A post-mortem study of gastric and duodenal peptic lesions

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EDITORIAL SYNOPSIS The overall incidence of peptic lesions in the reported series was 24.3%. Chronic peptic lesions were much higher in males (22.9%) than in females (12.2%). The incidence in males increased gradually from 19.6% in 1940-43 to 26.5% in 1956-58; in females there was an increase in the last few years only. Acute peptic lesions were approximately of the same incidence in males (6.3%) and in females (5.6%). In both sexes there was a sudden increase in frequency after 1949. Correlations have been demonstrated between acute peptic lesions and acute pathological conditions of the central nervous system, and between both acute and chronic lesions and chronic pulmonary diseases.

Part I Frequency and distribution by age and sex

The frequency of peptic lesions of the stomach and the duodenum is a highly controversial subject in the literature. Great discrepancies exist, especially between clinical and pathological statistics. Clinical statistics are apt to give a lower frequency for peptic lesions than do pathological statistics. This is because only those peptic lesions which give rise to symptoms are included in clinical statistics, whereas pathological statistics also include those lesions which have been found incidentally at necropsy. Thus, pathological statistics offer a more trustworthy impression of the frequency of peptic lesions, and clinical statistics more reliable information on the frequency of peptic disease or symptoms. However, pathological statistics are only reliable if they cover a large number of necropsies and the presence or absence of peptic lesions has been carefully noted in the records. The post-mortem material of the Central Pathological Laboratory of the Municipal Hospitals of Rotterdam (Netherlands) fulfils these requirements.

The results of the study of certain characteristics of peptic lesions found at necropsy in Rotterdam will be given below. This study is an extension of an earlier investigation by Levij (1959).

MATERIAL AND METHODS

The investigation includes all necropsies on persons aged 20 years and more, performed in Rotterdam between May 1940 and January 1959, the total number being 11,125. The age and sex distribution of the necropsied cases is given in Table I.

All peptic lesions found at necropsy were noted. A distinction has been made between three groups of peptic lesions.

TABLE I

AGE AND SEX DISTRIBUTION OF NECROPSIES ON
PERSONS AGED 20 YEARS AND OVER PERFORMED IN
ROTTERDAM BETWEEN MAY 1940 AND JANUARY 1959

Age Group (yr.)	Males	Females	Total
20-29	283	256	539
30-39	440	358	798
40-49	813	543	1,356
50-59	1,431	816	2,247
60-69	1,738	1,213	2,951
70-79	1,338	1,121	2,459
>80	409	366	775
Total	6,452	4,673	11,125

ACUTE PEPTIC LESIONS Haemorrhagic erosions are those haemorrhagic infarctions limited to the mucous membrane, sometimes to its superficial part only. They are usually round with a diameter which

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varies between 1 mm. and several centimetres. Haemorrhagic erosions may occur in large numbers. Acute ulcers extend into the submucous layer or even into the muscular wall and are often multiple. An inflammatory exudate is present in the floor of the defect and is usually more extensive than in haemorrhagic erosions, where at most a few leucocytes may be found. In the floor of acute ulcers no fibrous tissue is present.

CHRONIC PEPTIC LESIONS FOUND INCIDENTALLY Chronic ulcers are round or oval defects of the mucous membrane, the submucous tissue, and the muscular wall. The defect in the muscle is repaired by granulation tissue which later changes into scar-like fibrous tissue. The presence of this fibrous tissue is the most important distinction between acute and chronic peptic ulcers. In the floor of chronic ulcers four different layers are seen (Askanazy, 1921). The most superficial layer consists of an inflammatory exudate, next a layer of fibrinoid degeneration and necrosis, and finally granulation tissue is found, followed by scar-like fibrous tissue. When a chronic ulcer reaches a healing phase, the greater part of the ulcer floor is formed by fibrous tissue, retraction of which causes approximation of the borders of the defect. By overgrowth of epithelium from the margin the defect is epithelialized, the epithelium being flat or cubical, and there is no regeneration of functioning glandular tissue. At most some rudimentary tubules are formed. The scar is now formed.

Cases in which a gastrectomy had been performed for a chronic peptic lesion have been included in the group of chronic peptic lesions found incidentally.

CHRONIC PEPTIC LESION RELATED TO DEATH Cases are included where death was caused by the perforation of, or haemorrhage from, a chronic peptic lesion, and cases in which death followed within 10 days of a gastric resection for such a lesion.

Although possibly in some cases the gastro- or oesophagomalacia¹ found at necropsy had already been present during life, these cases have not been included among the peptic lesions, as it was deemed probable that the greater part of the malacias represent post-mortem changes.

RESULTS

In 2,702 (24.3%) of 11,125 necropsies peptic lesions were found. Table II shows the frequency of the various groups of peptic lesions in males and in females.

The frequency of acute peptic lesions was approximately the same in males as in females. Chronic peptic lesions, however, showed a clear predilection for males. They were found in 22.9% of the males and in only 12.2% of the females, *i.e.*, about half as often. Chronic peptic lesions related to death were found in 5.3% of the males and in 2.2% of the females. Whereas for all chronic peptic lesions the male:female ratio was 1.9:1, in the case of chronic peptic lesions related to death this ratio was 2.4:1. Thus it appears that the male preponderance in chronic peptic lesions related to death is greater than that in chronic peptic lesions on the whole.

The frequencies of the various groups of peptic lesions have been arranged according to age and sex in Table III and in Figures 1 and 2.

Table III and Figures 1 and 2 show that in both sexes the frequency of acute peptic lesions increased more or less regularly with increasing age. The same is true for chronic peptic lesions in females. Chronic peptic lesions in males, however, show frequency peaks between the ages of 40 and 50 years (chronic peptic lesions related to death) and between the ages of 50 and 60 years (incidentally found chronic

¹Gastromalacia is the result of autodigestion of the stomach or oesophageal mucosa when pepsin and hydrochloric acid in sufficient concentration or highly acid pathological products of digestion are present in the stomach (Kaufmann, 1956).

TABLE II
FREQUENCY OF VARIOUS GROUPS OF PEPTIC LESIONS IN MALES AND IN FEMALES

	Males		Females		Males and Females	
Number of necropsies	6,452		4,673		11,125	
Acute peptic lesions	404	(6.3%)	261	(5.6%)	665	(6.0%)
Chronic peptic lesion in stomach leading to death	195	(3.0%)	61	(1.3%)	256	(2.3%)
Chronic peptic lesion in duodenum leading to death	149	(2.3%)	40	(0.9%)	189	(1.7%)
Chronic peptic lesion in stomach incidentally found	355	(5.5%)	200	(4.3%)	555	(5.0%)
Chronic peptic lesion in duodenum incidentally found	505	(7.9%)	202	(4.5%)	707	(6.3%)
Chronic peptic lesion in stomach and duodenum incidentally found	72	(1.1%)	28	(0.6%)	100	(0.9%)
Gastric resection in the past	201	(3.1%)	29	(0.6%)	230	(2.1%)
Chronic peptic lesion accompanied by acute peptic lesion (included in chronic peptic lesions)	(79)		(30)		(109)	
Total	6,452	1,881 (29.2%)	4,673	821 (17.8%)	11,125	2,702 (24.3%)

TABLE III

AGE AND SEX FREQUENCIES OF VARIOUS GROUPS OF PEPTIC LESIONS AS PERCENTAGES OF THE NUMBER OF NECROPSIES IN EACH AGE GROUP

Age Groups (yr.)	20-29	30-39	40-49	50-59	60-69	70-79	80	Total
<i>Males</i>								
Acute peptic lesions of stomach	2.5	2.7	2.5	3.2	3.9	4.0	2.9	3.4
Acute peptic lesions of duodenum	2.5	1.8	1.6	2.2	2.7	2.8	3.2	2.4
Acute peptic lesions of stomach and duodenum	0.4	0.3	0.7	0.2	0.7	0.4	0.5	0.5
Acute peptic lesions and chronic peptic lesions	0.3	0.0	0.6	1.3	1.3	1.9	1.2	1.2
Total acute peptic lesions	5.7	4.8	5.4	6.9	8.6	9.1	7.8	7.5
Chronic peptic lesions of stomach related to death	0.0	2.5	4.1	3.3	2.8	3.2	2.9	3.0
Chronic peptic lesions of duodenum related to death	2.8	3.0	3.0	2.3	1.9	2.0	2.5	2.3
Total chronic peptic lesions related to death	2.8	5.5	7.1	5.6	4.7	5.2	5.4	5.3
Incidentally found chronic peptic lesions of stomach	0.7	2.0	5.7	5.7	6.4	6.5	4.6	5.5
Incidentally found chronic peptic lesions of duodenum	2.1	5.2	7.4	9.2	8.2	8.1	7.8	7.9
Incidentally found chronic peptic lesions of stomach and duodenum	0.0	0.0	1.5	0.9	1.7	1.0	1.0	1.1
Gastric resection in the past	0.7	1.8	3.6	5.7	2.4	2.3	1.7	3.1
Total incidentally found chronic peptic lesions	3.5	9.0	18.2	21.5	18.7	17.9	15.1	17.6
<i>Females</i>								
Acute peptic lesions of stomach	2.0	1.1	3.1	2.0	3.0	4.1	4.6	3.0
Acute peptic lesions of duodenum	0.3	2.5	1.7	2.2	1.9	2.0	3.0	2.0
Acute peptic lesions of stomach and duodenum	0.0	0.0	0.2	0.4	0.5	0.8	1.9	0.6
Acute peptic lesions and chronic peptic lesions	0.0	0.0	0.3	0.7	1.0	0.8	0.3	0.6
Total acute peptic lesions	2.3	3.6	5.3	5.3	6.4	7.7	9.8	6.2
Chronic peptic lesions of stomach related to death	0.0	0.0	0.7	1.2	1.4	2.2	1.4	1.3
Chronic peptic lesions of duodenum related to death	0.0	0.0	1.1	0.6	0.7	0.9	2.7	0.9
Total chronic peptic lesions related to death	0.0	0.0	1.8	1.8	2.1	3.1	4.1	2.2
Incidentally found chronic peptic lesions of stomach	0.4	1.9	0.7	3.2	5.0	6.8	6.8	4.3
Incidentally found chronic peptic lesions of duodenum	1.2	2.5	4.6	4.8	3.9	5.5	4.6	4.5
Incidentally found chronic peptic lesions of stomach and duodenum	0.0	0.0	0.4	0.7	0.7	0.5	1.4	0.6
Gastric resection in the past	0.3	0.3	0.6	0.5	0.6	1.0	0.3	0.6
Total incidentally found chronic peptic lesions	1.9	4.7	6.3	9.2	10.2	13.8	13.1	10.0

FIG. 1

FIG. 2

FIG. 1. Frequency of various groups of peptic lesions in males, arranged according to age.

FIG. 2. Frequency of various groups of peptic lesions in females, arranged according to age.

TABLE IV

INCIDENCE OF CHRONIC PEPTIC LESIONS AT DIFFERENT PERIODS IN MALES AND IN FEMALES AS A PERCENTAGE OF THE NUMBER OF NECROPSIES IN EACH PERIOD

	Related to Death	Incidentally Found	Post-gastrectomy	Total
<i>Males</i>				
1940-43	7.9	10.0	1.7	19.6
1944-47	4.5	13.8	2.2	20.5
1948-51	4.7	13.9	2.7	21.3
1952-55	4.1	15.5	3.8	23.4
1956-58	4.6	17.7	4.2	26.5
<i>Females</i>				
1940-43	2.6	7.8	0.3	10.7
1944-47	0.6	9.9	0.6	11.1
1948-51	2.0	8.2	0.6	10.8
1952-55	2.3	8.3	0.3	10.9
1956-58	1.6	11.4	1.1	14.1

FIG. 3. Incidence of chronic peptic lesions in males and in females in different periods.

peptic lesions). In the older males the frequency of chronic peptic lesions decreased.

The results of a study of changes in the incidence of chronic peptic lesions during the observed period are given in Table IV and Figure 3.

In males there has been a steady increase of incidentally found chronic peptic lesions. The importance of chronic peptic lesions as a cause of death has remained the same throughout the years, with the exception of a peak during World War II.

The incidence of chronic peptic lesions in females shows some fluctuations, but no clear trend emerges. It is not possible to say whether the high incidence of incidentally found chronic peptic lesions in females during the last years of the observed period represents the beginning of an increase of these lesions in females. A temporary fluctuation cannot be excluded.

The incidence of acute peptic lesions during the same period is shown in Table V and Figure 4. The

TABLE V

INCIDENCE OF ACUTE PEPTIC LESIONS IN MALES AND IN FEMALES AT DIFFERENT PERIODS AS A PERCENTAGE OF THE NUMBER OF NECROPSIES IN EACH PERIOD

	Males	Females
1940-45	4.0	2.8
1946-49	4.4	3.7
1950-53	9.0	8.7
1954-58	8.7	6.8

FIG. 4. Incidence of acute peptic lesions in males and in females in different periods.

arrangement of the groups by year in Table V is slightly different from that in Table IV in order to illustrate more clearly the very sudden increase of acute peptic lesions in both sexes found since 1949.

DISCUSSION

Although peptic lesions of the stomach and the duodenum have been the subject of innumerable studies, reliable factual material about the frequency of these lesions remains scarce. An investigation like the one reported here is only possible if a large amount of necropsy material is available and has been accumulated with special attention to the occurrence of peptic lesions. Such necropsy surveys are few, and this is the reason for our adding one more report to the already very large literature on this subject.

A comparable study has been published by Falconer (1943). He analysed 4,553 male and 4,747 female necropsies performed in Stockholm (Sweden) during the period 1930-41, and found a high incidence of peptic lesions, namely, 18.1% in the males and 17.9% in the females. Some remarkable

similarities exist between the results of Falconer's study and those of this investigation. As in most reports on this subject, the incidence of peptic lesions is higher in males than in females. The age distribution of chronic peptic lesions in females shows a regular increase with advancing age in Stockholm as well as in Rotterdam, whereas in males in both cities the age frequency curve for chronic peptic lesions shows a peak. In Stockholm this peak was situated between the ages of 40 and 50 years, in Rotterdam between the ages of 50 and 60 years.

Because chronic peptic disease is regarded as a chronic disease which leaves scars, age frequency curves such as those found in females in both cities must be expected. With advancing age new chronic peptic ulcers will appear, while some of the existing ones will change into scars. Therefore in old people more chronic peptic lesions have to be expected than in younger people. The peak found in the age frequency curves for chronic peptic lesions in males in both cities may be explained by a specific increase of chronic peptic lesions in males under the age of 60 years in the recent past. In an earlier publication (Levij and Straub, 1957) this assumption could be illustrated by making use of the cohort method, which is a statistical method used for studying the incidence of a disease in a group of persons born in a certain period. When the incidence of the disease in question in this group of persons is determined in a number of consecutive years, changes in the incidence can be demonstrated.

An increase of peptic lesions in post-mortem material during the past decades has also been postulated by other authors. Gordon and Manning (1941) found 2.9% peptic lesions during 1920-32 and 4.2% during 1933-36. Roulet and Frutiger (1943) found an increase from 6% to 12% shortly after World War I. Watkinson (1950-51) found 13.8% peptic lesions in 1928 and 18.2% in 1933. Wüst (1952) found an increase from 2.9% to 5.8% during the period 1930-49. Table VI (Levij, 1959), compiled from the literature, gives the lowest and highest percentages of peptic lesions found by different

investigators during different periods, and from it a clear trend emerges. After 1920 the minimum as well as the maximum percentages show an increase.

One of the remarkable findings in this investigation has been the very high incidence of peptic lesions (24.3%). In comparison with other statistics based upon necropsies, for example, those mentioned in the preceding paragraph, this is exceptionally high. There is one exception, namely, the study by Watkinson (1960) who describes the incidence and other characteristics of peptic lesions found in Leeds, England, between 1930 and 1949 during necropsy examinations conducted under the supervision of the late Professor Matthew Stewart. Watkinson found chronic peptic gastric lesions in about 20% of the males over the age of 35 years and in about 12% of the females in this age group. He emphasizes the necessity for a very careful necropsy technique and for a special interest in peptic lesions if the statistics prepared from the material are to be reliable.

Although the incidence of peptic lesions in the Rotterdam material is greater than in most other necropsy statistics, an even greater difference exists with the clinical incidence of peptic disease. Doll and Avery Jones (1951), for example, interrogated 4,871 males on present or past complaints of dyspepsia. If these or other complaints suggested the presence of a peptic lesion, clinical investigations were instituted. In their very careful investigation they found peptic lesions in only 6.5% of their subjects.

Table II shows that the male:female ratio for all chronic peptic lesions was 1.9:1. The male:female ratio for chronic peptic lesions related to death was 2.4:1. It follows that a chronic peptic lesion in a male is more often related to death than a chronic peptic lesion in a female. This is caused by the fact that in males more gastric resections are performed than in females, even more than would be expected on the basis of the higher frequency of chronic peptic lesions in males. The male:female ratio for cases where in the past a gastrectomy had been performed was 5:1, which far exceeds the male:female ratio for all chronic peptic lesions (1.9:1). Apparently chronic peptic lesions give rise to more, or more severe, symptoms of peptic disease in males than in females, thus necessitating more gastric resections in males. This entails a proportionally higher frequency of post-operative deaths in males.

Table IV shows that the incidence of acute peptic lesions increased during the period of study. However, this was no gradual increase as in the case of chronic peptic lesions, but a very sudden one, starting in 1950. We did not succeed in finding an explanation for this phenomenon. Before and after

TABLE VI

LOWEST AND HIGHEST INCIDENCE OF PEPTIC LESIONS
IN WESTERN COUNTRIES DURING DIFFERENT PERIODS

Years	Incidence of Peptic Lesions (%)	
	Minimum	Maximum
1840-60	0.6	10.9
1860-80	0.3	11.0
1880-1920	0.2	11.9
1920-30	2.4	13.5
1930-40	2.0	17.8
1940-50	2.0	18.3

1949 the Rotterdam laboratory had the same Director, and the same necropsy technique was used. An increased use of steroids, salicylates, or other anti-inflammatory drugs has been advanced to explain this rise but in fact no sudden increase in the requests for these drugs at that time could be demonstrated by Dr. Lenstra in the Pharmacy of the Rotterdam Municipal Hospitals.

SUMMARY

The frequency of peptic lesions of the stomach and the duodenum in post-mortem material of the Central Pathological Laboratory of the Municipal Hospitals of Rotterdam, Netherlands, has been investigated.

From May 1940 to January 1959 11,125 necropsies were performed on persons of 20 years and older. The overall incidence of peptic lesions was 24.3%. The frequency of acute peptic lesions was about the

same in males and in females, *i.e.*, 6.3% and 5.6% respectively. The frequency of chronic peptic lesions was much higher in males (22.9%) than in females (12.2%). A chronic peptic lesion in a male is more often related to death than a chronic peptic lesion in a female, *i.e.*, 1.3 times as often. This is in part due to the fact that a chronic peptic lesion in a male necessitates a gastric resection about 2.5 times as often as a chronic peptic lesion in a female, thus causing more postoperative deaths in males. The frequency of chronic peptic lesions in males increased gradually during the period of study from 19.6% in 1940-43 to 26.5% in 1956-58. The incidence of chronic peptic lesions in females showed an increase in the last few years only. It is too early to say whether this represents a real increase or just a fluctuation caused by unknown factors. In both sexes the incidence of acute peptic lesions suddenly increased after 1949. No explanation could be found for this phenomenon.

Part II Correlations with other pathological conditions

Many authors have reported that peptic ulcer subjects are more prone to certain diseases and that these associations might throw some light on the pathogenesis of ulcer. However, in most of these correlated studies obvious defects are present in the statistical presentation of the data, the numbers analyzed, or the care with which the lesions were identified. A few of the papers from a vast literature will be briefly reviewed.

In 1913 Roessle advanced a theoretical basis for the hypothesis by which peptic lesions could be secondary to pathological conditions elsewhere in the body. Before Roessle, only hypotheses of a limited value had been presented concerning the correlation between peptic lesions and other pathological conditions, and could explain only in part the observations. Inflammatory processes in the abdomen, chronic endocarditis, and surgery in parts of the body far removed from the stomach, especially the neck and the ears, often coincided with peptic lesions in Roessle's material. He found 70 (30%) cases with appendicitis among 234 cases with acute or chronic peptic lesions at necropsy. The other pathological conditions, named earlier, were present in 95 cases (40%). Roessle tried to construct a theory of general validity. He called peptic lesions a *zweite Krankheit*. According to Roessle, peptic lesions are the result of spasm of the stomach musculature, supposedly caused by some nervous reflex mechanism and hypersecretion of the stomach,

caused by irritation of the parasympathetic nervous system elsewhere in the body. This spasm, especially that of the muscle fibres in the mucous membrane, gives rise to necrosis, and the concomitant hypersecretion results in digestion of the necrotic parts. The irritation of the parasympathetic system, on the other hand, is the consequence of a primary disease (*Quell-Affektion*) in some other organ.

Other authors localized the primary diseases in several other organs. During the past 40 years diseases of almost every organ have been suspected of being connected with the aetiology of peptic disease, such as burns (Stewart 1923; Hummel, Lanchantin, and Artz, 1957), coronary thrombosis (Roulet and Frutiger, 1943; Watkinson, 1950, 1956), cirrhosis of the liver (Uebelhart, 1957), diseases of the central nervous system (Cushing, 1932; Heyde and Robinson, 1948; Arteta, 1951; Dalgaard, 1957, 1960), and pulmonary diseases (Engel, 1854; Sturtevant and Shapiro, 1931; von Albertini and Verdan, 1938; Plotkin, 1957).

In the last decades Selye and McLean (1944) and Selye (1950) developed the concept of the general adaptation syndrome as a stereotype reaction of the organism to any kind of stress. During the alarm phase of this syndrome acute upper alimentary tract ulceration can occur. Basically this is a modification of Roessle's theory. A critical perusal of the pertinent literature led to the conclusion that in investigations of correlations between peptic lesions and other