Choice of Operation in Gastric Ulcer

It will be agreed by most surgeons that simple gastro-enterostomy is not a satisfactory operation for gastric ulcer. Although it will produce brilliant results in a proportion of cases it is too often followed by recurrence. And any operation that fails to excise the ulcer gives no safeguard against the development of a cancer if the diagnosis should be mistaken. Gastro-enterostomy is not enough. Simple excision of the ulcer also stands condemned because it leaves unaltered the physiological conditions that led to the formation of an ulcer, and is followed in a large proportion of cases, as we might expect, by recurrence. Excision of the ulcer combined with gastro-enterostomy is a much more satisfactory operation, but its results are in no respect better than those of partial gastrectomy, and it is often a much more difficult operation to perform. For this reason I now find myself doing it very rarely.

The operation of choice for any accessible chronic ulcer in the stomach is undoubtedly some form of partial gastrectomy. On this main question there is very general unanimity among surgeons. It is only when we come to discuss the precise method of performing the gastrectomy that differences of opinion appear. This is not the place to discuss the minutiae of surgical technique, but the choice lies between some form of Billroth I operation in which the stump of the stomach remaining is anastomosed with the first part of the duodenum, or some variety of the Polya gastrectomy (including Finsterer's operation) in which the stomach is united to the side of the first jejunal loop. There is perhaps no very fundamental principle involved, and every surgeon will tend to get the best results with the type of operation in which constant practice has steadily improved his technique. My own preference is decidedly in favour of that modification of the Billroth I operation associated with the name of Schoemaker. It has the advantages that it is simple to perform, it is less destructive of gastric function than the Polya operation, and it is therefore less liable to be followed by a severe degree of achlorhydric anaemia. I repeat that each surgeon will be guided chiefly by his practical experience. My own experience is that the Schoemaker gastrectomy is the safer operation. For gastric ulcer I have performed the Polya operation only forty-seven times with three deaths, a mortality of 6.4 per cent., while I have performed the Schoemaker operation 171 times with five deaths, a mortality of 2.9 per cent.

I submit that a method of gastrectomy involving a mortality of less than 3 per cent. is getting near to the ideal that it should be as safe as gastro-enterostomy. The convalescence is always smooth and uneventful, and the late results are good in a very high proportion of cases. I have a record of only one anastomotic ulcer following the Schoemaker operation in my own series. For the large ulcers extending high up on the lesser curvature I find this operation rather more feasible than the Polya, because one is not compelled to use the fibrosed lesser curvature adjacent to the ulcer in making the anastomosis.

Treatment of Gastro-jejunal Ulcer

There is no comparison between the ease of operating on a gastric or duodenal ulcer that is, so to speak, virgin soil for the surgeon and the difficulty of an operation for an anastomotic ulcer. To undo the gastro-enterostomy, excise the ulcer, and restore the stomach and jejunum to their original state is often a long and arduous undertaking, so that a surgeon who has accomplished it is

tempted to be content and to close the abdomen. But if he does the original duodenal ulcer may usually be relied upon to re-form, and if later another gastro-enterostomy should be undertaken for its relief the gastro-jejunal ulcer will almost inevitably recur.

There is only one satisfactory operation for a gastro-jejunal ulcer that resists all medical treatment, as a good many of them do, and that is to undo the gastro-enterostomy and then to proceed to perform a high Polya gastrectomy. Only by abolishing the gastric function and removing the oxyntic cells as completely as possible can the vicious circle be broken. There is no more formidable operation in the surgery of the stomach, particularly where a gastro-colic fistula has to be closed in addition. The mortality is a very considerable one, but for those patients who come safely through the operation the prospects of a permanent cure are extremely good.

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THE VALUE OF PATERNITY EXCLUSIONS MADE BY THE BLOOD-GROUPING TEST

BY

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With the increasing demand for the introduction of legislation in this country to allow of the use of the blood-grouping test in all paternity cases it is desirable to examine the test in greater detail to see exactly what it will do. It is unnecessary to discuss in detail the method of inheritance of the blood groups, as this has recently been done by other authors (Harley and Roche Lynch, 1937, 1937a), but it may conveniently be summarized in four laws, two relating to the ABO system and two to the MN system. The heredity of the ABO system is dependent upon three allelomorphous genes, A, B, and O, of which A and B are dominant over the recessive O. The MN system is inherited by two genes, M and N, each of equal dominance. Thus we have the four main blood groups, A, B, AB, and O, each of which may be further subdivided by the independent MN system into M, N, or MN.

The Laws of Inheritance

The laws of inheritance which have been formulated from the investigation of many thousands of families are:

ABO.—(1) The factors A and B cannot appear in the blood of a child unless they are present in the blood of one or both parents. (2) The combinations AB parent and O child, and vice versa, are incompatible with the laws of heredity of the group factors.

MN.—(1) The factors M and N cannot appear in the blood of a child unless they are present in the blood of one or both of the parents. (2) The combinations M parent and N child, and vice versa, are incompatible with the laws of heredity of the group factors.

The groups A and AB may be further subdivided into A_1 and A_2 and A_1B and A_2B by the use of appropriately absorbed group B or normal animal sera. This observation was first made by von Dungern and Hirsch-

field in 1911, and from it has arisen the accurate sub-grouping of the factor A; A_1 being the "strong" A and A_2 the "weak" A. Recently Friedenreich (1936) has demonstrated the existence of a still weaker type of A receptor, which he calls A_3 . All these factors are inherited according to simple Mendelian laws, A_1 being dominant over A_2 , which in turn is dominant over A_3 . I propose to ignore the A_3 group, as the factor is extremely rare and very few families have so far been investigated. However, with the introduction of the A_1 - A_2 system into paternity cases we have a greatly increased probability of exclusion based upon four further laws:

A_1 - A_2 —(1) The agglutinin A_1 cannot appear in the blood of a child unless it is present in the blood of one or both parents. (2) The combinations A_1 B parent and A_2 child, and vice versa, are incompatible with the laws of heredity of the group factors. (3) In the special matings A_1 B $\times$ B and A_1 B $\times$ A_1 B, A_2 B children cannot result. (4) Where several children are available in each mating further special exclusions are possible with the following five special crosses: $A_1 \times O$, $A_1 \times A_1$, $A_1 \times B$, $A_1 \times A_1B$, and $A_1 \times A_2B$. In these matings, if there is one child belonging to either group O or B none of the remaining children can be of group A_2 or A_2B , and conversely. This is easily understood from a consideration of the genotypes of the parents concerned (Table I).

We are dealing, therefore, with two independent genetic systems (the ABO and A_1 - A_2 systems may conveniently be taken together), the genotypes of their various constituent groups being shown in Table I.

TABLE I.—Composition of the Blood Groups.

Genotype	Phenotype	Genotype	Phenotype
A_1 - A_2 system :		ABO system :	
A_1A_1	A_1	AA	A
A_1A_2		AO	
A_1O			
A_2A_2	A_2		
A_2O			
A_1B	A_1B	AB	AB
A_2B	A_2B	BB	B
		BO	
		OO	O
MN system :			
N_1N_1	M		
N_2N_2	N		
MN_1	MN		
MN_2			

* The N_2 type is discussed under exclusion type 4. No person corresponding to N_2N_2 has yet been demonstrated.

It is upon these laws of inheritance that the possibility of making paternity exclusions is based. There are, however, certain reservations attached to some of the exclusions, and I propose to discuss each of the various types of exclusion in detail, starting with the strongest and going down to the weakest.

Types of Exclusion

FIG. 1.—Exclusion type 1.

In these two cases the exclusion of the man from paternity is so strong as to be almost absolute. In case 1a we know that the father must possess the B factor, and in case 1b he must possess the M factor, neither of which obtains with the men in question. Both the B and the M factors are extremely stable, and there is no reason to suppose that they are ever suppressed—that is, fail to appear in the phenotype although actually present in the genotype. This exclusion, therefore, is the strongest which is compatible with the accuracy of the test.

FIG. 2.—Exclusion type 2.

This exclusion, although apparently the same as type 1, is in fact slightly weaker. This will become obvious after discussion of type 3.

FIG. 3.—Exclusion type 3.

Haselhorst and Lauer (1930, 1931) described a case of an AB mother whose child had persistently remained group O. This is the only proved exception to the ABO system that has been demonstrated, all the other reported exceptions of the same type showing a latent development of the specific factors in the child. In the Haselhorst case, as the child was blind at birth, was markedly deformed, and suffered from a severe anaemia, the anomaly is probably due to a failure in the development of the agglutinin in the child. The mother was of group A_2B , and in view of the stability of the B factor it is probably the A_2 factor which has not developed—that is, the child is a "latent" or "repressed" A_2 , which may later become manifest or may remain hidden throughout his life.

Exclusion type 3 is really a Haselhorst case against the father, and in estimating the value of the exclusion we have to take into account the possibility of a recurrence of the Haselhorst case. Owing to the comparative rarity of group AB, relatively few AB mother-child combinations have been investigated (1,500), whereas 15,000 group O mothers have been examined, none of their children being of group AB. The estimated chance of the failure of a dominant gene in the genotype to develop phenotypically is less than 1 in 10,000, so that, even bearing in mind the possibility of an exception, the value of the exclusion is still very great. It cannot, however, be as absolute as that of exclusion type 1.

Suppose, now, that a person did contain a suppressed A gene which was not apparent in the phenotype. It is possible, if he married, that he might transmit the suppressed gene, which in the next generation might assume its normal dominance and become apparent in the phenotype. Thus it is remotely possible for two group O parents to have a group A child if this eventuality came to pass. Such a case is envisaged in exclusion type 2, in which a group O man is to be excluded as the father of an A child, the mother being either O or B. The chance of such an occurrence is extremely remote, being obviously even less than that of the Haselhorst case, but to be entirely accurate a "formal reservation" in these cases should be made.

It is possible that type 3 of the exclusions may operate against the mother in a paternity case, and if an AB mother is found with an O child in such a case there is a very strong probability that the child is not the natural child of the woman but has been adopted for the purposes of blackmail. Such a case is recorded by Wiener in

New York, where he was able to show that the woman was not the mother; she withdrew her charges against the defendant and the case was stopped (personal communication).

This type of exclusion may be further divided by the A_1 - A_2 system:

FIG. 4.—Exclusion types 3a and 3b.

The A_1 factor is very much more stable than the A_2 and is more on a par with the B factor in its exclusion power. Thus the exclusion type 3a is almost as strong as type 1, whereas type 3b, in which exclusion has to be made on account of the A_2 factor, is equivalent to the Haselhorst case and requires a definite reservation in assessing its value.

FIG. 5.—Exclusion type 4.

This again appears superficially to be an absolute exclusion, the N factor not being present in either of the parents. Crome (1934), however, described a 19-year-old mother of group OM with an 18-months-old child of group ON, and this apparent exception was confirmed by a number of workers. Thomsen examined the mother with exceptionally strong sera and found that she actually possessed a very weak N receptor as well (analogous to the A_2 factor), and he classified her as OMN₂. The father was an N, so that the child's genotype became NN₂ instead of the MN which was expected. Friedenreich (1936a) has investigated a number of families in which the N₂ receptor is present, and has shown that in fact the MN system is represented by three genes—M, N₁, and N₂—instead of just M and N as was previously supposed. Of these N₁ is dominant over N₂ in the same way as A_1 is dominant over A_2 .

In this exclusion type the possibility is that either of the parents may be MN₂, the N₂ receptor being suppressed in them but becoming dominant again in the child. There is a second possibility—that the N₂ factor might be missed by the use of too weak test sera. The possibility of suppression of the N₂ factor is the same as that for the suppression of the A_2 factor, and requires only a formal reservation in interpreting the value of the exclusion. The possibility of an error in technique outweighs the possible error in genetic transmission. It is therefore essential that blood-grouping tests, when used for medico-legal purposes, should be entrusted only to competent experts who have the requisite apparatus and sera continually in use under properly controlled conditions (Thomas, 1937).

FIG. 6.—Exclusion type 5.

Here again a factor (A_2) is present in the child but is not present in the blood of either the mother or the putative father. The A_2 factor is a weak one and may easily be missed, especially if it is present in conjunction with the more powerful B receptor. As an instance of this I may give my own blood group. As a matter of interest a year ago I was grouped by three persons independently. The first told me I was a group O—his sera were useless, being totally inactive; the second informed me I was a group B—his anti-A serum was of low titre and reacted with A_1 only as far as a dilution

of 1 in 2, and with A_2 not at all; the third correctly grouped me as an AB, although even with his potent sera the A reaction was not marked. In fact, the correct group is A_2 B, so that there is a very real possibility of error in failing to detect the A_2 in an A_2 B blood. Unless this possibility is excluded by the use of properly controlled sera of high titre the value of the exclusion is lost.

FIG. 7.—Exclusion type 6.

Here, at first sight, the man may be excluded, as his blood contains no N receptor. The exclusion is similar to that of type 4, the same reservation applying to both, the possibility being that the man may be an MN₂, in which case the child could be genotypically N₁N₂. Although it appears exactly similar to type 4 it is in fact a slightly different exclusion. In this case the child is N₁N₂, inheriting an easily demonstrable factor from the mother, the possibility of error arising from the failure to demonstrate the weak N₂ in the alleged father. In type 4 the exclusion is obviously stronger, for if the child is MN₂ and one of the parents is MN₂ there is no reason why the N₂ should be demonstrated in the one and not in the other. Thus the possibility of technical error is greater in type 6 than in type 4.

In effect the exclusion made by type 6 is the case which Crome described, and the possibility of error must always be borne in mind. The error, however, is one of technique rather than of heredity, and as such should be guarded against and overcome.

FIG. 8.—Exclusion type 7.

This is an immediate exception to the laws of inheritance of the A_1 - A_2 system, in that A_1 is not present in either the mother or the alleged father. The reservation which must be made in these cases is again one of the possibility of error in technique, and unless the criteria of proper technique are satisfied and *completely typical* reactions obtained the exclusion cannot stand.

FIG. 9.—Exclusion type 8.

No importance should be attached to this exclusion type owing to the possibility of technical error at the present time.

Considerations in Evaluation

In general the following considerations apply in the evaluation of paternity exclusions by the blood-grouping test.

ABO SYSTEM

By far the most complete investigations of the heredity of the blood groups have been made with the ABO system, and out of the many tens of thousands of families examined only one exception to the accepted laws of transmission of the group factors has been demonstrated (the Haselhorst case). The possibility of the recurrence of such a case is so slight that *paternity incompatible with the ABO system must be excluded with as great a degree of certainty as a biological method can give*. It is justifiable to leave the Haselhorst case out of consideration unless there are quite exceptional circumstances, apart from the blood-grouping test, which indicate that the paternity is established.

TABLE II.—*Paternal Exclusions by the ABO and A₁-A₂ Systems*

Mother	Child	Father	
		Possible	Impossible
O	O	O, A ₁ , A ₂ , B	A ₁ B, A ₂ B
O	A ₁	A ₁ , A ₁ B	O, A ₂ , B, A ₂ B
O	A ₂	A ₁ , A ₂ , A ₂ B	O, B, A ₁ B
O	B	B, A ₁ B, A ₂ B	O, A ₁ , A ₂
A ₁	O	O, A ₁ , A ₂ , B	A ₁ B, A ₂ B
A ₁	A ₁	All groups	None
A ₁	A ₂	O, A ₁ , A ₂ , B, A ₂ B	A ₁ B
A ₁	B	B, A ₁ B, A ₂ B	O, A ₁ , A ₂
A ₁	A ₁ B	B, A ₁ B, A ₂ B	O, A ₁ , A ₂
A ₁	A ₂ B	B, A ₁ B, A ₂ B	O, A ₁ , A ₂
A ₂	O	O, A ₁ , A ₂ , B	A ₁ B, A ₂ B
A ₂	A ₁	A ₁ , A ₁ B	O, A ₂ , B, A ₂ B
A ₂	A ₂	O, A ₁ , A ₂ , B, A ₂ B	A ₁ B
A ₂	B	B, A ₁ B, A ₂ B	O, A ₁ , A ₂
A ₂	A ₂ B	B, A ₁ B, A ₂ B	O, A ₁ , A ₂
B	O	O, A ₁ , A ₂ , B	A ₁ B, A ₂ B
B	A ₁	A ₁ , A ₁ B	O, A ₂ , B, A ₂ B
B	A ₂	A ₁ , A ₂ , A ₂ B	O, B, A ₁ B
B	B	All groups	None
B	A ₁ B	A ₁ , A ₁ B	O, A ₂ , B, A ₂ B
B	A ₂ B	A ₁ , A ₂ , A ₂ B	O, B, A ₁ B
A ₁ B	A ₁	All groups	None
A ₁ B	B	All groups	None
A ₁ B	A ₁ B	A ₁ , B, A ₁ B, A ₂ B	O, A ₂
A ₁ B	A ₂ B	A ₁ , A ₂ , A ₂ B	O, B, A ₁ B
A ₂ B	A ₁	A ₁ , A ₁ B	O, A ₂ , B, A ₂ B
A ₂ B	A ₂	O, A ₁ , A ₂ , B, A ₂ B	A ₁ B
A ₂ B	B	All groups	None
A ₂ B	A ₁ B	A ₁ , A ₁ B	O, A ₂ , B, A ₂ B
A ₂ B	A ₂ B	A ₁ , A ₂ , B, A ₁ B, A ₂ B	O

A₁-A₂ SYSTEM

Here the available family material is considerably smaller than that of the other two systems, but there can be no doubt as to the correctness of the genetic hypothesis which has been advanced. In a few persons the red cells give atypical reactions so that they cannot be classified sharply into either group A₁ or A₂, and no conclusions ought to be drawn from them by the A₁-A₂ exclusion system. When, however, the group reactions are quite typical the possibility of a man being the father in fact when he has been excluded by the A₁-A₂ system is exceedingly slight. The possibility of A₁ being mistaken for A₂ in rare cases cannot, however, be entirely ruled out, although it is very remote if the examination is properly conducted by agglutination and absorption tests, and typical reactions have been obtained. It is not safe at the present time to consider a paternity incompatible with the A₁-A₂ system as excluded with biological certainty; it is, however, justifiable to regard such incompatibility as *strong circumstantial evidence of non-paternity*.

Owing to the possibility of technical error, the diagnosis of group A₂B is less reliable than that of group A₂, although the diagnosis of group A₁B is quite as reliable as that of group A₁. If a paternity is incompatible with the A₁-A₂ system because one of the parties is of group A₂B (while no exclusion could have been made had this person been of group A₁B) it is not justifiable at present to consider the paternity so improbable that a decisive importance may be attached to the blood grouping in such a case.

MN SYSTEM

The material available here is already large and is steadily growing. Although the system has been widely investigated for ten years now, it was not until three years ago that the N₂ factor was discovered. This factor is extremely rare, and is characterized by an abnormal but inherited weakness of the N receptor; one has always to consider the possibility that it may escape detection with a resulting erroneous exclusion. This, however, only applies to certain of the parent-child combinations (exclusion types 4 and 6).

The remaining exclusions made by this system are not affected, as paternity would still be incompatible even if

there were a concealed N₂ receptor in one of the parties. In these cases a *paternity incompatible with the MN system may be excluded with as great a degree of certainty as a biological method can give*.

List of Paternal Exclusions

All the possible exclusions are given in Tables II and III. Table II showing the combined exclusions by the ABO and A₁-A₂ systems, and Table III those by the MN and N₁-N₂ systems.

TABLE III.—*Paternal Exclusions by the MN and N₁-N₂ Systems. (After Thomsen, 1936.)*

Mother	Child	Father		
		MN System (old)		M-N ₁ -N ₂ (new)
		Possible	Impossible	
M	M	M, MN	N	If the child is MN ₂ , the father may be NN ₂ or possibly N ₂ N ₂ . Thus N cannot be excluded with certainty
M	MN	N, MN	M	M still excluded
N	N	N, MN	M	If the child is NN ₂ , the father may be MN ₂ , so that M cannot be excluded with certainty
N	MN	M, MN	N	N still excluded
MN	M	M, MN	N	If the child is MN ₂ , the father may be NN ₂ or possibly N ₂ N ₂ . Thus N cannot be excluded with certainty
MN	N	N, MN	M	If the child is NN ₂ , the father may be MN ₂ , so that M cannot be excluded with certainty
MN	MN	All	None	Theoretically a N ₂ N ₂ father may be excluded. This is of no practical significance
M	N	The mother may be MN ₂ , and the child may receive its N from the father. Thus all M men are excluded. If the father is MN ₂ the child can be N ₂ N ₂		
N	M	The mother may be NN ₂ , and the child must be MN ₂ . In this case the father must be M or MN. Thus all N men are excluded		

Summary

1. The value of each type of paternity exclusion has been discussed.

2. In most cases the possibility of error is that of an error in technique rather than a deviation from the genetic laws which govern the heredity of the group factors, and as such should be properly guarded against.

3. The appropriate reservations for each type of exclusion have been discussed.

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The German Pathological Society will hold its congress at Frankfurt a.M. under the presidency of Professor H. Beitzke of Graz from September 16 to 18, when the chief subjects for discussion will be allergy, and occupation and cancer. Further information can be obtained from the secretary, Professor G. B. Gruber, Planckstrasse 8, Göttingen.