BLOOD GROUPS OF GASTRIC ULCER AND CARCINOMA

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The earliest attempt to find a relationship between the ABO blood groups and disease was that of Alexander (1921). From a study of 50 malignant neoplasms he concluded that groups B and AB were peculiarly susceptible to various forms of neoplasm and that O was more stable or resistant, but admitted that his figures were too small for the susceptibility of group A to be discerned. He found that neoplasms in B and AB groups were severe and rapidly growing, while those in groups O and A were of low malignancy and of long duration.

In the same year Buchanan and Higley (1921) published their results of the ABO groups in 2,446 patients. Their conclusions were that there was no relationship between blood groups and any disease; that the percentage distribution of blood groups shown originally by Moss, whom they quoted, was approximate and capable of a considerable variation, which did not have any special significance; and that nationality should be considered in any statistical study of blood groups. Yet their figures show an excess of group O in chronic ulcers (148 peptic out of 172) and an excess of group A in pernicious anaemia and jaundice.

Another early report on blood groups and disease was that of Johannsen (1925) from Copenhagen. Basing his conclusions on a series of 263 various malignant tumours and 107 carcinomata of the uterus, he claimed that A and AB individuals were more susceptible and B and O relatively more resistant to the external influences that provoke carcinoma.

Mitra (1933) attempted to discover if the ABO groups had any influence on certain pathological states. He concluded, as the result of examining groups from a very heterogeneous series of diseases, that there was none, except in helminthiasis (112 cases) where group AB was preponderant, and in malignancy (16 cases) where A was diminished and AB increased.

In a series of 461 cases of widely differing types of neoplasm Macleod (1937) found no ABO relationship, but concluded that, in 193 cases diagnosed as pernicious anaemia, groups B and AB showed a high percentage (12.95 and 6.7 respectively). Goldfeder and Fershing (1937) cited five series in the literature: Hoche and Moritsch (1926) found a slight increase in A and AB in patients with malignant disease; Hirschfeld and Hittmair (1926) did not demonstrate any variation from the normal range in 150 cancer patients; Einaudi (1927) showed no variation from normal in his series; Thomsen (1931) concluded that there were no definite differences from normal in 1,200 cancer cases; Matousek (1935), from a study of 200 women with malignant tumours, claimed an excess of group O in carcinoma of the breast. Goldfeder and Fershing themselves determined the groups in 300 cases of cancer of 44 different sites and showed a diminished A and an increased B and AB, but said, significantly, that whether these results were valid would depend on the study of larger numbers. Ugelli (1936) made the important discovery that in his series of 244 peptic ulcers there was an excess of group O when compared with a population sample, but Tinney and Watkins (1941), who ascertained the ABO groups in 612 various blood dyscrasias, stated that they did not believe there was any relationship between an individual group and any specific haematological disease. Lessa and Alarcao (1949), confirmed the results of Ugelli with 500 of their own cases of peptic ulcer.

The first report which based its conclusions on large numbers was that of Aird, Bentall, and Fraser Roberts (1953). Initially, the experiment was designed to discover if there was a connexion between the higher incidence of carcinoma of the stomach in Northern England and genetical differences that are shown by a higher incidence of group O in the north and of group A in the south. They investigated the blood groups of 1,046 cases of stomach cancer in the North of England, 1,340 in London, and 478 in Scotland, and in all the hospitals concerned there was an excess of group A and a deficiency of group O.

Statistical calculations from all the hospital figures showed the excess of group A to be highly significant. The same authors also quoted the blood-group distribution of 704 cases of gastric cancer from Basle, and among these, too, there was a distinctly significant excess of group A.

However, in the same month in which the report of Aird *et al.* (1953) appeared, Mayo and Ferguson (1953) produced their results of the ABO groups in various gastro-intestinal diseases, which included 935 cases of carcinoma, and concluded that there was no significant relationship between the disease studied and the groups.

In 1954 Aird, Bentall, Mehigan, and Fraser Roberts produced the results of a further investigation into the relationship between blood groups and disease, and the most interesting finding was a statistically significant association between group O and peptic ulcer. They found no great variation from controls in the blood groups in cancer of breast, bronchus, and colon and rectum. A total of 1,015 patients with gastric and 1,851 with duodenal ulcers had their blood groups analysed and no difference in the incidence of the ABO groups between the two ulcers was observed.

A Diversity of Findings

Since the publications of Aird *et al.* (1953, 1954) a number of other investigations have been reported, some with confirmatory results and others with conflicting results. Køster, Sindrup, and Seele (1955), in Denmark; Buckwalter, Wohlwend, Colter, Tidrick, and Knowler (1956a), in America; and Segi, Fujisaku, Kurihara, and Moniwa (1957), in Japan, found a significant excess of group A in carcinoma of the stomach. From his results, Jordal (1956), in Denmark, claimed a significant excess of A (his probability value was 6%), and Weiser (1957), in Germany, found a slight excess of A. Mayr, Diamond, Levine, and Mayr (1956), in America, and Jennings, Balme, and Richardson (1956), and Walther, Raeburn, and Case (1956), in England, showed an excess of A.

On the other hand, Wallace (1954), in Scotland, found no significant increase in group A in gastric carcinoma; neither did Billington (1956a, 1956b), in Australia, nor Speiser (1956), in Vienna.

Similarly, the findings of Aird *et al.* for gastric ulcer have been followed by a diversity of results. Køster

et al. (1955), Heistø (1956), and Buckwalter *et al.* (1956b) agreed, but Clarke (1955), Clarke, Cowan, Wyn Edwards, Howel-Evans, McConnell, Woodrow, and Sheppard (1955), Billington (1956a), and Brown, Melrose, and Wallace (1956) found no significant difference between controls and patients with gastric ulcer.

Jennings *et al.* (1956) classified 119 cases of carcinoma of the stomach into three sites: (1) pyloric and antral, (2) cardiac, and (3) body, and found that the overall excess of group A in carcinoma of the stomach was due to the excess of that group in pyloric lesions. They found no association between blood groups and lesions elsewhere in the stomach. Later in the same year, Billington (1956b), from a series of 483 carcinomata, confirmed the significant excess of group A in pyloric lesions, and also showed that in cardiac lesions there was an excess of group A, and in body neoplasms group O was preponderant. However, Haddock and McConnell (1956) did not confirm the findings of these authors, and, on the contrary, showed an association between A and body and cardiac cancers, and between O and pyloric cancers.

Billington (1956a), in another paper, showed that there was an increased incidence of A in prepyloric chronic gastric ulcer and an excess of O in non-pyloric ulcers. Balme and Jennings (1957) compared sites and ABO groups of both gastric ulcers and cancers, and reported that the A/A+O ratio was similar for both lesions at each site. They found that in antral lesions (male and female) A was more frequent, and in the body lesions O was more frequent, but only in males. The explanation of the association between A and cancer was because most cancers were antral in site, whilst the association between O and gastric ulcer was due to the fact that most ulcers occurred in the body.

Most of the reports on the ABO distribution in gastric ulcer and gastric carcinoma were collected, combined, and statistically examined by Fraser Roberts (1957). With the mathematical technique of Woolf (1955) it is possible to combine the various authors' series. It will be recalled that a statistically significant excess of group A in gastric cancer was not claimed by all investigators, yet when all the series were combined (Aird *et al.*, 1953; Walther *et al.*, 1956; Wallace, 1954; Køster *et al.*, 1955; Speiser, 1956; Buckwalter *et al.*, 1956a; Billington, 1956b; Hollander, quoted by Aird *et al.*, 1953) it was shown by Fraser Roberts (1957) that there was an overall association with group A, and that the centres were not significantly heterogeneous. Using the same method, he demonstrated an excess of O in patients with gastric ulcers, from series quoted by Aird *et al.* (1954), Clarke *et al.* (1955), Køster *et al.* (1955), Brown *et al.* (1956), Heistø (1956), Speiser (1956), Buckwalter *et al.* (1956b). The centres showed no significant heterogeneity for gastric ulcer.

This paper reports the findings of an investigation into the relationship of blood groups and gastric ulcer and cancer in Glamorganshire and Monmouthshire.

Methods

Gastric Cancer.—The in-patient records from a number of hospitals were examined to find cases of carcinoma of the stomach and their blood groups. From the operation, pathology, and post-mortem reports the site of the lesion was determined. The pyloric region was accepted as the distal 1 in. (2.5 cm.) of the stomach; "body region" means that the pyloric region and cardiac region were not involved; "cardiac region" indicates involvement of the cardiac orifice and the adjacent part of the stomach and oesophagus. "Extensive" means that the lesion could not be allotted to a particular region and includes cases of linitis plastica. No case of squamous carcinoma has been included.

Gastric Ulcer.—From the same hospitals cases of gastric ulcer diagnosed at operation, radiologically, gastroscopically, and at post-mortem examination were obtained. The ulcers found at operation and necropsy were placed in one of two sites, pyloric or non-pyloric.

TABLE I.—*Control Figures*

Area	O	A	B	AB	Total
Glamorgan 1 ..	1,658 47·18%	1,356 38·59%	373 10·61	127 3·61%	3,514
,, 2 ..	1,025 44·53%	979 42·53%	206 8·95%	92 4%	2,302
Monmouthshire	986 43·47%	988 43·56%	206 9·08%	88 3·88%	2,268

Controls (see Table I).—The ABO blood-group distributions for Glamorganshire and Monmouthshire were given me by Dr. A. C. Kopec. In her accompanying letter she pointed out that Glamorganshire could be divided into two areas, each with a different ABO blood-group distribution, and the difference was statistically significant. Area 1 comprised Cardiff, Swansea, and all of Glamorganshire except the north-eastern corner. This north-eastern corner (area 2) is an area within a line joining Dowlais, Merthyr, Aberdare, Treorchy, Pontyclun, and Caerphilly, and the eastern border of the county. The ABO blood-group distribution in Monmouthshire shows no statistical differences from that of Glamorganshire area 2. According to their addresses, patients were assigned to one of the Glamorganshire areas or Monmouthshire.

Statistical Methods.—The statistical method employed in the comparison of the ABO groups of the disease with those of the population was that of Woolf (1955), which was also used by Fraser Roberts (1957) in a statistical survey of various reports. The comparison of the ABO groups of one site in the stomach with those of another was made using the 2×2 Table with Yates's corrections if numbers were less than 100. The value of P taken as the significant level was 0.05.

Blood Groups.—The blood groups of nearly all of these patients were determined in the laboratories of the hospitals, using the tube technique. In a small number in which it was a matter of urgency the tile technique was employed. In no case was the blood group assumed to be group O just because the patient was given an emergency group O transfusion. In some cases the group was determined in the laboratories of the National Blood Transfusion Service of the Welsh, or South-Western, Regional Hospital Boards.

Disease and Population

Gastric Cancer

A total of 780 cases of gastric carcinoma was obtained by examining the case records in a number of hospitals. Of these there was histological confirmation in 610, and in the remainder the diagnosis was made by macroscopic appearances (Table II).

TABLE II.—*Blood Groups of Gastric Cancer*

Method of Diagnosis	O	A	B	AB	Total
Histological ..	255 41·8%	283 46·4%	56 9·18%	16 2·62%	610
Macroscopic ..	71 41·77%	79 46·47%	15 8·82%	5 2·94%	170
Total ..	326	362	71	21	780

$\chi^2 = 0{\cdot}0062$; P = approximately 1.

TABLE III.—*Cases of Gastric Cancer According to the Geographical Area in Which the Patient Lived*

Area	O	A	B	AB	Total
Glamorgan 1 ..	152 44·06%	157 45·51%	29 8·41%	7 2·03%	345
,, 2 ..	63 44·68%	61 43·26%	13 9·22%	4 2·84%	141
Monmouthshire	96 36·93%	132 50·77%	23 8·85%	9 3·46%	260
Combined Glamorgan 2 and Monmouthshire ..	159 39·66%	193 48·14%	36 8·98%	13 3·24%	401

TABLE IV.—*Analysis of Gastric Carcinoma*

Areas	Total in Disease Series	Relative Incidence A : O	χ^2
Glamorgan 1 ..	345	1·263	3·820
,, 2 and Monmouthshire ..	401	1·241	3·738
Total	746		
Mean weighted relative incidence ..		1·251	
χ^2 Total			7·558
χ^2 Difference from unity. D. of F. = 1			7·548
χ^2 Heterogeneity			0·010
P Heterogeneity			1·0

TABLE V.—*Blood Groups of Gastric Ulcer*

Method of Diagnosis	O	A	B	AB	Total
Histologically proved ulcer	372 53·92%	254 36·81%	49 7·10%	15 2·17%	690
Gastroscopical, radiological, etc.	154 48·73%	131 41·46%	29 9·18%	2 0·63%	316
Total ..	526	385	78	17	1,006

$\chi^2 = 2{\cdot}329$; P = 0·13.

TABLE VI.—*Cases of Gastric Ulcer, All Diagnostic Types, According to Geographical Areas in Which the Patients Lived*

Area	O	A	B	AB	Total
Glamorgan 1 ..	289 52·93%	207 37·91%	44 8·06%	6 1·1%	546
,, 2 ..	57 50·9%	46 41·08%	6 5·35%	3 2·68%	112
Monmouthshire	163 51·1%	123 38·56%	26 8·15%	7 2·19%	319
Combined Glamorgan 2 and Monmouthshire ..	220 51·04%	169 39·21%	32 7·42%	10 2·32%	431

TABLE VII.—*Analysis of Incidence of All Gastric Ulcers*

Area	Total in Disease Series	Relative Incidence O : A	χ^2
Glamorgan 1 ..	546	1·141	1·82
,, 2 and Monmouthshire	431	1·274	5·08
Total ..	977		
Mean weighted relative incidence ..		1·199	
χ^2 Total			6·90
χ^2 Difference from unity. D. of F. = 1			5·032
χ^2 Heterogeneity			1·868
P Heterogeneity			0·168

As there is no significant difference in the A and O groups between the histologically proved and macroscopically diagnosed cases, both are included in all statistical comparisons.

Table III shows the distribution of the patients with carcinoma of the stomach in Monmouthshire and the two areas of Glamorganshire. The remaining 34 patients resided outside these counties and are excluded from the analysis of population and disease.

In Table IV is the statistical comparison of the blood groups of the disease with the controls. The χ^2 result is almost significant in the two geographical areas analysed, but if the two areas are taken together the χ^2 result is significant ($\chi^2 = 7.548$; P = 0.0062) and the areas are homogeneous. Therefore in Glamorgan and Monmouthshire there is a statistically significant relationship between group A and carcinoma of the stomach.

Gastric Ulcer

From the same hospitals 690 cases of histologically proved chronic gastric ulcers were obtained and also 316 diagnosed by gastroscope, radiological examination, and at operation and necropsy but without histological proof (Table V). There is no significant difference between these two diagnostic divisions, and both types are included in the statistical analysis.

These cases were then, according to the address of the patient, assigned to one of three geographical areas as described for carcinoma of the stomach (Table VI). Twenty-nine patients resided outside these areas and are not included in the analysis (Table VII).

There is no significant association between group O and gastric ulcer in Glamorgan 1, but there is a significant association in the Combined Glamorgan 2 and Monmouthshire. When the two areas are taken together the analysis reveals a significant relationship between O and gastric ulcer ($\chi^2 = 5.032$; P = 0.025) and the two areas are homogeneous (Table VII).

Relationship of Site of Lesion to Blood Group

Gastric Carcinoma.—From the operation, pathology, or post-mortem reports a note was made of the site of the lesion. This series also includes 140 cases from two Bristol hospitals (Table VIII). In each of the three sites and in the extensive and the not-sited classifications group A is in excess. The results in Table IX do not reveal any significant differences in the blood-group distribution between the various sites in the stomach.

TABLE VIII.—*Blood Groups and Sites of Cancer*

Site	O	A	B	AB	Total
Pylorus ..	144 42·86%	149 44·35%	31 9·23%	12 3·57%	336
Body	142 42·78%	154 46·38%	32 9·64%	4 1·21%	332
Cardiac ..	34 40·00%	46 54·21%	5 5·88%	—	85
Extensive ..	50 39·68%	62 49·21%	8 6·35%	6 4·76%	126
Not sited ..	17	23	—	1	41
Total ..	387 42·02%	434 47·12%	76 8·36%	23 2·50%	920

TABLE IX.—*Comparison of ABO Groups at the Various Sites of Gastric Cancer*

Comparisons	χ^2	P
Pyloric and body sites	0·083	0·78
Body and cardiac ,, ...	0·55	0·46
Pyloric ,, ,, ,, ...	0·86	0·35

TABLE X.—*Sites of Gastric Ulcer. Histologically Proved*

Sites	O	A	B	AB	Total
Pyloric ..	76 60·32%	37 29·36%	9 7·14%	4 3·18%	126
Non-pyloric ..	281 52·72%	204 37·9%	39 7·32%	11 2·06%	535
Total ..	357 54·01%	241 36·46%	48 7·26%	15 2·27%	661

Gastric Ulcer.—The histologically proved ulcers were divided, according to site, into pyloric and non-pyloric. The site was not known in some cases (Table X). Comparing the O and A groups in pyloric and non-pyloric ulcers, $\chi^2=2.782$, $P=0.094$, which is not a significant result.

Discussion

General Relationship Between Disease and Group

The relationship of group A with gastric cancer and of group O with gastric ulcer, that Aird *et al.* (1953, 1954) first showed, and that Fraser Roberts (1957) demonstrated for a number of different geographical areas, has been confirmed for Eastern Glamorganshire and Monmouthshire. It must now be apparent that people of group A are more liable to develop a carcinoma of the stomach, and those of group O to develop a gastric ulcer.

Stocks (1950) showed that the mortality of gastric cancer is positively correlated with the proportion of unskilled workmen in the population. But in a survey of the North of England, Fraser Roberts (1953) showed that there was no relationship between social status and ABO blood groups, nor between sex and the ABO blood groups. The relationship, therefore, of group A to cancer of the stomach is a general one amongst the population, and it cannot be explained on the basis of an association between blood groups and social status or sex.

An explanation of the association between these two diseases and the A and O groups has been sought in the relationship of acid production to blood groups. Køster *et al.* (1955) and Mosbech and Hauze (1956) found an association between group A and achlorhydria, but Brown *et al.* (1956) and Buckwalter *et al.* (1956a, 1957) found none. These results do not help to explain the association between gastric cancer and group A, and between gastric ulcer and group O.

Woolf (1955) demonstrated a hereditable component in cancer of the stomach, finding that actual deaths due to gastric cancer in relatives were greater than expected. There were, he considered, genetic and non-genetic factors, but the effect of the genetic factor was small compared with the non-genetic or exogenous factor. A study of cancer in twins was published by Gorer in 1938. While genetic factors, he claimed, did not play a decisive part in the development of tumours, his studies suggested that they play a major part in determining the organ affected by the tumour. This was especially true for carcinoma of the stomach. Videbaek and Mosbech (1954) investigated the pedigree of 332 patients with gastric cancer, and concluded that there was an inherited predisposition to gastric cancer, and it was not associated with a general disposition to cancer. These authors also said that unknown exogenous factors may accelerate its development. This opinion was confirmed by Macklin (1955), who wrote: "The inevitable conclusion is that genetic factors play the predominant role in gastric and intestinal cancer." He did not preclude the possibility that extrinsic factors played a part also.

The evidence, then, is in favour of there being a hereditary factor in the aetiology of gastric cancer. Perhaps the association between this disease and blood group A, which is inherited, explains the hereditary factor that others have observed.

Another hereditary factor that may be involved in the aetiology of gastric cancer and gastric ulcer is the secretor status of a person. It is genetically determined by a single pair of allelic genes independent of those for the ABO groups. About 75% of persons secrete the ABO group substance (A and H secreted in a group A secretor, B and H secreted in a group B secretor, AB and H in group AB secretor, and H in group O secretor) in saliva and gastric juice. Complicating this is the presence of a further blood-group-specific substance Le^a, which is found in the secretion of 90% of people independent of whether they are ABH secretors or non-secretors. The secretion of the Le^a substance is dependent upon another independent gene. The need to elucidate the secretory status so far as cancer of the stomach is concerned is emphasized by the finding of an excess of blood group A in tumours of salivary tissue (Cameron, 1958). There are therefore two sources of secretor substance (salivary glands and stomach) in the tumours of which there is an excess of group A.

Sheppard (1953) wondered whether the swallowing of secretor substance by group A secretors played a part in the inducement of gastric cancer. He thought that a reasonable explanation of the excess of group A in gastric cancer was that the stomach could be affected by an accumulation within it of saliva containing A substance. Jordal (1956) ascertained the secretor status in 492 patients with gastric cancer, gastric and duodenal ulcer, carcinoma of colon and rectum, and gall-stones. He claimed a statistically lower frequency of non-secretors in the whole series, but his figures for each disease were too small for an accurate conclusion to be drawn. McConnell and Sheppard (1957) assessed the secretory activity in 86 cases of gastric cancer, and concluded that, in 65 men, the percentage of non-secretors did not deviate significantly from normal. In 21 females they found 9.5% non-secretors, but added that their number was too small for any significance to be attached to the result.

Barber and Dunsford (1959) reported a case of gastric cancer, and in the serum of the patient there was an excess of group A substance. It was believed, because her cells were Le (a−b+), she was a secretor of A substance. In 12 other cases of presumed gastric cancer they found that there was no excess of A, B, or H substance, and in only one of 500 group A donors did they find a comparable amount of A substance. This result may be compared with that of Glynn, Holborow, and Johnson (1957), who found A substance in the cells of a gastric carcinoma and its metastases.

The result of investigations into the secretor status of gastric and duodenal ulcers was reported by Clarke, Evans, McConnell, and Sheppard (1959). They found, in Liverpool, that there was a clear association between ABH non-secretion and duodenal ulcers, but there was no association between gastric ulcers and non-secretion. Further, they showed a significant difference between these two ulcers when their ABH non-secretion was compared. Four years before, in 1955, these authors had shown an association between group O and

duodenal ulcer, but none between group O and gastric ulcer. They wondered, therefore, if in those areas where there was an association between group O and gastric ulcer there would also be an association between non-secretion and gastric ulcer.

Sites of Carcinoma of the Stomach

Billington (1956a, 1956b) showed a statistically significant excess of group A in carcinoma of both the pyloric and cardiac ends of the stomach, and an excess of group O in body cancers. Jennings *et al.* (1956) confirmed this significant excess of group A in pyloric cancers, but Haddock and McConnell (1956) showed a significant excess of group A in body cancers.

In this series of 920 gastric cancers the site was stated in 753 cases, but was considered so extensive in 126 that the site of the origin was not determinable. Group A was in excess, but not in numbers that were statistically significant when the sites were compared with each other, and group A was in excess, also, where the cancers were extensive and in those where no site was mentioned. These results therefore do not confirm the findings of previous investigators. Table XI shows the figures for these investigations and also the figures for this series.

TABLE XI.—*Sites of Gastric Cancer*

Series	Pylorus		Body		Cardia	
	O	A	O	A	O	A
Billington (1956b)	53	96	154	47	24	50
Jennings *et al.* (1956)	33	64	41	42	15	22
Present series ..	144	149	142	154	34	46
Haddock and McConnell (1956)	118	87	85*	109*		

* Body + cardia.

There are wide differences between this series and those of the other authors, and therefore I have not made an overall statistical comparison.

Balme (1956) endeavoured to explain the difference between his results and those of Haddock and McConnell (1956). He claimed that in 50% of his operation specimens the growth was so small that the diagnosis caused difficulty, but that, by being so small, the site was more accurately determinable. By the comparison of old with recent *x*-ray films, he said he was able to tell how a tumour had spread, and that therefore he could allocate a tumour to the pyloric group even though most of the body was involved. Shrinkage of the muscle after removal of the stomach could, he thought, produce distortion and so increase the difficulty of localization of the tumour.

Because of the spreading nature of cancer, a tumour beginning in the lower part of the body might well spread into the pyloric region, and at operation be considered as pyloric in origin. The converse is also true. Thus figures for the site of a gastric carcinoma may not be accurate, and therefore the ABO blood-group incidence at each site may not be accurate.

The work of Glynn *et al.* (1957) in investigating secretor substance in stomachs does not lend support to the supposition that there is an association between a particular blood group and a particular site. Secretor substance was found by them in both body and pyloric superficial zones in secretors, and was absent in non-secretors. In non-secretors the secretor substance was present in the deeper zones of both sites, and was replaced in non-secretors in the superficial zones of both by Le^a substance. Thus, so far as the A substance is concerned, their work shows that the body and pyloric regions do not differ, and one would therefore expect no difference in the blood groups of gastric cancer in the two sites. This investigation of the relationship between site and blood group is thus confirmed by the work of Glynn *et al.*

Sites of Gastric Ulcer

Billington (1956a) reported that there was a statistically significant association between group A and pyloric gastric ulcers, and between O and body gastric ulcers. Balme and Jennings (1957) confirmed the excess of group A in pyloric ulcers. In this series of ulcers there are more group O than group A in both pyloric and body ulcers. Comparison of the ulcers at these two sites shows, however, no statistical significance between the groups. Table XII shows the figures of these other two series and mine.

TABLE XII.—*Sites of Gastric Ulcers*

Series	Pyloric		Non-pyloric	
	O	A	O	A
Billington (1956a)	22	52	94	47
Balme and Jennings (1957)	20	29	76	67
Present series	76	37	281	204
Total	118	118	451	318

In view of the difference between these two series and the present one, it would not be reasonable to make a statistical overall comparison of site and blood group.

Histologically, there are some resemblances between pyloric glands and Brunner's glands in the duodenum, and sometimes Brunner's glands extend into the pyloric region for several centimetres (Maximov and Bloom, 1948). Greep (1954) states that Brunner's glands contain a dipeptidase similar to that found in pyloric and cardiac glands. He also quoted Plenk (1932), who thought that the cells in the cardiac glands of the oesophagus and in Brunner's glands in the duodenum are similar. Therefore it would be expected that there would be a similar ABO distribution in pyloric and duodenal ulcers. Clarke *et al.* (1955), in a mainly juxtapyloric group, found 77 ulcers of group O and 55 of group A. Sørensen (1957) also observed an excess of group O in juxtapyloric ulcers in which he included both gastric and duodenal ulcers diagnosed at operation. His figures were 278 of group O and 189 of group A. I collected, mainly from Monmouthshire hospitals, 417 cases of duodenal ulcers which had been seen at operation or at necropsy. Table XIII gives their ABO blood groups. Comparison between the O and A groups of the pyloric and duodenal ulcers shows no statistical significance ($\chi^2=0.77$; $P=0.38$), and the distribution of groups is of the same order as that in my cases of pyloric gastric ulcers. It is difficult, therefore, to reconcile the results of this series with those of

TABLE XIII.—*Blood Groups of Patients With Duodenal Ulcer Diagnosed at Operation or Necropsy*

O	A	B	AB	Total
228 (56·02%)	139 (34·15%)	33 (8·11%)	7 (1·72%)	407

Billington (1956a) and Balme and Jennings (1957), and until further series are published there can be no explanation of these divergences.

Summary

In Monmouthshire and Eastern Glamorganshire there was a statistically significant excess of group A in 746 cases of gastric cancer.

There was no statistical difference between 610 histologically proved gastric cancers and 170 diagnosed macroscopically.

In a series of 753 gastric cancers where the site in the stomach was known there was no association between the blood groups and the site of the tumour.

In Monmouthshire and Eastern Glamorganshire there was a statistically significant excess of group O in 975 cases of gastric ulcer.

No statistical differences were found in the ABO blood-group distribution between 690 cases of histologically proved chronic gastric ulcers and 316 macroscopically diagnosed gastric ulcers.

In a series of 661 histologically proved chronic gastric ulcers where the site was mentioned there was no evidence of an association between the blood groups and the site of the ulcer.

I am most grateful to many physicians and surgeons in hospitals in Monmouthshire and Glamorganshire and to the hospital records officers for much valuable assistance. I thank Dr. A. C. Kopec, of the Nuffield Blood Group Centre, for giving me the control figures for Glamorganshire and Monmouthshire, and particularly Dr. G. S. Andrews for advice on the preparation of this paper.

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DISTRIBUTION OF THE ABO BLOOD GROUPS IN CASES OF ACQUIRED HAEMOLYTIC ANAEMIA

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The association of various diseases with a particular blood group has been shown by several investigators. Aird, Bentall, and Roberts (1953) showed that carcinoma of the stomach was more prevalent among people of group A. Struthers (1951) found a deficiency of group O among young infants dying of bronchopneumonia in Glasgow. It was later shown that the incidence of gastric ulcers was higher among group O people (Aird, Bentall, Mehigan, and Roberts, 1954). Other associations have been reported and reviewed (Roberts, 1957).

Hunt and Lucia (1953) noted that out of a series of 27 haemolytic anaemia patients 21 were of group O. This corresponded with an incidence of 77.8% among group O, while the control series of the general population for which the subjects were drawn showed an incidence of 45% group O. Dacie (1954) found no significant difference in the blood-group distribution of his series of 28 cases. Clemens and Walsh (1955) investigated a series of 66 cases and found that the frequency of the gene O is 0.7977 among the patients with haemolytic anaemia, but only 0.6933 among the control series. There is an excess of group O which is significant at the 5% level, but not so marked as in the series of Hunt and Lucia (1953).

The present series consists of 127 patients, in each of whom a positive anti-human-globulin test was obtained,