

The Immediate Results of Operations for Duodenal Ulcer:

A Comparative Study of the Morbidity and Mortality of Vagotomy and Pyloroplasty versus Subtotal Gastrectomy

JOHN A. MacDONALD, M.D., F.R.C.S.[C] and
W. K. WELSH, M.B., F.R.C.S.[C], *Toronto*

ABSTRACT

Immediate postoperative results of vagotomy and pyloroplasty were compared with those of subtotal gastrectomy. Ulcer recurrence rate and the long-term complications of the two procedures were not studied. Age and sex distribution, and pre-operative indications in the two groups of patients were almost identical. Vagotomy and pyloroplasty has gradually superseded subtotal gastrectomy at St. Michael's Hospital, Toronto. One hundred and seventy vagotomy and drainage procedures were compared with 173 subtotal gastric resections performed over a five-year period. There were 39 postoperative complications and five deaths in the subtotal gastrectomy group, an overall mortality of 2.8% and an elective mortality of 2.4%. In the vagotomy and pyloroplasty group there were 31 postoperative complications and two deaths, an overall mortality of 1.2% and an elective mortality of zero. Vagotomy and pyloroplasty is a relatively safe procedure, associated with fewer complications, shorter hospital stay and a lower mortality than subtotal gastrectomy.

SOMMAIRE

Les auteurs ont comparé les résultats post-opératoires immédiats d'une vagotomie et d'une pyloroplastie à ceux qu'on obtient d'une gastrectomie subtotale. Ils n'ont pas cependant fait mention de la fréquence des récurrences de l'ulcère ni des complications à longue échéance des deux types d'intervention. Chez les deux groupes de malades, les facteurs relatifs à l'âge et au sexe et aux indications pré-opératoires étaient virtuellement identiques. A l'Hôpital St. Michael de Toronto, la vagotomie avec pyloroplastie a graduellement remplacé la gastrectomie subtotale. La comparaison a porté sur 170 vagotomies et drainage et sur 173 résections gastriques subtotaux, pendant une période de cinq ans. Au sein du groupe ayant subi la gastrectomie subtotale, on a compté 39 complications post-opératoires et cinq décès, la mortalité globale ayant été de 2.8% et la mortalité élective de 2.4%. Parmi les malades du groupe ayant subi la vagotomie avec pyloroplastie, on dénombra 31 complications post-opératoires et deux décès, la mortalité globale ayant donc été de 1.2% et la mortalité élective de zéro. La vagotomie avec pyloroplastie est une opération relativement sûre, entraînant moins de complications, une hospitalisation moins longue et une mortalité plus faible que la gastrectomie subtotale.

THERE has been a trend in recent years toward the employment of more conservative operative procedures in the treatment of duodenal ulcer. The combination of vagotomy and pyloroplasty is currently popular because of its lower mortality and morbidity. The dominant consideration in the choice of any operation for benign peptic ulcer must be the morbidity and mortality associated with the procedure. Furthermore, the surgical mortality should not exceed the mortality that occurs among medically treated ulcer patients.

At St. Michael's Hospital, Toronto, as noted above, vagotomy and pyloroplasty for duodenal ulcer has become increasingly popular. In the following report the morbidity and mortality associated with this combination of procedures are compared with those following subtotal gastric resection. The study is a retrospective one and the cases were not randomized. All operations for duodenal ulcer performed in this hospital over

the past five years have been reviewed. Approximately two-thirds of these procedures were carried out on private patients by members of the surgical staff of the hospital. The other third were performed by residents in surgery under the supervision of the attending staff. Subtotal gastric resections performed for gastric ulcer are not included in the study. A long-term follow-up of these patients for recurrent ulcer is not included in this review, nor was an evaluation made of the late complications such as anemia, chronic weight loss, diarrhea and the dumping syndrome. Only immediate complications—those occurring within the first 30 days after operation—are described.

Between 1960 and July 1964, 343 operations were performed for duodenal ulcer on 341 patients. Subtotal gastrectomy was performed in 173 of these, and vagotomy and a drainage procedure in

TABLE I.—OPERATIONS BY YEAR

	1960	1961	1962	1963	1964
Vagotomy and pyloroplasty	0	2	42	54	49
Vagotomy and gastroenterostomy	1	1	10	6	5
Total (170)	1	3	52	60	54
Subtotal gastrectomy only	35	61	28	14	7
Subtotal gastrectomy with vagotomy	0	3	10	13	2
Total (173)	35	64	38	27	9

170. Acute perforations treated by primary suture have not been included.

The number of operations performed each year are shown in Table I and Fig. 1. It can be seen that in 1961 subtotal gastrectomy was the operation of choice. In the following year, vagotomy and drainage procedures exceeded gastrectomies, and for the past two years vagotomy and pyloroplasty has been the operation of choice in this institution.

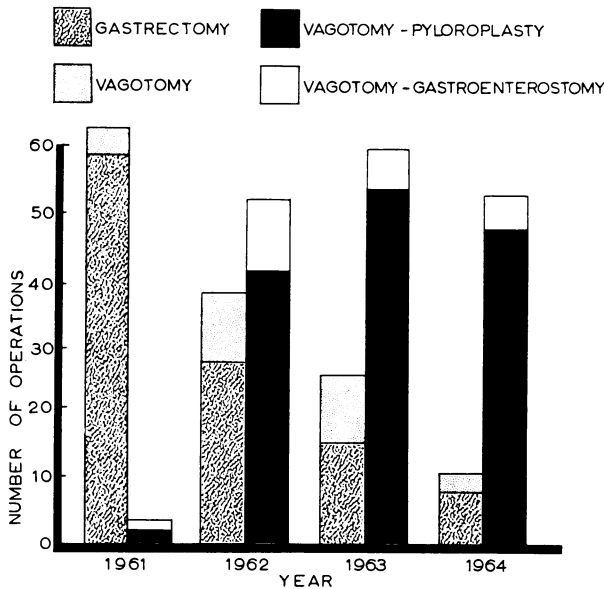


Fig. 1.—The type of procedure and the number of cases performed for each year are shown.

AGE

The average age of the patients subjected to each procedure is identical. In Table II a breakdown of age according to decades is shown. A few more vagotomy and drainage procedures were

TABLE II.—AGE OF PATIENTS

	Range	Average age	Age Group						
			<20	20-29	30-39	40-49	50-59	60-69	70-79
Subtotal gastrectomy	17-78	50.2	2	6	35	37	55	31	7
Vagotomy and drainage procedure	16-77	50.2	2	8	30	49	36	32	13

performed in elderly patients, but otherwise the breakdown is quite similar. Approximately the same number of patients in both groups were in the early and middle decades.

SEX

The overall preponderance of males in the study is comparable to that described in other reports. In this series 130 males and 43 females underwent gastrectomy, a 75% male predominance. There were 114 males and 56 females in the vagotomy and pyloroplasty group, a 70% male predominance.

GASTRIC ANALYSIS

Gastric test meals were done preoperatively in the majority of cases, and in some the augmented histamine test was used. Free acid of 10 to 35 units and total acid of 20 to 50 units were accepted as the normal values. The results are summarized in Table III. The majority of patients in both groups showed high and medium acid levels. Postoperative test meals and the Hollander test for the completeness of vagotomy were performed in a limited number of patients.

TABLE III.—GASTRIC ACIDITY

Subtotal gastrectomy:	
High and medium	48
Low or NFA*	33
No test	92
Total	173
Vagotomy and pyloroplasty:	
High and medium	45
Low or NFA*	44
No test	81
Total	170

*NFA—no free acid.

INDICATIONS FOR OPERATION

Very little difference was noted between the two groups in terms of age, sex distribution, or preoperative acid determinations. The indications for surgery in these 343 patients were analyzed using commonly accepted criteria (Table IV). The term *intractability* refers to the state of disability caused by chronic peptic ulcer; in such patients the ulcer was usually refractory to medical therapy. Many had had previous hemorrhage and a number had had a previous perforation.

TABLE IV.—INDICATION FOR OPERATION

	Subtotal gastrectomy	Vagotomy and pyloroplasty
Intractability	111	124
Hemorrhage	Elective	22
	Emergency	12
Obstruction	29	12
Perforation	4	0
Total	173	170

Hemorrhage was the indication for operation in those patients who were actively bleeding at the time of admission to hospital or during hospitalization. The procedures in these patients have been

further subclassified as "elective" or "emergency". In the elective group, bleeding was usually moderate and blood replacement averaged about four units a patient. Frequently bleeding had ceased shortly after admission, with or without the administration of blood, and a short recuperative interval was allowed before operation. In these last patients the hemorrhage was considered to have been arrested. In the emergency group, operation was performed for persistent or recurrent hemorrhage, which was of massive proportions. Blood replacement was considerably greater and averaged 13 units per patient. Also, some measure was usually employed at operation to arrest the bleeding, e.g. suture of a bleeding vessel in the base of an ulcer.

Obstruction was the indication for operation in patients presenting with persistent vomiting, with either peristaltic waves or a succussion splash, and with marked depression of serum chlorides and an alkalosis. In these patients a small barium swallow generally showed marked obstruction and many required gastric lavage before operation.

Acute perforation was the indication for operation in a small number of patients.

Reference to Table IV indicates that the two groups are again quite similar. Intractability was the indication in 124 patients in whom vagotomy and pyloroplasty was performed, and in 111 in whom gastrectomy was done. A few more patients in the obstructive group underwent gastrectomy than vagotomy and pyloroplasty. Hemorrhage was the indication in about the same number of patients in each group.

TYPE OF OPERATION

The types of gastrectomy employed are indicated in Table V. The Polya-Hofmeister modification of the Billroth II procedure was performed in the greatest number of patients. Anterior anastomosis was preferred to posterior. Approximately two-thirds of the patients were private patients and one-third were ward patients. Vagotomy was performed as an associated procedure in 25 patients. The technique of duodenal-stump closure varied from surgeon to surgeon. It is of interest

TABLE V.—TYPE OF PROCEDURE

<i>Subtotal gastrectomy</i>	<i>Number</i>
Anastomosis:	
Polya-Hofmeister	100
Polya	73
Antecolic	105
Retrocolic	68
Duodenal closure, Bancroft procedure	23
Associated procedure*	
Vagotomy	25
Hiatus hernia repair	5
Cholecystectomy	6

*Appendectomy not included.

that the Bancroft-Plenk technique was used in 23 cases. In this technique, because of the presence of a mass associated with a large duodenal ulcer, the stomach is divided an inch and a half to two inches proximal to the pylorus, and the mucosa of the gastric antrum is dissected away as far down as the pylorus itself. The gastric antrum is then closed with several rows of interrupted sutures.

TABLE VI.—VAGOTOMY AND PYLOROPLASTY

	<i>Number</i>
Associated procedure:	
Gastrostomy	65
Hiatus hernia (repair)	30
Cholecystectomy	3

The standard type of vagotomy was used throughout; no selective vagotomies were done. The pyloroplasty was of the Heineke-Mikulicz type. In a few the Weinberg one-layer closure was performed. Associated procedures are listed in Table VI. It is of interest that 30 hiatus hernias, either pre-existent or potential, were discovered and repaired after completion of the vagotomy. The vagotomy and pyloroplasty group included 116 private patients and 54 ward patients.

In 10 patients in the vagotomy and pyloroplasty group the operative record noted that only one branch of the vagus nerve was found at operation, or the pathology report indicated that only one specimen was submitted.

SURGICAL MORBIDITY (NUMBER OF DAYS IN HOSPITAL)

With respect to duration of postoperative stay in hospital, day one was taken as the day of operation. For gastrectomy the average postoperative stay was 16.4 days. For a vagotomy and drainage procedure the overall average was 15.5 days; and for vagotomy and pyloroplasty, 15.2 days.

POSTOPERATIVE COMPLICATIONS

Thirty-nine complications were encountered in 36 patients who underwent subtotal gastrectomy. These complications occurred within the first 30 days of operation and are set out in Table VII. Pulmonary and wound complications occurred most frequently. There were four duodenal fistulas, one anastomotic leak and one anastomotic hemorrhage.

Among those subjected to vagotomy and drainage procedures, 31 complications occurred in 30 patients (Table VII). Again pulmonary and wound problems predominated. No instances of leakage at the anastomosis or pyloroplasty site were noted.

Gastrostomy was performed on 65 patients who underwent vagotomy and pyloroplasty. A duodenal tube was used for gastric decompression in the remaining 105 cases. In Table VIII the respiratory complications in these two groups of patients are listed. In this small series there were more pul-

TABLE VII.—SURGICAL COMPLICATIONS RESULTING IN PROTRACTED MORBIDITY OR MORTALITY

	Subtotal gastrectomy		Vagotomy and pyloroplasty	
	Number	Deaths	Number	Deaths
Pulmonary				
Pneumonia.....	8		9	
Atelectasis.....	1		1	
Pleurisy and effusion..	1			
Pulmonary embolism..	4		1	
Tracheobronchitis....	1			
Resp. acidosis.....			1	
Wound				
Evisceration.....	4	1	3	1
Dehiscence.....	1			
Staph. infection.....	4		1	
Unspecified infection..	1		3	
Abscess.....	2		1	
Duodenum				
Fistula.....	4	2		
Obstruction.....			1	
Anastomosis				
Leakage.....	1	1		
Hemorrhage.....	1	1		
Cardiovascular				
Myocardial infarction..			1	
Congestive failure....			1	1
Other				
Peritonitis.....	1			
Bowel obstruction....	1			
Subphrenic abscess....	1			
Pancreatic necrosis....	1			
Pyrexia—unknown origin.....	2		1	
Diarrhea.....			3	
Urinary infection....			1	
Urinary retention....			1	
Uncontrolled diabetes..			1	
Anal abscess.....			1	
Total.....	39	5	31	2

monary complications in patients who had duodenal tube-decompression than in those who had a gastrostomy.

TABLE VIII.—RESPIRATORY COMPLICATIONS AND GASTRIC DECOMPRESSION IN PATIENTS SUBJECTED TO VAGOTOMY AND PYLOROPLASTY

	Number	Respiratory complications
Duodenal tube (nasogastric).....	105	9
Gastrostomy.....	65	2

MORTALITY

Mortality is defined here as any death occurring within 30 days of operation.

Among those who underwent subtotal gastrectomy, there were five deaths in 173 cases, an overall mortality of 2.8% (Table IX). When the deaths that occurred following emergency operation for hemorrhage are excluded, the corrected mortality is 2.4%. The causes of death in the five patients were: duodenal fistula (two), anastomotic leakage (one), anastomotic hemorrhage (one), evisceration and myocardial infarction (one). The ages of the patients who succumbed were, respectively, 52, 56, 56, 71 and 73 years.

TABLE IX.—SURGICAL MORTALITY

<i>Subtotal Gastrectomy</i>	
Total number of operations.....	173
Total number of surgical deaths.....	5 (2.8%)
Elective operations.....	161
Surgical deaths.....	4 (2.4%)
Emergency operations for massive hemorrhage..	12
Surgical deaths.....	1 (8.3%)
<i>Vagotomy—Pyloroplasty</i>	
Total number of operations.....	170
Surgical deaths.....	2 (1.2%)
Elective operations.....	158
Surgical deaths.....	0 (0.0%)
Emergency operations.....	12
Surgical deaths.....	2 (16.6%)

In the vagotomy and pyloroplasty group only two deaths occurred in 170 patients, an overall mortality of 1.2%. The "elective" mortality (that occurring among patients on whom elective procedures were done) is zero in this group; both of the patients who died had massive gastrointestinal hemorrhage. The cause of death in these two patients was cardiac failure and evisceration. Their ages were 75 and 74 years.*

The mortality for subtotal gastrectomy at St. Michael's Hospital, Toronto, in the previous five years (1955-1959) was 3.1% (11 deaths in 350 patients). Excluding those operated on for massive hemorrhage, the corrected mortality is the same as that for subtotal gastrectomy in the present study, 2.3%.

In the patients who underwent subtotal gastrectomy, four of the five deaths (80%) occurred in those who had a Bancroft type of closure. The mortality rate with this technique was 17.3%. Furthermore, this technique had been used in four of the patients who developed fistulas.

DISCUSSION

Since 1961 at St. Michael's Hospital, Toronto, elective vagotomy and pyloroplasty has been performed 137 times without mortality. We believe that this negligible mortality is far more important than the prediction that between 5% and 10% of these patients may develop recurrent ulcer. Indeed the most important consideration in any elective surgical procedure for duodenal ulcer is its morbidity and mortality. There has been a tendency to overemphasize the incidence of ulcer recurrence as the absolute criterion of the success of a procedure. What has not been emphasized sufficiently is the fact that subtotal gastrectomy is associated with a significant mortality and morbidity rate.

Vagotomy and gastroenterostomy is associated with a higher rate of ulcer recurrence than is subtotal gastrectomy, in the neighbourhood of 10% to 15% for the former¹ and 2% to 3% for the latter.²

*After this paper was submitted for publication, a 62-year-old man died following elective vagotomy and pyloroplasty performed for pyloric obstruction. A gastrostomy was not done. The patient aspirated some of his gastric contents and developed massive bilateral pneumonia and pulmonary edema. He died on the fifteenth postoperative day of respiratory insufficiency.

However, vagotomy and pyloroplasty is superior to vagotomy and gastroenterostomy from the standpoint of recurrence. In a recent analysis by Weinberg³ of 486 patients observed for from two to 14 years, proved or suspected recurrence was noted in 22 patients, an incidence of 4.5%. This is quite an acceptable figure.

Apart from the consideration of ulcer recurrence, pyloroplasty has other important advantages over gastrojejunostomy. Pyloroplasty does not alter the continuity of the upper gastrointestinal tract. Also, gastrojejunostomy may actually encourage ulcer formation in that it sets the stage for the circuitous passage of ingested food from the stomach into the duodenum, then through the gastrojejunal stoma back into the stomach in a repetitive manner, stimulating the antrum to release gastrin in excess.

The higher ulcer recurrence rate with vagotomy and drainage procedures is believed to be related to incomplete vagus nerve section. In the present series there were 10 patients in whom a review of hospital records suggests that vagus section was incomplete and that a later recurrence is likely. In our opinion, when vagotomy is performed, tissue from each nerve should be submitted for histological examination.

The increasing popularity of vagotomy and pyloroplasty in this hospital over the past four years can only be attributed to an awareness on the part of the surgical staff of the decreased morbidity and reduced mortality of the procedure. It is evident from this review that the choice of vagotomy and pyloroplasty was not based on considerations of sex, age, preoperative acid estimations, or any specific type of operative indication. The two groups of patients are remarkably similar in these respects. The operation of subtotal gastrectomy was preferred for patients with obstruction, and this is to be commended. Pyloroplasty on a very markedly scarred duodenum may be technically quite difficult. In addition, the performance of vagotomy in a patient who already has a dilated and atonic stomach may simply replace a mechanical obstruction with a functional one.

It may be that, in several patients in this series, pyloroplasty was unwisely selected as the procedure of choice when obstruction was the indication for operation. Two patients, one within 30 days of operation and another two years after operation, required subtotal gastrectomy following pyloroplasty and vagotomy. These failures may have been related to the use of a two-layer closure or an excessive turn-in of the pyloroplasty suture line. To avoid this excessive turn-in Weinberg³ recommends the one-layer closure.

Pyloroplasty offers obvious advantages in uncontrolled hemorrhage from duodenal ulcer, as it permits direct exposure and visualization of the ulcer. This operation combined with suture of the bleeding vessel at the base of the ulcer is an excellent procedure for the elderly patient with an active hemorrhage who must be operated upon

under emergency conditions, because it takes less time than subtotal gastrectomy.

Twelve emergency operations for hemorrhage were performed in both groups, with one death after subtotal gastrectomy and two after vagotomy. The number of patients in the two groups is too small to permit statistical comparison. An average of 13 units of blood was given to these patients prior to emergency operation for massive hemorrhage.

TABLE X.—MORTALITY OF GASTRIC RESECTION FOR DUODENAL ULCER*

Year	Author	No. of cases	% mortality
1954	Palumbo, Mazur and Doyle ⁵	189	4.2
1956	Priestley <i>et al.</i> ⁶	359	0.8
1957	Schirmer and Bowers ⁷	245	4.1
1957	Smithwick ⁸	190	2.6
1957	Pearce, Jordan and DeBailey ⁹	324	3.1
1958	Collected—Ohio Hospitals ¹⁰	2048	4.9
1959	Rothenberg, Lerner and Yaeger ¹¹	300	3.3
1960	Ferguson <i>et al.</i> ¹²	295	2.7
1960	Buffalo General Hospital	482	6.0

*Reprinted, with permission, from Paine, J. R.: *Surgery*, 51: 561, 1962, published by the C. V. Mosby Company, St. Louis, Mo., U.S.A.

The mortality rate of subtotal gastrectomy in the present series is 2.4%, if the patients operated upon because of massive hemorrhage are excluded. This mortality compares favourably with the results from most institutions reported in the literature. It is virtually identical to that of the previous five-year period in this hospital. Paine⁴ recently reviewed the mortality and morbidity figures at the Buffalo General Hospital, where the mortality was in the neighbourhood of 6%. He also reviewed the mortality figures from other institutions and these are tabulated in Table X. Apart from the figures of Priestley *et al.*,⁶ the mortality varies from 2.6 to 6%. More recently Hamilton *et al.*¹³ reported a 2.9% mortality in 98 cases and Herrington, Edwards and Grossman¹⁴ reported a 2.7% mortality in 832 cases. Postlethwait and Thoroughman,¹⁵ in a review of data from 12 veterans' hospitals, reported a mortality of 3.4% for 1403 subtotal gastric resections.

One of the lowest reported mortality rates for subtotal gastrectomy is that of Thoroughman, Walker and Raft,¹⁶ who reported an elective mortality of 0.54% and an overall mortality of 1.59% for 504 cases of hemigastrectomy and vagotomy. This low mortality rate is quite remarkable in view of the fact that these authors reported a rather high morbidity rate. They encountered eight duodenal fistulas with one death and eight subphrenic abscesses with only one death.

In the majority of the reports, referred to above, operations for benign gastric ulcer have been excluded, as the mortality associated with gastrectomy for gastric ulcer is somewhat lower than that for duodenal ulcer.

The morbidity and mortality in patients subjected to subtotal gastrectomy is partially related to duodenal stump closure.¹⁷ Duodenal fistula, subphrenic abscess, trauma to the common bile duct and acute pancreatitis are complications specifically related to dissection in the neighbourhood of the duodenum, and these complications account for the greatest number of deaths. Four duodenal fistulas occurred in the cases reviewed in this report, all in patients who had a Bancroft type of closure; four of the five deaths occurred in patients with this type of operation. The mortality for patients subjected to this operative technique is 17.3%. For this reason it seems better to perform a vagotomy and drainage procedure in patients presenting with a periduodenal mass or an extremely large duodenal ulcer.

The morbidity in the present series, as measured by the total number of complications and the duration of postoperative hospital stay, is greater for subtotal gastrectomy than for vagotomy and pyloroplasty. It will be noted in Table VII that diarrhea is included as an early complication following vagotomy, although it is a very minor complication and is seldom disabling. The complications following subtotal gastrectomy, however, were of a more serious nature.

The use of a gastrostomy tube in the patients subjected to pyloroplasty is related to a significantly reduced incidence of pulmonary complications. The authors recommend that this procedure be employed whenever a vagotomy and pyloroplasty is carried out.

SUMMARY

The morbidity and mortality of 173 patients subjected to subtotal gastric resection have been compared with those of 170 patients on whom vagotomy and drainage procedures were performed, over a five-year period. Vagotomy and pyloroplasty has superseded

subtotal gastrectomy in popularity at St. Michael's Hospital, where this study was conducted.

The age and sex distribution and the indications for operation in the two groups were almost identical.

There were 39 complications and five deaths among 36 of the 173 gastrectomy patients, an overall mortality of 2.8% and an "elective" mortality of 2.4%.

There were 31 complications and two deaths among 30 of the 170 patients subjected to vagotomy and pyloroplasty, an overall mortality of 1.2% and an elective mortality of zero.

The Bancroft-Plenk procedure was associated with a high incidence of duodenal fistula. It was the procedure carried out in four of the five patients who died.

Vagotomy and pyloroplasty is a relatively safe procedure associated with fewer complications, shorter hospital stay and lower mortality than gastrectomy.

Respiratory complications may be reduced by the use of a gastrostomy tube.

The authors wish to thank Dr. John R. Paine for permission to reproduce Table X, and Mr. Arthur Smialowski and Miss Susan Allison for the preparation of the tables.

REFERENCES

1. MARSHALL, S. F. AND FREEDMAN, A. N.: *Ann. Surg.*, **153**: 940, 1961.
2. MAINGOT, R.: *Abdominal operations*, Appleton-Century-Crofts, Inc., New York, 1955.
3. WEINBERG, J. A.: *Curr. Probl. Surg.*, **1**, April, 1964.
4. PAINE, J. R.: *Surgery*, **51**: 561, 1962.
5. PALUMBO, L. T., MAZUR, T. T. AND DOYLE, B. J.: *Ibid.*, **36**: 1043, 1954.
6. PRIESTLEY, J. T. *et al.*: *Proc. Mayo Clin.*, **31**: 62, 1956.
7. SCHIRMER, J. F. AND BOWERS, W. F.: *A.M.A. Arch. Surg.*, **74**: 447, 1957.
8. SMITHWICK, R. H.: *Surgery*, **41**: 344, 1957.
9. PEARCE, C. W., JORDAN, G. L., JR. AND DEBAKEY, M. E.: *Ibid.*, **42**: 447, 1957.
10. American College of Surgeons, Ohio Chapter Committee Report: *Amer. J. Surg.*, **96**: 365, 1958.
11. ROTHENBERG, R. E., LERNER, R. AND YAEGER, L.: *Surgery*, **46**: 496, 1959.
12. FERGUSON, D. J. *et al.*: *Ibid.*, **47**: 548, 1960.
13. HAMILTON, J. E. *et al.*: *Ann. Surg.*, **153**: 934, 1961.
14. HERRINGTON, J. L., JR., EDWARDS, W. H. AND GROSSMAN, L. A.: *Ibid.*, **154**: 949, 1961.
15. POSTLETHWAIT, R. W. AND THOROUGHMAN, J. C., editors: *Results of surgery for peptic ulcer. A cooperative study of twelve veterans administration hospitals*, W. B. Saunders Company, Philadelphia, 1963.
16. THOROUGHMAN, J. C., WALKER, L. C., JR. AND RAFT, D.: *Surg. Gynec. Obstet.*, **119**: 257, 1964.
17. MARTIN, J. D., JR., GRADY, E. D. AND MCGARITY, W. C.: *Amer. Surg.*, **19**: 593, 1953.

PAGES OUT OF THE PAST: FROM THE JOURNAL OF FIFTY YEARS AGO

WAR NOTES II: THE FIRST HUNDRED

Up to date on our ward we have had about one hundred and twenty cases, but it will be convenient to discuss the first hundred. Most of the wounds have been caused by fragments of shell; only nine were wounds from rifle bullets. Broadly speaking, bullet wounds are cleaner than the others for the fragments of shell are rough and carry in more clothing.

It is of interest to note that we have had fifty-five wounds of the lower extremity and only twenty-nine of the upper. As a general rule wounds of the arm are less serious than those of the legs for the reason that the trousers, socks, and boots are dirtier and cause more infection than the clothes of the upper extremity. Of the cases thirty-two have been compound fractures. The fracture cases have done well on the whole, though practically always there has been suppuration. Several have had gas gangrene and

one tetanus. The vast majority of fractures have been put up in plaster of Paris, leaving large openings for dressings and irrigation. It is an extremely good method and by its means we have been able to maintain good apposition of the bones. There is no movement of the fragments and the dressings are rendered much less painful. One man with compound fracture in the middle third of the right thigh and also compound fracture of both bones in both legs, presented a difficult problem, but a double spica was applied and both limbs encased in plaster, leaving the three sites of fracture open. To make the "construction" more solid three wire splints were also firmly fixed between the thighs and legs, and now the patient may be turned about in any direction; both legs may even be lifted up together and allowed to drop back on to the bed without causing any pain.—T. A. Malloch, *Canad. Med. Ass. J.*, **5**: 360, 1915.