

## Treatment and mortality of perforated peptic ulcer: A survey of 852 cases

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**Summary:** All proved cases of perforated peptic ulcer occurring in the Greater Vancouver area during the decade 1959-1968 have been studied. The incidence of perforation was approximately 10 per 100,000 population. The mean age was 55 years and the peak age incidence was in the fifth decade. The site of perforation was pyloroduodenal in 88% of cases and simple closure was the treatment employed in 81%. The overall mortality rate was 18.3% and one-third of these fatalities were due to misdiagnosis. The operative mortality rate was 9%.

The overall mortality rate was significantly greater among women and the elderly, in gastric perforations, and in perforations occurring between 11 p.m. and 8 a.m.

A close correlation was found between operative mortality rate and the time interval between perforation and operation. This elapsed time was found to be significantly greater among women and the elderly, in gastric perforations and in perforations occurring during the night.

Perforation is a serious complication of peptic ulcer, a disease known to afflict about 10 million Americans,<sup>1</sup> and it accounts for 10% of hospital admissions for this disease.<sup>2, 3</sup> By far the commonest treatment of perforation is simple surgical closure. Emergency gastric resection<sup>4</sup> and vagotomy and pyloroplasty<sup>5, 6</sup> have been advocated but have not won general acceptance. Nor has the conservative management of selected cases been widely adopted.<sup>7</sup> Mortality rates reported from various centres with similar policies differ considerably, and there is no convincing evidence that one particular approach is significantly advantageous. Regardless of treatment policy there is evidence of a recent rise in the mortality rate from perforation.<sup>8-10</sup>

A series of 852 perforations occurring during the decade 1959-1968 in the Greater Vancouver area is presented in this survey and the treatment and other factors affecting mortality are analyzed.

### Methods

The precise area surveyed and the methods employed have been described in detail in an earlier report dealing with the incidence, time and site of these perforations.<sup>11</sup>

The hospital records were studied of every patient admitted during the 10-year period 1959-1968, in whom the diagnosis of perforated peptic ulcer was proved either at laparotomy or at autopsy.

All 12 hospitals in the region were included in the survey and 852 perforations in 840 individuals were detected. Analysis of the data was carried out using a computer, and the Chi-square test was used to test the significance of the results.

### Incidence and site

There were 852 perforations in the period 1959-1968. The annual incidence of perforation was 10 per 100,000 population (based on the 1966 census). The male-to-female ratio was 3.4:1. The mean age of the males was 53.9 years and of the females 56.5 years (overall mean age 54.5 years) and the peak age incidence was found in the decade 40 to 49 years. Patients with gastric perforations were significantly older ( $P < 0.0001$ ) than patients with pyloroduodenal perforations.

The ratio of pyloroduodenal perforations to gastric perforations was 8:1 and gastric perforations were twice as common among females as

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among males, a difference which was statistically significant ( $P < 0.01$ ).

### Treatment

The treatment of patients with perforated peptic ulcer is shown in Table I. Simple closure was clearly the standard treatment of pyloroduodenal perforation, and definitive emergency surgery was rarely performed. In 10.2% of cases no operation was attempted and the outcome was fatal in all of these; no doubt an unknown number of patients with perforations were managed conservatively and subsequently recovered. The commonest reason for conservative management was misdiagnosis (5.6% of all cases). In 37 instances the patient was admitted moribund.

### Delay in treatment

In 737 of the 765 cases treated surgically the length of time between perforation and operation was known with a reasonable degree of accuracy (Table II). Seventy per cent of cases reaching the operating room did so within 12 hours of perforation while 11% arrived after a delay of more than 24 hours. The mean time interval between perforation and operation was 13.6 hours. The mean delay in males was 12.2 hours and in females 18.7 hours (Table III); this difference was highly significant ( $P < 0.0001$ ). The relationship of the delay interval to the age of the patient is shown in Table IV. In patients over 65 years of age the interval between perforation and surgery was significantly longer ( $P < 0.0001$ ) than in patients under 65 years. The delay interval was also examined in relation to the site of the perforation (Fig. 1). While in 74% of cases of pyloroduodenal perforation treated surgically the operation was delayed less than 12 hours, only 54% of those with gastric perforations were operated on within that interval.

**Table I**  
Treatment and site of perforation\*

Treatment	Pyloroduodenal		Gastric		Stomal	
	No.	%	No.	%	No.	%
Simple closure	630	84.5	50	54.4	7	58.3
Definitive surgery	21	2.7	16	17.4	3	25.0
Other operations	28	3.8	8	8.7	0	—
No operation	67	9.0	18	19.5	2	16.7
Total	746	100	92	100	12	100

\*Excludes a case of esophageal perforation and one of a perforation of a peptic ulcer in a Meckel's diverticulum.

**Table II**  
Delay in operation for perforation

No. of hours' delay	No. of cases	%
1-3	67	8.8
4-6	221	28.9
7-9	163	21.3
10-12	82	10.7
13-18	79	10.3
19-24	39	5.1
25-48	49	6.4
49-72	17	2.2
More than 72	20	2.6
Not known	28	3.7
Total	765	100

This difference is statistically significant ( $P < 0.01$ ). The delay in treatment of perforations occurring at different times of the day is shown in Table V. For simplicity the 24 hours were arbitrarily divided into *night* (from 11 p.m. until 8 a.m.) and *day* (from 8 a.m. until 11 p.m.). There was a highly significant ( $P = 0.00001$ ) greater delay in the treatment of perforations occurring at night. It was disappointing to find that while in 1959, 22% of cases had a delay in operation of more than 12 hours, in 1968 37% of cases experienced such a delay. However, this increase did not reach statistical significance (Chi-square = 23.61, d.f. = 18,  $P = 0.17$ ). Finally, it was apparent that the longer the interval between perforation and surgery the more likely was the surgeon to perform an operation other than simple closure of the perforation (Fig. 2).

### Mortality

There were 852 cases of perforation in the Greater Vancouver area during the decade 1959-1968 and 156 of these patients died, giving an overall mortality rate of 18.3%. In view of the dramatic illness caused by perforation it is very unlikely that more than a few individuals died of this condition at home and were undetected by this survey. This figure, therefore, is almost certainly the true fatality rate from perforation. A total of 765 cases were treated by surgery and of these 69 died, giving an operative mortality of 9.0%. The overall and operative mortality rates for each year of the survey are shown in Fig. 3. There was no significant change in either rate during the decade.

### Mortality and age

Both the overall and operative mortality rates rose with increasing age. The steep increase in mortality among the elderly, a relationship which was highly significant

**Table III**  
Delay in treatment according to sex

Delay in hours	Male		Female	
	No.	%	No.	%
1-12	440	76	93	59
13-24	82	14	36	22
> 24	56	10	30	19
Total*	578	100	159	100

\*In 28 cases the length of delay was not accurately known.

**Table IV**  
Delay in surgery and age of patient

Delay in hours	Age 0-65 years		Age > 65 years	
	No.	%	No.	%
1-12	427	76.4	106	59.6
13-24	82	14.7	36	20.2
> 24	50	8.9	36	20.2
Total*	559	100	178	100

\*In 28 cases the length of delay was not accurately known.

**Table V**  
Delay in treatment and time of perforation

Delay in hours	8 a.m.-11 p.m.		11 p.m.-8 a.m.	
	No.	%	No.	%
1-12	310	82	219	70
13-24	38	10	74	24
> 24	30	8	18	6
Total	378	100	311	100

( $P < 0.00001$ ), is shown in Fig. 4. It is impressive that except for one fatality in a teenager there were no deaths among 125 patients under the age of 35 years and operative mortality was negligible in patients under 45.

### Mortality and sex

There was a significantly greater ( $P < 0.01$ ) overall mortality among women (Table VI). This higher fatality rate was evident in all age groups (Fig. 5), but was seen particularly in women under the age of 65 years and in those suffering perforations of pyloroduodenal ulcers (Table VII). In patients with gastric perforations the female mortality rate was not significantly higher than that for males.

The operative mortality rate was greater among women (12.6%) than among men (8.0%) but this difference did not achieve statistical significance (Fig. 6). There were no deaths among women aged 50-54 or 65-69 but the numbers in each group were small. It was not surprising, therefore, that the higher operative mortality among women was not significant either below or above the age of 65 years. Similarly, women suffering gastric perforations were not significantly more at risk from surgery than those with pyloroduodenal perforations (Table VII).

### Mortality and time of perforation

The actual time of perforation was accurately known in 728 of the 852 cases (85%) and 689 of the 765 operative cases (90%). The overall and operative mortality of perforations occurring at each hour of the day is shown in Fig. 7. While there was considerable variation in the rates, there was clearly a greater mortality at night. When the day was divided into two parts it emerged that the overall mortality was probably significantly greater ( $P < 0.05$ ) among perforations occurring between 11 p.m. and 8 a.m., but the difference in the operative mortality rate did not quite achieve significance (Chi-square = 3.59, d.f. = 1,  $P = 0.05$ ).

No statistically significant trend appeared in either the overall or operative mortality of perforations occurring on each day of the week (Table VIII) although the peak rate for both was at the weekend.

Similarly, there was no statistical significance in the relationship of overall or operative mortality to the month of perforation (Table IX). However, it is curious that during September, when there was the lowest incidence of perforation, mortality was highest and that in December,

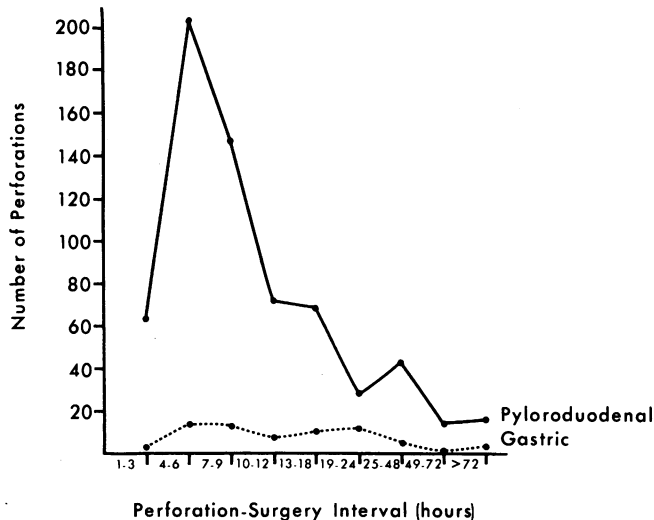


FIG. 1—Delay in treatment of pyloroduodenal and gastric perforations.

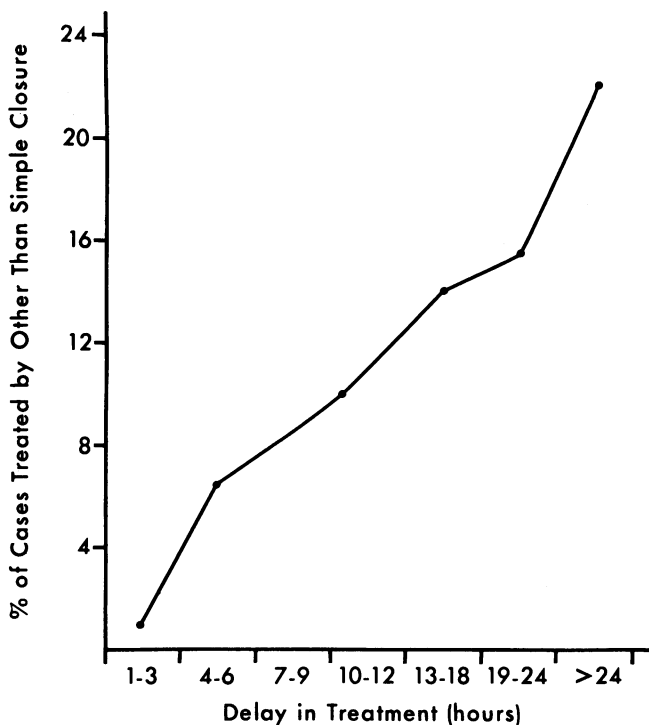


FIG. 2—Delay in treatment and surgical procedure for perforated peptic ulcer.

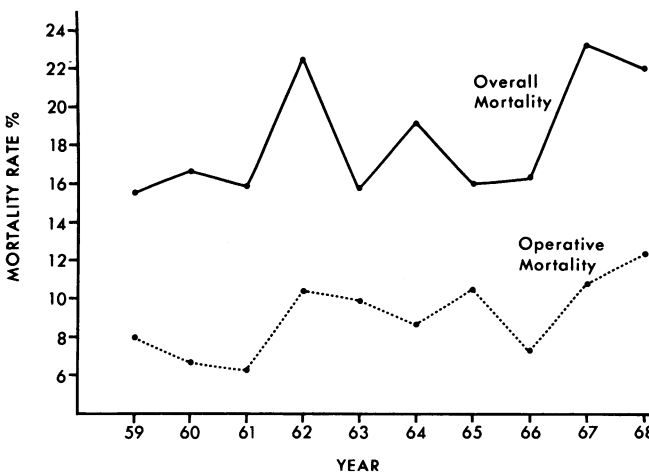


FIG. 3—Overall and operative mortality from perforated peptic ulcer.

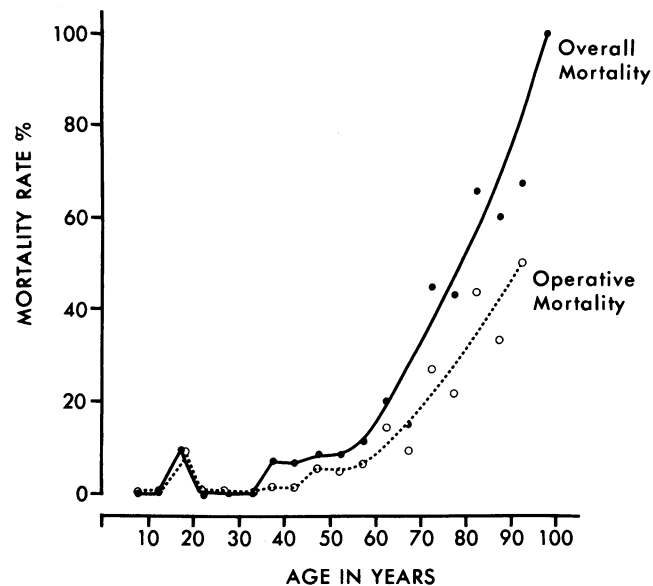


FIG. 4—Overall and operative mortality in different age groups.

when the incidence of perforation reached its peak, the mortality rates approached their lowest levels.

### Mortality and treatment

The fatality rate of the various treatments undertaken is shown in Table X. In 81% of cases the treatment was simple closure of the perforation and the operative mortality was 8%. Only 4.7% of cases had definitive emergency surgery and of these 12.5% died. A total of 37 cases (4.3% of the series) had various other procedures (e.g., appendectomy, cholecystectomy) in addition to closure of the perforation or had laparotomy and drainage only (seven cases), and in this miscellaneous group the mortality was 27%. It is not surprising that these latter procedures carried statistically greater ( $P < 0.001$ ) mortality rates than simple closure.

In 87 (56%) of the fatalities no operation was performed. Almost half of these cases were admitted either moribund or in the terminal stage of a concurrent fatal illness, and surgical intervention was deliberately avoided. However, in 48 cases (5.6% of the entire series) the reason for non-surgical treatment was misdiagnosis and the perforation was found only at autopsy. It is the policy in the 12 hospitals in this region to conduct an autopsy on every fatal case where the diagnosis is in any doubt, and therefore it is unlikely that many undiagnosed cases ended in death and were undetected. Inevitably some will have eluded recognition, and the figure of 5.6% must be an

**Table VI**

#### Overall and operative mortality in males and females

Sex	All perforations			Operated cases		
	No.	Deaths	Mortality	No.	Deaths	Mortality
Male	657	107	16.3	598	48	8.0
Female	195	49	25.1	167	21	12.6

**Table VII**

#### Overall and operative mortality in males and females by site of perforation

Perforation	All perforations*			Operated cases†		
	No.	Deaths	Mortality	No.	Deaths	Mortality
<b>Pyloroduodenal:</b>						
Male	587	83	14.1	542	38	7.0
Female	159	34	21.4	138	13	9.4
<b>Gastric:</b>						
Male	58	21	36.2	47	10	21.3
Female	34	15	44.1	27	8	29.6

\*Excludes 12 stomal perforations and the two cases referred to in footnote to Table I.

†Excludes 11 of the above cases treated surgically.

**Table VIII**

#### Overall and operative mortality and day of perforation\*

Day of week	All perforations			Operated cases		
	No.	Deaths	Mortality	No.	Deaths	Mortality
Monday	113	21	18.6	103	11	10.7
Tuesday	115	25	21.7	98	8	8.2
Wednesday	137	18	13.1	127	8	6.3
Thursday	120	17	14.2	110	7	6.4
Friday	120	21	17.5	107	8	7.5
Saturday	133	30	22.6	118	15	12.7
Sunday	113	23	20.4	101	11	10.9

\*In one case the day of perforation was unknown.

underestimate of the misdiagnosis rate.

The operative mortality of the 737 cases for which the time interval between perforation and surgery was accurately known is shown in Fig. 8. The steep increase in mortality with increasing delay was quite striking. This is the pattern which would be expected and is of extreme significance ( $P < 0.00001$ ).

### Mortality and site of perforation

Perforations were classified as pyloroduodenal, gastric, stomal and "other" (e.g. esophageal, Meckel's diverticulum). The "pyloroduodenal" group was employed because of the difficulty frequently encountered in deciding at operation whether the perforation is duodenal or pyloric. The overall and operative mortality rates for these perforations are shown in Table XI. It was at once apparent that gastric perforation carried a far greater risk than pyloroduodenal perforation. This was statistically significant both for the overall mortality ( $P < 0.00001$ ) and for operative mortality ( $P < 0.0001$ ).

**Table IX**

#### Overall and operative mortality and month of perforation

Month	All perforations			Operated cases		
	No.	Deaths	Mortality	No.	Deaths	Mortality
January	64	15	23.4	55	6	10.9
February	59	6	10.2	57	4	7.0
March	75	19	25.3	66	10	15.2
April	75	12	16.0	67	4	6.0
May	86	16	18.6	79	9	11.4
June	65	11	16.9	59	5	8.5
July	82	14	17.1	72	4	5.6
August	68	11	16.2	62	5	8.1
September	52	13	25.0	45	6	13.3
October	71	15	21.1	61	5	8.2
November	64	11	17.2	58	5	8.6
December	91	13	14.3	84	6	7.1

**Table X**

#### Mortality rate and treatment of perforation\*

Treatment	No. of cases	Deaths	Mortality
Simple closure	687	54	7.9
Closure + anastomosis	18	2	11.1
Resection	22	3	13.6
Other	37	10	27.0
No operation	87	87	—
<b>Total</b>	<b>851</b>	<b>156</b>	<b>18.3</b>

\*Excludes one case in which the type of operative procedure was not recorded.

**Table XI**

#### Overall and operative mortality and site of perforation

Site	All perforations			Operated cases		
	No.	Deaths	Mortality	No.	Deaths	Mortality
Pyloroduodenal	746	117	15.7	680	51	7.5
Gastric	92	36	39.1	74	18	24.3
Stomal	12	2	—	10	0	—
Other	2	1	—	1	0	—

The mortality rates from pyloroduodenal and gastric ulcer in males and females are given in Table VII. There was no significant difference in the overall or operative mortality from gastric perforation in males and females. However, while there was no difference in the operative mortality from pyloroduodenal perforation in males and females, there was a significantly higher overall female mortality ( $P < 0.05$ ).

### Discussion

This survey of the factors influencing the mortality from perforated peptic ulcer is the first epidemiological study of the problem conducted on the North American continent. While there have been numerous reports from individual institutions,<sup>12-18</sup> and even of large series,<sup>19</sup> these are reduced in value by the factor of selection involved in the choice of hospital for a particular patient. We have shown that even within the same city area the various general hospitals have significantly different referral patterns for perforated peptic ulcer.<sup>11</sup> Thus a complete regional survey is the only method by which the incidence and mortality of this condition can be accurately studied.

Such epidemiological studies of perforated peptic ulcer have been conducted in Scotland,<sup>8, 20</sup> England,<sup>9</sup> Israel<sup>21</sup> and New Zealand.<sup>22</sup> In all of these countries simple closure of the perforation was the standard treatment; the commonest site of perforation was pyloroduodenal; and the sex ratio and age incidence were similar to those in the present study. The only major point of divergence was in the actual incidence of the complication, it being twice as common in Scotland and only half as frequent in Israel. The surveys mentioned above are therefore strictly comparable with the present investigation.

It was disconcerting to find that despite the considerable advances made in anesthesia, fluid and electrolyte therapy and intensive care during the period under study, there was no detectable trend towards a reduction in either the overall or operative mortality rates (Fig. 3). Sanders<sup>9</sup> found an actual increase in the overall mortality rate from perforation in the Oxford area of England during the period 1957-1963 and MacKay<sup>8</sup> found a similar increase

in West Central Scotland during the decade 1954-1963 which he attributed to an increase in the age of the patients at risk. There was no increase in the proportion of the elderly among patients with perforation during the period of the present study, and the sex ratio and proportion of gastric ulcers also remained constant. There was, however, an increase in the proportion of patients experiencing a delay of more than 12 hours from time of perforation to time of operation, and a slight tendency away from simple closure has been detected. While neither of these trends was statistically significant, together they may have been sufficient to explain the lack of improvement in the operative mortality. The alternative possibility that there had been an increasing tendency to operate on poor-risk patients can be discounted, as the operative rate was constant throughout the decade. The steady overall mortality of course indicates that there was no reduction in the percentage of cases arriving moribund or, distressingly, in the rate of misdiagnosis.

The high rate of misdiagnosis largely accounts for the difference between the overall mortality rate (18.3%) and the operative mortality rate (9.0%). Forty-eight deaths (31%) could be attributed to this directly. This experience is shared by others,<sup>16, 22, 23</sup> but MacKay<sup>8</sup> in a series of 5343 perforations collected in a manner identical to the present series found that while in 44% of his 633 fatalities no operation had been performed, only in a few cases was this attributable to misdiagnosis. The extremely low rate of misdiagnosis in the West of Scotland is further supported by the fact that only 5% of MacKay's cases did not have surgical treatment compared with 10% in the present series, which is a more usual figure.<sup>9, 16, 23</sup> While it is unlikely that much can be done to reduce the number of patients arriving at hospital moribund, there is clearly room for significant improvement in the diagnosis of acute perforated peptic ulcer, the overall mortality of which could potentially be reduced from approximately 18% to 13%. Examination of the records of those patients in whom a wrong diagnosis was made revealed that most were elderly (mean age 74.4 years), there were relatively more females (32%) and gastric perforations were twice as

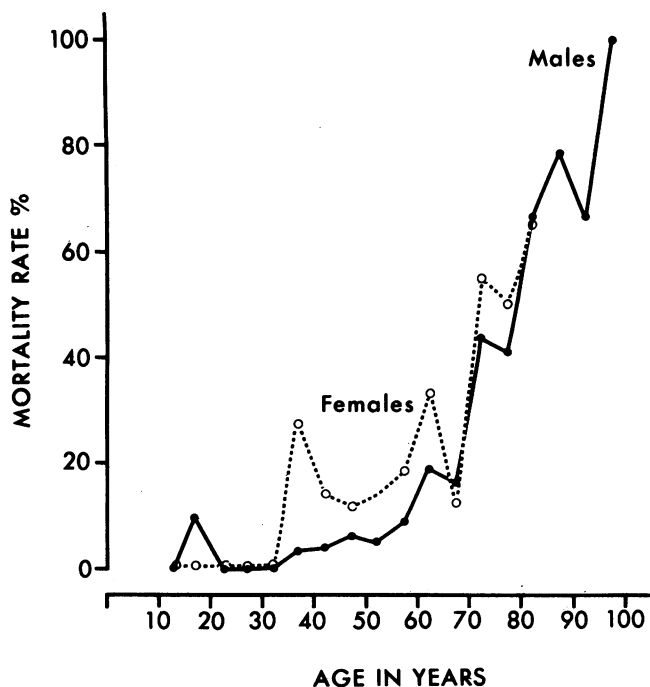


FIG. 5—Overall mortality in males and females of all age groups.

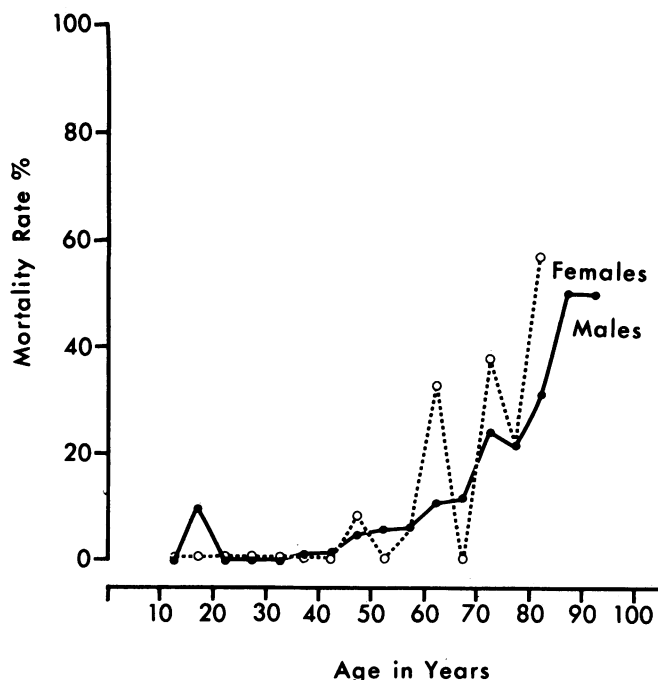


FIG. 6—Operative mortality in males and females of all age groups.

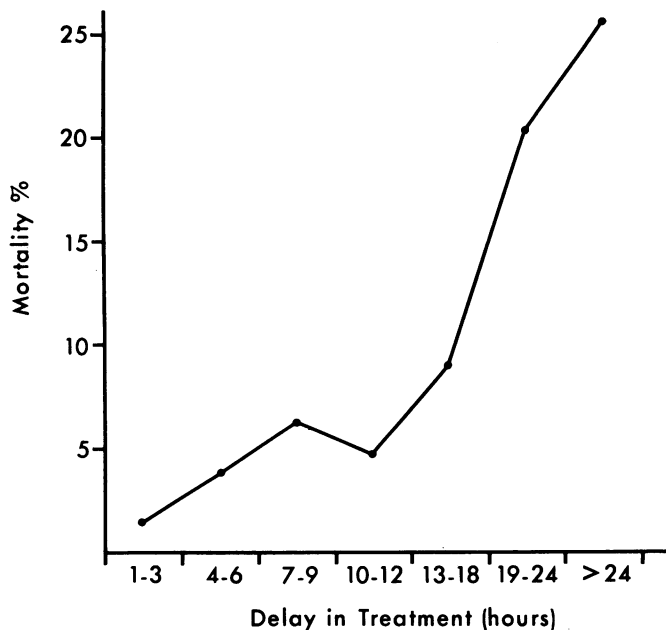


FIG. 7—Overall and operative mortality and time of perforation.

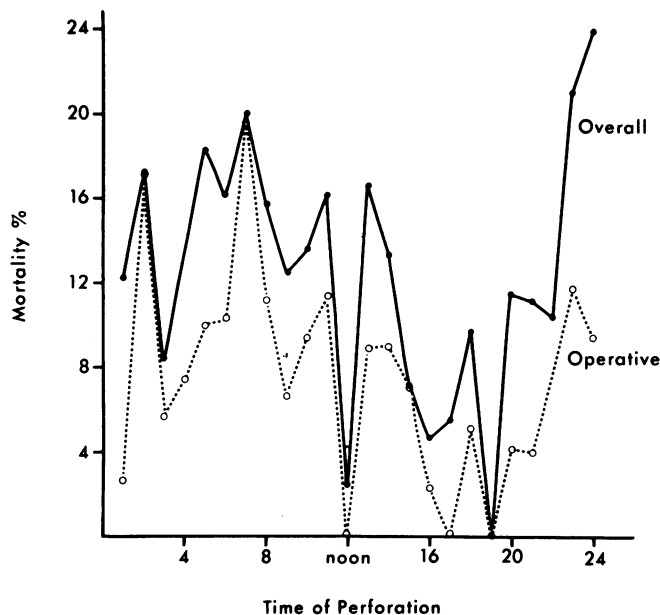


FIG. 8—Mortality and delay in surgery for perforated peptic ulcer.

common (21%) as in the series generally (10.8%). While frequently the history obtained was too poor to fix the time of perforation, among patients for whom this information was known the majority had perforated during the night. Finally it was noted that the majority of these patients were admitted primarily to non-surgical wards and were denied a surgical consultation until too late. This suggests that in the elderly, particularly in females and in cases of gastric perforation, the diagnosis is difficult. A more aggressive approach to the investigation of these cases and a greater willingness by the physician to obtain a surgical opinion might produce a significant reduction in overall mortality.

This study has shown that the overall and operative mortality are significantly greater among patients over the age of 65. This is the expected finding which has been widely reported,<sup>8, 9, 16, 21, 24</sup> and indeed Norberg<sup>25</sup> believed that age was the single most important prognostic factor in perforated peptic ulcer.

The crude fatality rate for perforations occurring during the night (from 11 p.m. until 8 a.m.) was significantly higher (15.0%) than for perforations occurring during the day (8.9%). The operative mortality was also higher among perforations occurring at night (9.0%) than in those occurring during the daytime (5.0%), but this difference just failed to achieve statistical significance. The very high overall and operative mortality rates (57.3% and 29.3%, respectively) of the patients whose exact time of perforation was unknown merely reflects the grave prognosis for the moribund or elderly confused patient. MacKay<sup>8</sup> suggested that delay in seeking or obtaining medical advice during the night and the resulting increased delay in surgery could explain the higher mortality from perforations occurring in the early hours of the morning. This view is confirmed by this study, which found that among patients for whom the time of perforation was known, 82% of perforations occurring during the day were subjected to a delay of treatment of less than 12 hours compared with only 70% of cases occurring at night. Factors other than delay may have contributed to this higher mortality of night-time perforations. For example, the non-operative rate was found to be rather higher for cases perforating at

night (6.6%) than for those perforating during the day (4.1%), but this difference did not achieve statistical significance ( $P = 0.17$ ). There was also a slightly greater likelihood of misdiagnosis in cases perforating at night (57% of non-operated cases) than in those perforating during the day (44% of non-operated cases), but again this difference was not statistically significant.

No significant difference was found in the overall or operative mortality rates from perforation occurring on the various days of the week or during the various months of the year. MacKay<sup>8</sup> found a peak mortality during February in Scotland, and Lazarus<sup>21</sup> found that in Israel the fatality rate during the months October to March was significantly greater than during the period April to September. Jamieson<sup>26</sup> postulated that the higher mortality rate in winter might be due to a greater incidence of pulmonary complications in that season. The relatively steady fatality rate in the present series may be related to the low incidence of chronic bronchitis in the population and to the mild climate enjoyed throughout the year.

That procedures other than simple closure of the perforation carried a significantly higher mortality is hardly surprising. Simple closure is the standard treatment in the area, and other operations would normally be reserved for unusual or unfavourable cases, and indeed the patients having simple closure were significantly younger. The total operative mortality rate of 9.0% was similar to that found in other regional surveys.<sup>8, 9, 21, 22</sup> The fatality rate following simple closure was 7.9% as compared to that of 13.6% following gastrectomy which was performed in 2.9% of the perforations treated surgically. It is interesting that whereas in MacKay's<sup>8</sup> series only 2.0% of the operative cases had gastrectomy with a fatality rate of 15.5%, in Singh and Taylor's<sup>22</sup> series 7.8% had gastrectomy performed with a mortality rate of only 10%. This illustrates clearly that where the standard treatment of perforation is simple closure the mortality rate from emergency gastrectomy is reduced when more are performed but the total operative mortality is unaffected. The most likely explanation is that as the proportion of cases treated by gastrectomy increases the proportion of poor-risk patients among them decreases. This also explains the very low

mortality rates following emergency gastrectomy for perforation reported by Jordan, DeBakey and Cooley.<sup>4</sup>

The direct relationship between mortality rate and delay in operation (Fig. 3) is the expected one and has been well documented.<sup>8, 16, 17, 21, 23</sup> In addition, Antila<sup>27</sup> from Finland and Hennessey<sup>23</sup> from Australia reported that delay in treatment was commoner among women and among the elderly. The present study has confirmed these findings and has also shown that the delay in operation is greater among patients with perforated gastric ulcer and in perforations occurring during the night. This suggests that while delay in treatment adversely affects the outcome, those patients whose operation was delayed were already at greater risk at the actual time of perforation on account of age, sex, site and time of perforation. It was this poor-risk group which was most likely to have surgical procedures other than simple closure (Fig. 2).

The overall mortality and operative mortality rates from gastric perforation were significantly higher than those from pyloroduodenal perforation, and this, although the general experience,<sup>8, 9, 14, 16, 22</sup> is not entirely understood. Hennessey<sup>23</sup> noted an increasing mortality with increasing size of perforation but was unable to demonstrate that gastric perforations were significantly larger than others. Mortality also increases with age, and MacKay<sup>8</sup> found that the mean age of patients with gastric perforation in his series was 51.2 years compared with 46.1 years for patients with pyloroduodenal perforations, statistically a highly significant difference. In the present series also, patients with gastric perforations were significantly older than those with pyloroduodenal perforations. In addition, gastric perforation was relatively more frequent among women who had a higher mortality rate, and operation was statistically more likely to be delayed in cases of gastric perforation. It seems likely, therefore, that the greater mortality from gastric perforation is due to a combination of factors, including age, sex and delay in treatment.

There was no significant difference in the operative mortality for males and females regardless of age and site of perforation. The overall mortality, however, in patients with pyloroduodenal perforations was significantly greater in women, although in gastric perforations there was no sex difference. Similarly, among elderly patients the overall mortality rate of the women was significantly greater than that of the men. Other studies<sup>16, 21, 22</sup> have shown that the female is more at risk, although Hennessey found only one death among 80 women subjected to operation. MacKay also found that in pyloroduodenal perforations there was a significantly lower fatality rate among the males, which he ascribed to the lower age of males with pyloroduodenal perforation.

I wish to thank the medical directors, surgeons and record librarians who willingly co-operated in this study. I am also indebted to Miss Robin Russell, B.Sc., of the computer centre at the University of British Columbia, for technical assistance. I am grateful to Dr. R. C. Harrison for advice and encouragement.

## Résumé

*Le traitement et la mortalité de l'ulcère gastro-duodénal perforé: revue de 852 cas*

Nous avons procédé à une analyse rétrospective de tous les cas flagrants d'ulcère gastro-duodénal perforé qui sont survenus au cours de la décennie 1959-1968 dans la région du grand Vancouver. La fréquence de la perforation a été

d'environ 10 par 100,000 habitants. L'âge moyen du malade était de 55 ans et la fréquence maximum de l'accident survenait durant la cinquième décennie de la vie. Dans 88% des cas, la perforation siégeait dans la région pyloro-duodénale et la fermeture simple a été pratiquée dans 81% des cas. La mortalité globale a été de 18.3%: un tiers de ces décès était attribuable à un diagnostic erroné. La mortalité opératoire a été de 9.0%.

La mortalité globale a été sensiblement plus élevée parmi les femmes et les vieillards, dans les cas de perforation gastrique et dans les accidents survenus entre 23.00 h. et 8.00 h. La mortalité opératoire a été nettement plus élevée dans les perforations gastriques et parmi les vieillards, mais n'a pas été plus élevée chez les femmes ou dans les cas survenus pendant la nuit.

On a noté une étroite corrélation entre la mortalité opératoire et l'intervalle écoulé entre la perforation et l'opération. Ce laps de temps a été notablement plus grand parmi les femmes et les vieillards, dans les cas de perforation gastrique et dans les perforations survenues au cours de la nuit. Plus ce délai est long, plus la nécessité d'une intervention majeure devient probable, laquelle comporte ipso facto une mortalité nettement plus élevée.

Un groupe qui est soumis à un risque particulièrement élevé comprend les gens âgés souffrant de perforation gastrique dont le traitement a été retardé, ce qui impose une intervention d'urgence majeure et comporte un pronostic grave.

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clinic at The Hospital for Sick Children. Determinations of hemoglobin levels were repeated for 80% and iron was prescribed for 65% of the 54 infants. For a number of reasons there was a delay of up to three months between initial testing and the visit to the physician or clinic. It would be desirable to reduce this time interval to verify results and begin treatment.

### Conclusion

A systematic community approach using seven selected child health centres in the City of Toronto indicated the need for screening for anemia, since 29% of the infants in the age group 6-18 months had hemoglobin levels which required referral for further medical investigation. The present study method for hemoglobin determinations can be easily applied with the support of community laboratory facilities to routine screening of large numbers of infants. Implementation of such a program on a large scale is being planned. Current public health programs which encourage the use of iron-rich foods in the infant's diet should continue, as no evidence has been produced to contradict this need.

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### Résumé

*Le taux d'hémoglobine et l'apport de fer chez des nourrissons fréquentant des centres de consultations infantiles de la ville de Toronto*

La détermination des taux d'hémoglobine chez des nourrissons susceptibles de représenter des risques élevés a permis de démontrer la possibilité d'établir le bilan de la santé publique par dépistage et traitement de l'anémie. Dans sept centres de consultations infantiles particulièrement choisis de la ville de Toronto, les équipes du Service de Santé ont recueilli chez 252 enfants de 6 à 18 mois les échantillons de sang nécessaires au dosage de l'hémoglobine et les détails concernant les rations alimentaires des

24 heures. L'analyse du taux d'hémoglobine faite par la méthode de la cyanméthémoglobine à l'École d'Hygiène a permis de constater que 29% des nourrissons avaient un taux d'hémoglobine inférieur à 10 g/100 ml de sang. Les médecins auxquels ces enfants avaient été adressés pour examen ultérieur ont prescrit une médication martiale dans la majorité des cas. Les difficultés rencontrées dans la cueillette et l'analyse des données sur le régime alimentaire ont malheureusement limité l'interprétation de la ration de fer alimentaire. Les autorités étudient actuellement la possibilité de créer une méthode de dépistage collectif pour un grand nombre de nourrissons.

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