which is obstructing the bronchus. Deep breathing, whether produced by inhalation of carbon dioxide or done by the patient's own efforts, is not nearly so good, either theoretically or in practice, as coughing. It tends to suck the mucus further in rather than push it out. With a high abdominal incision a patient does not readily cough; but a good nurse or physiotherapist can assist enormously by persuading and helping him to cough up a quantity of thick mucus which, if the patient was left to himself, would otherwise remain for days, acting as a bung. If one is fortunate enough to have the services of a physiotherapist skilled in pummelling the chest, so much the better, for this is a most valuable procedure in loosening the mucus plug before coughing it up. These simple procedures are often overlooked.

If the patient cannot or will not cough he can be made to do so most violently by the injection of 4 ml. of nikethamide intravenously: this should be combined with a few millilitres of thiopentone—enough to make him drowsy so that coughing will not hurt him too much. We have carried this out in only two cases in the present series, with satisfactory results so far as the lungs were concerned, but in the second case the great violence of the coughing produced a hernia through the midline incision, which was repaired at a later date. Aspiration of the mucus plug can be carried out through a bronchoscope; but this is not often called for, and was done only three times in this series.

The infection which so often follows atelectasis is dealt with by sulphonamides and penicillin. Seven years ago during the whole of one winter I used sulphonamides prophylactically in every case, but it was difficult to assess with certainty the value of this step, and now I use them only prophylactically in poor-risk cases.

Peritonitis from Leakage

There are two places from which a leak may occur in a Polya type gastrectomy—the duodenal stump and the gastro-jejunal anastomosis. It occurs more commonly from the former.

There is probably more variation in the technique of closing the duodenum than of any other step in the operation, and undoubtedly a great many of the methods are equally good and safe. There should be no difficulty in the duodenal closure in the case of a gastric ulcer where the duodenum is healthy and of average length and mobility, but in the case of a chronic duodenal ulcer this step is usually the most exacting in the operation and fraught with more danger afterwards than any other. However, by not sacrificing time and patience to speed, or improvisation to standard technique, a reasonably satisfactory closure can be made even in difficult cases. Nevertheless, a leak at the duodenal stump is an accident that continues to occur from time to time, and it still ranks high as a cause of death after partial gastrectomy, as it may lead either to general peritonitis or to a subphrenic abscess.

A simple manœuvre which I believe greatly lessens the danger of a leaking duodenal stump is the putting of a rubber drain into the abdomen. In no single instance in the present series of 200 cases have I failed to do this. Most surgeons look upon it as entirely unnecessary, and probably in 95% of cases it is; but it is a harmless procedure, and as, I believe, it saves a few lives and helps to reduce the mortality of the operation to nearer zero it is well worth doing. A drain must not be put in haphazard but must be most carefully placed (this applies equally to all parts of the abdomen). A "stab" incision is made on the right of the abdomen over the duodenum by cutting down on to the thimble finger, and a long thin corrugated rubber drain is introduced; it is placed so that it lies immediately inferior to and against the liver—it lies directly over the duodenal stump and then runs across the abdomen upwards and to the left to the site of the anastomosis. It is removed after four days if the abdomen seems quite satisfactory.

If a duodenal leak occurs the fluid is likely to track along the drain to the surface and a fistula to form: continuous suction is then applied to a rubber tube with several holes in it which is inserted just into the opening of the fistula; this prevents the fluid running all over the skin, with the consequent extreme soreness. The fistula then gradually closes. In four cases in this series there was a leak at the duodenal stump; but in none was it necessary to open the abdomen, and all recovered after a fistula had formed along the line of drainage.

Many surgeons dislike putting a rubber drain into the abdomen, the two chief objections being that it causes adhesions which may later lead to small-intestine obstruction, and, secondly, that it is as likely to do harm by letting infection in as it is to do good by letting infection (or other things) out. I do not for one moment believe that the second reason holds good, provided asepsis is observed. So far as adhesions are concerned they may cause obstruction later if a drain is placed near the centre of the abdomen and particularly suprapubically, but never when placed against the liver as described above.

Increased pressure from accumulation of fluid in the stomach or duodenum after operation is another possible cause of leakage occurring at the anastomosis or at the duodenal stump. This is obviated by leaving a Ryle's or similar tube in the stomach and using suction for 24 to 48 hours.

Uraemia, Embolus, and Haemorrhage

Uraemia.—In every case an estimation of the amount of urea in the blood is made, and if this is found to be raised or if for any other reason it is suspected that there is an alkalosis or acidosis, the alkali reserve and the blood chlorides are also estimated. In a number of cases (some of them quite unsuspected) the blood urea is raised, sometimes strikingly so. In Case 192 at one stage before operation it was as high as 530 mg. per 100 ml. (believed to be accurate). It is often due to a long-standing dehydration or to excessive use of alkalis or to vomiting. With rest, time, adequate fluids, and control of alkalis most cases will improve greatly and the blood chemistry return to normal; but there should be no hurry to operate provided there is no stenosis at the pylorus.

Embolus.—It has been most fortunate that in this series there has been no fatal pulmonary embolus. In one woman an embolus that must have been large very nearly caused death, but she gradually improved after papaverine. There seems little evidence for the old teaching that emboli commonly arise in the abdominal wall. It is far more probable that the most frequent site of formation is in the veins of the calf and foot; and certainly since the calves of all patients have been under careful observation one has been surprised at the number which have shown the characteristic pain or tenderness of thrombophlebitis. In some doubtful cases this has been confirmed by phlebograms. Active exercises and early ambulation are employed in the hope of preventing thrombosis. Heparin and/or dicoumarol are used as a routine when thrombosis is detected, but not as prophylactics.

Haemorrhage.—Haemorrhage at the suture line of the anastomosis is always a possibility, though it should not occur if care is taken. In every case the clamps which are used are not only loosened but are taken off after the posterior row of sutures has been completed. All bleeding points can then be clearly seen and ligated, especial care being paid to the lesser curve of the stomach, even though the left gastric artery has been well and truly tied. Taking off the clamps makes the operation look less neat, but it is without doubt a safer procedure and the anastomosis is easier to complete. There has been no trouble or alarm at all about post-operative haemorrhage in this series except in Case 47, in which about a pint of fresh blood was vomited an hour after the operation, in addition to some blood which had already been aspirated from the stomach by the Ryle's tube. The patient, a woman of 47, with a duodenal ulcer, then made an uninterrupted recovery after a transfusion of blood.

Best Type of Operation

In an endeavour to determine the type of partial gastrectomy which will be found most satisfactory it is obviously necessary to determine and compare the results of operations done by a variety of methods. In assessing and classifying the results of any operation so many factors have to be taken into consideration that nearly always some difficulty arises. A surgeon who grades the results of his own operations may be too optimistic owing to his surgical enthusiasm, while another may be too modest to claim the wonderful results of the enthusiast.

In all of the 200 cases a similar type of partial gastrectomy has been performed, in that the open end of the duodenum has been invaginated and a blind end formed. But at the anastomosis there has been a variation of method, for, although an end-to-side union between the remains of

the stomach and jejunum has been made in each case, the arrangement and details of this step have varied. It has been carried out in the five different ways shown in Table III and in the diagrams.

TABLE III.—Types of Anastomosis Used

A. Retrocolic anastomosis with valve	18
B. Retrocolic anastomosis without valve	77
C. Antecolic anastomosis with the afferent loop to the greater curvature without valve	6
D. Antecolic anastomosis with the afferent loop to the lesser curvature with valve	23
E. Antecolic anastomosis with the afferent loop to the lesser curvature without valve	76

Most surgeons seem to keep to one type of anastomosis, are usually quite satisfied with it, and believe it to be the best. Lake (1948) almost invariably does a retrocolic anastomosis with a valve, and indeed was one of the earliest to do this, so that the operation is often, and rightly, known by his name. Ogilvie (1947), who does a similar operation, admits that an antecolic anastomosis is a satisfactory operation when a moderate amount only of the stomach has been resected, but says that, "when the gastrectomy is not merely radical but also valvular, an anterior anastomosis is incompatible with proper routing of the afferent jejunal loop." On the other hand, Wells and Brewer (1948), who do a very radical gastrectomy with excellent results, prefer an antecolic anastomosis with a valve; and Visick (1948), who has reported in much detail his series of over 500 cases, always does an antecolic anastomosis without a valve: he leaves very little of the stomach, and the functional results of his cases are also excellent.

The obvious conclusions to be drawn from these facts are that good results are being obtained with either an antecolic or a retrocolic anastomosis and with or without a valve.

Results

Of the 199 patients in this series who survived the operation the results after a period of between one year and eleven years are available in 177.

To make an exact classification of results after partial gastrectomy is very difficult. They can be divided quite simply into good and bad, but there are so many degrees of goodness and badness that this is inadequate. It is easy to subdivide them into a greater number of grades, taking into consideration such things as age, work, social conditions, psychological outlook of the patient, as well as the position, size, and chronicity of the ulcer, etc.; and this is possibly wise when the purpose is purely to give an account of the results of partial gastrectomy. Here, however, I am largely absolved from many of these difficulties, because I am not so much endeavouring to say how good or how bad the results of partial gastrectomy are as striving to compare the results of one type of gastrectomy with another.

I have divided the results arbitrarily into three groups: (1) excellent, where the patient is free from all trouble and well in every way; (2) satisfactory, where there are some residual symptoms of a greater or less degree but where the patient is able to continue at his work and is definitely improved as a result of the operation; and (3) bad, where the patient is worse or no better than before operation. As years go by a patient is more likely to improve than to

deteriorate, and some who could previously have been in group 3 are now rightly placed in group 2, and similarly some have moved from group 2 to group 1. A continuous follow-up of all patients has unfortunately not been carried out, and the number of patients in whom a result is not known (8%) is somewhat high; but there have been great difficulties in the London area with evacuation and population movements, and returned letters marked "house destroyed" have not been rarities.

For the purpose of simplicity the results from one to eleven years have all been put together. The results for all types of gastrectomy for gastric, duodenal, and anastomotic ulcer according to the above grouping are shown in Table IV.

TABLE IV

Result	Cases	Percentage of Cases Followed up
Excellent	128	72
Satisfactory	45	25
Bad	5	3
Died in hospital (operative mortality)	1 (0.5%)	—
Died of intercurrent disease a year or more later	5 (2.5%)	—
Not traced	16 (8%)	—
Total	200	

Table V gives the results of the antecolic and retrocolic anastomoses grouped together and of those cases with a valve (erroneously called Hofmeister) and without a valve grouped together. The results in these several groups are

TABLE V

	Result		
	Excellent	Satisfactory	Bad
Retrocolic anastomosis	59 (74%)	16 (21%)	4 (5%)
Antecolic anastomosis	69 (70%)	29 (29%)	1 (1%)
With a valve	24 (69%)	10 (28%)	1 (3%)
Without a valve	104 (73%)	35 (24%)	4 (3%)

so similar as to suggest that no one type of anastomosis has any appreciable advantage over another, and that the addition of a valve does not make any significant difference. We have to consider the results not only months and years afterwards but also in the first few days after the operation, while the patient is still in hospital. At this time there is not, so far as I can detect, the slightest difference in the comfort of the patients or the smoothness of their convalescence whatever the kind of anastomosis, so long as it has been properly done.

Many objections to one or other type of anastomosis are theoretical and are not based on a careful study of symptomatic results. The importance of peristalsis seems sometimes to be forgotten and intestinal contents to be thought to move along by the same mechanism as the water in a garden hose.

The feeling of fullness with or without nausea after meals can be shown by radiographs to occur either with a slow emptying or with a rapid emptying of the stomach into the jejunum, though it is commoner with rapid emptying. It is often said that the feeling of fullness is due to part of a meal entering the afferent loop and distending the duodenum; but against this are the facts that in some people screening of a barium meal after partial gastrectomy will show some barium entering the duodenum without the patient being aware of it, while in others the patient experiences the feeling of fullness without any barium being observed to enter the duodenum at all. The clinical result is more important than the radiological. These remarks appear to apply equally to a retrocolic or an antecolic anastomosis.

A number of advantages are attributed to a "Hofmeister" valve: (a) It obviates the feeling of fullness by preventing food entering the duodenum; but the fallacy of this has just been mentioned. (b) It delays the emptying of the stomach because the exit is smaller; but this is fallacious, because the size of the exit is really the width of the jejunum at the entrance to the efferent loop. (c) It prevents, or at least diminishes, the regurgitation of bile into the mouth. From the results of my cases in which a valve has and has not been used there does seem to be slight statistical evidence for the belief that the last-mentioned is true. When food passes quickly out of the stomach the latter may be empty when the bile reaches it from the duodenum, and, should the patient be one whose stomach is intolerant to bile, regurgitation is likely to occur. If, however, a valve has been made, the flow of bile along the jejunum is so directed that it may pass the opening into the stomach without entering the latter at all.

Summary

A series of 200 cases of partial gastrectomy for peptic ulcer is reviewed with special reference to the causes of post-operative mortality, and to the comparative merits of an antecolic and a retrocolic anastomosis.

The commonest (so believed) causes of death after partial gastrectomy in this country are reviewed and means for preventing them discussed.

Emphasis is laid on the value and importance of draining the peritoneal cavity after partial gastrectomy.

It is unsound and apt to lead to error to compare the results of one type of operation performed by one surgeon with a different operation performed by another surgeon.

Figures are shown comparing the symptomatic results of antecolic and retrocolic anastomoses in this series. It is believed that the results are equally good.

There is little practical evidence that a valve at the anastomosis makes much difference to the symptomatic result, except possibly by decreasing the liability to bile regurgitation.

I am much indebted to a series of house-surgeons and chief assistants for their painstaking work in looking after these patients; but I owe an even greater debt of gratitude to the nurses for their endless skill and care, without whom many patients would have perished. They are far too numerous to name, but I make special mention of Miss E. M. Constable, sister of my male ward for almost the whole period.

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The National Council for the Unmarried Mother and her Child has published a *Directory of Homes and Hostels* in which those organizations and institutions existing primarily for the care of unmarried mothers and illegitimate children are listed, together with information on their scope, limitations, and methods of admission. The list includes all the Homes and Hostels which the N.C.U.M.C. has been able to trace, whether affiliated to it or not. Homes which are primarily *shelters* have been omitted even though they may occasionally take a case of this type. The *Directory* is in three parts. First is the main list of Homes and Hostels, with particulars, arranged under counties, with London at the end. Then comes a classified list showing Maternity Homes (confinements take place in the Home), Before- and After-care Homes (confinements take place in hospital), and After-care Homes. Finally there is a general index. Although the denomination of the Homes is given where applicable, in nearly every case Homes will take cases of denominations other than their own. The *Directory* is not intended to facilitate the direct approach of outside agencies to Homes without prior reference to social workers. This would not be in the interest of either patients or institutions. Rather is it intended to facilitate the work of all in this field. The National Council would be grateful to hear about inaccuracies and omissions, and to receive criticisms and suggestions on how the list could be improved. The list may be obtained for 2s. 6d. from the N.C.U.M.C. at 21, Coram Street, London, W.C.1.