extreme restlessness and resistiveness of the patient, and an anaesthetic may have to be administered, which will increase the risk and is scarcely justified.

The following case report illustrates most of the features described above.

Case Report

A married woman aged 26 was brought to hospital at 3.30 p.m., having taken 400 tablets of aspirin about five hours previously. The dose of 400 5-gr. (0.32-g.) tablets was later confirmed by the patient on recovery and by police investigations. She had vomited once, and on arrival at hospital was very agitated and complained of severe ringing in the ears. Her general condition was good, but she was flushed and perspired freely. Her temperature was 98.4° F. (36.9° C.) and the pulse rate 100. The stomach was washed with a solution of sodium bicarbonate until the washings were clear, and 1 pint was left in the stomach. The early washings contained aspirin powder. Nikethamide, 4 ml. intramuscularly, was given. The heart, lungs, and C.N.S. were normal.

After this first-aid treatment she remained flushed, drowsy, and perspiring, and complained of tinnitus and deafness. The pulse rate increased to 120. Nikethamide and copious fluids containing 2% sodium bicarbonate were given throughout the night.

The following day her physical condition was not so satisfactory. There was much restlessness and profuse perspiration. Respirations were regular but forced at a rate of 28 per minute, the pulse thready and the rate rising to 130. Systolic blood pressure ranged from 80 to 90 mm. Hg. The diastolic pressure could not be recorded. Heart sounds were normal. Fine crepitations were heard over the anterior aspects of both lung fields. With the exception of absent knee reflexes the C.N.S. was normal. There was no abdominal tenderness and the liver was not palpable. The urine contained a trace of albumin, and tests for salicylates were positive. Penicillin was given prophylactically in addition to sodium bicarbonate, nikethamide, and fluids. On account of the low blood pressure 10 mg. of desoxycortone acetate was given and later repeated.

The next day her general condition was much improved. Her blood pressure was 100/60 and her pulse rate 115. The deafness and tinnitus gradually declined in intensity, and she made an uninterrupted recovery. Salicylates were excreted in the urine until the fifth day.

At no time had there been more than mild confusion of thought. Her mental state was one of severe depression.

Summary

There was an increase in the use of aspirin as an agent for attempting suicide in 1947 and 1948.

The clinical features of aspirin poisoning are described.

Treatment, with special reference to the value of early gastric lavage, is discussed.

A case of aspirin poisoning in which 2,000 gr. were taken, with recovery, is reported.

It is with pleasure that I acknowledge my thanks to Dr. F. Hopkins, consulting psychiatrist, Smithdown Road Hospital, for his constant encouragement, advice, and stimulation; to the nursing staff for their help; and to Dr. J. P. Steel, medical superintendent, for permission to refer to hospital records and to publish this report.

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HAEMATEMESIS AS A SURGICAL PROBLEM

BY

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In the past three years 150 patients have been admitted to the Royal Berkshire Hospital with gastro-duodenal haemorrhage. After excluding 15 patients who were known to have bled from tumours, oesophageal varices, etc., there remain 135 cases in which the haemorrhage was believed to be from an acute or chronic peptic ulcer. Their treatment forms the subject-matter of this paper. There were 10 deaths in the series. The cases were all admitted to surgical wards and were therefore regarded as potential surgical problems. Thirty-three patients were selected for surgical treatment, with two deaths.

There is still considerable difference of opinion about the part to be played by surgery in the treatment of this condition. This is partly due to a widespread belief that under medical treatment the mortality is very low, and partly to a concept that these patients cannot be treated surgically without a very high death rate. Avery Jones (1947), reporting on the results of his large series of cases so carefully treated and so fully investigated, has given us much new information and a very clear picture of the dangers of the disease with which we are dealing. There were 615 cases of peptic ulceration in his series, and the mortality was 7.8%. This is undoubtedly much lower than for the country as a whole; thus Lewin and Truelove (1949) have recently reported a 19% death rate from Oxford.

Avery Jones emphasized that we are dealing with two distinct and almost unrelated diseases—the acute erosion and the chronic ulcer—the most striking difference between the two conditions being in their respective death rates. He gives us the following facts with regard to medical treatment. (1) The mortality following haemorrhage from a chronic gastric ulcer is 20%. If bleeding recurs the mortality rises to 48%. (2) The mortality following haemorrhage from a chronic duodenal ulcer is 9% for males and 6% for females. If bleeding recurs this rises to 35%. (3) The risk of death falls almost entirely on patients over 40 years of age. (4) The acute ulcer has a very low mortality, but this rises to 7% if bleeding is recurrent. (5) Very severe recurrent haemorrhage may be caused by an acute ulcer.

From his results Avery Jones logically concluded that surgery might be indicated in "those patients, particularly over 50, with good clinical evidence of a chronic ulcer . . . who had brisk recurrent haemorrhage after admission."

Gordon-Taylor (1946) has long taught that surgery could save many lives if employed with discretion and skill and if supported by adequate blood transfusion. He pleads for early consultation with the surgeon in all cases where surgery might be of value.

Unfortunately, the results of surgery have not in the past been encouraging, and although Finsterer obtained a mortality of less than 4% by operating on all cases within 48 hours he could have achieved this only by operating on many patients who would have recovered without surgery. It is not justifiable to subject large numbers of patients to an unnecessary operation in order to save the few who would die without it.

In order that surgery may be used with good results in the treatment of haematemesis our aims should be to recognize those patients who are likely to die without operation, to recognize them while they are still fit to undergo the operation, and to make the operation itself a safe procedure.

Selection of Patients for Surgery

In this series surgery was considered if the haemorrhage was unduly severe, if the patient was over 40, if there was good evidence of a chronic ulcer, or if bleeding recurred after admission. Of these indications the first was by far the most important: the more severe the bleeding the more essential was surgical treatment considered to be. Usually at least two of these conditions existed before surgery was decided upon.

So far as was possible a decision was made at once. Sixteen patients were therefore operated upon a few hours after admission. In many other cases it was decided that operation should be performed if the bleeding recurred. These were the patients who were over 40 but who gave a somewhat indefinite history of dyspepsia, or patients whose haemorrhage did not appear to be severe enough to cause anxiety. The decision in the remaining cases was that medical treatment should be continued even if bleeding recurred. Three patients, all over 40 and all with a typical ulcer history, had lost a large amount of blood, but had lost it slowly. Although the haemoglobin was less than 50% the blood loss had never been rapid enough to cause a fall in blood volume—i.e., there had been no history of collapse and the pulse rate was 80. These patients were transfused slowly and were operated upon several days after admission. They are included in the results as cases treated medically, as the operation was not performed primarily for haemorrhage.

Blood Transfusion

Our experience is that transfusion does not increase the incidence of recurrent haemorrhage. There was therefore no hesitation in giving blood if the patient needed it. If transfusion is adequate at every stage of treatment so that the patient is never allowed to suffer severe depletion of his blood volume, then he can be maintained in a condition good enough to undergo an operation even after several days of repeated haemorrhages.

Our indications for transfusion were: massive haemorrhage—in preparation for operation; a raised pulse rate persisting after the stage of initial collapse had passed; a persistently low blood pressure even if the pulse rate was normal; and a haemoglobin percentage of less than 50.

It was unusual to find a low haemoglobin after a single haemorrhage. If it was less than 60% it was probably due either to a previous anaemia or to a previous haemorrhage. In such a case it was our practice to do no more than restore the blood volume in the first instance, even if the patient was to be operated upon. The anaemia could be corrected later by a slow drip of packed cells. In an average case the patient would enter the theatre after receiving three bottles of blood, with a fourth bottle dripping in slowly and available for emergencies. A haemoglobin estimation next day would show whether further transfusion was then required.

The Operation: Technical Details

It is usual for haemorrhage from an ulcer to be curiously intermittent. In no case in this series was active bleeding found on exploration, although several times manipulation dislodged a clot and caused bleeding to start. Gentle handling is therefore advisable.

A chronic ulcer is usually easy to find, although if of short duration it may be flat and not easily palpable and may show little external evidence of its presence. The acute ulcer will usually be detected only after the stomach has been opened. A finger or part of the hand introduced into the stomach will often find the ulcer. It is not usually the ulcer itself that one feels but the stump of the artery with a clot in it. It feels like a mustard seed. Failing this, it may be found by inspection. It is important to remember how often the acute ulcer is multiple; if an ulcer has no obvious blood vessel in it then it is not likely to be the source of the haemorrhage.

When the source of the bleeding has been found a decision is made on the best procedure to adopt. The chronic ulcer should usually be treated by gastrectomy. I doubt if there is any increased risk as compared with local excision, and it is the only operation likely to ensure freedom from trouble in the future. Excision of the ulcer can be a more formidable procedure than gastrectomy, especially with the high gastric ulcer that has penetrated the pancreas. The chronic duodenal ulcer which bleeds briskly is usually on the medial wall of the duodenum and penetrates the pancreas. The bleeding vessel is then either the gastro-duodenal or the superior pancreaticoduodenal artery. Haemorrhage from it can be controlled by under-running the vessel above and below the bleeding-point.

Closure of the duodenal stump can be extremely difficult. Owing to the activity of the ulcer the tissues are friable and oedematous and the duodenum may have been slit up in order to expose the ulcer. Closure by the method of Yudin as described by Gordon-Taylor is probably safer than any other, but even so there is great danger of leakage. Two of these patients developed a temporary fistula.

In the past it has always been taught that speed was vital in these cases. My own experience has not confirmed this. In my hands the operation usually takes at least as long as does the "cold" gastrectomy, and neither the anaesthetists nor I have ever found the length of time to have any adverse effect.

These patients come into the theatre in very good condition and it is unusual to observe any deterioration during the operation. If the surgeon is in a frantic hurry with the patient *in extremis* then either the operation has been delayed too long or the resuscitation has been inadequate. A low mortality cannot be achieved in such circumstances. The patient should be fit enough to allow the surgeon to perform carefully an operation which will not only cure the haemorrhage but will give the patient a reasonable chance of freedom from further trouble.

TABLE I.—*Peptic Ulcer Haemorrhage, All Cases*

Diagnosis	Total		Medical Treatment		Surgical Treatment		Age Distribution		
	No.	Deaths	No.	Deaths	No.	Deaths	Under 40	Between 40 and 60	Over 60
Chronic G.U.	39	9	23	7	16	2	5	20	14
Chronic D.U.	41	1	33	1	8	0	12	17	12
Acute ulcers	48	0	43	0	5	0	8	23	17
G.J. ulcers ..	7	0	3	0	4	0	0	3	4
Total ..	135	10	102	8	33	2	25	63	47

Results

There were 10 deaths among the 135 cases in the peptic ulcer group—a mortality of 7.4%. Of the eight non-surgical deaths five could not easily have been prevented.

The other three patients could have been saved only by earlier transfusion or by surgery.

The age distribution, given in Table I, confirms the increasing incidence of this disease among older patients already shown in other recent series. This has an important bearing on the death rate. One would expect better results in a series with an unduly high proportion of young patients in it.

Thirty-three ulcer cases were treated surgically: 16 as soon as they could be prepared by transfusion, 13 because they had a second brisk haemorrhage, and four because prolonged medical treatment failed to control their haemorrhage. The ages of these four were 23, 24, 31, and 36. They were operated on because it was considered that nothing else would save them. The case history below is given as an example of unduly severe haemorrhages in a young man.

Case 15. Chronic Duodenal Ulcer.—This patient was an extremely fat man of 24 who had had attacks of dyspepsia at six-monthly intervals for five years. Just before his admission he vomited "two pints (1 litre) of blood." He looked very fit and his Hb was 80, but his pulse was 116. At the end of a 2-litre drip transfusion his pulse was 130 and he had vomited a great deal of blood and had several melaena stools. Forty-eight hours after admission he had received by drip 6 litres of blood. His pulse was now 140. It was quite obvious that a vessel was bleeding faster than he could be transfused, and must be stopped. At operation I accidentally knocked the clot off the gastro-duodenal artery and started a haemorrhage which reminded me of a slipped renal pedicle. The torrent was soon stopped with two stitches, and a high gastrectomy was completed at leisure without his condition deteriorating further. The 3 litres of blood used in the theatre and afterwards brought the total to 9 litres.

TABLE II.—Chronic Gastric Ulcers Treated Surgically

Case No.	Age and Sex	Prev. Hist. (Yrs.)	Prev. X-ray Films	Prev. Haem.	Blood (litres)	Operation	Ulcer	Result
17	54 M	Many	—	—	1½	Same day	Multiple small	R.
18	47 M	1½	G.U.	—	2	" "	Small	"
19	64 M	29	G.U.	—	2	" "	Large, into pancreas	"
20	60 F	5	—	5 yrs	2	" "	Large	"
21	46 M	3	G.U.	—	2	Next morning	Large, into pancreas	"
4	47 M	5+	—	4 yrs	3	Same day	Large	Died
22	53 F	20	—	1 yr	4	Next day	"	R.
1	23 M	5 wks	—	—	7	"	Small	"
23	38 M	3	Neg.	2 yrs	3	Two days later	Large	"
24	46 M	2	Neg.	—	8	" "	"	"
3	55 M	Many	G.U.	—	6	" "	Large, into pancreas	"
2	36 F	Very slight	—	—	2	Bled for 5 days	Small	"
5	45 M	14	—	—	7	"	Large, into pancreas	Died
25	56 M	1	G.U.	6 mths	3	Same day	"	R.
33	62 M	Many	—	—	4	Next morning	Large	"
34	57 F	Many	—	—	3	For 2nd haemorrhage	"	"

R. = Recovered.

The Chronic Gastric Ulcer Group

Of the 39 cases in this group 23 were treated medically either because they were not considered fit for surgery or because the haemorrhage was not dangerously severe. Of these medical cases eight subsequently required gastrectomy. The 16 surgical cases were all treated by gastrectomy, the operation being technically easy in most of them and the ulcer usually easy to find. The bleeding vessel in all cases but two was a branch of the left gastric artery eroded in the subserous fat on the lesser curvature. The surgical deaths both occurred in this group. In neither case was death attributable to the fact that the operation had been performed in the presence of haemorrhage.

TABLE III.—Chronic Duodenal Ulcers Treated Surgically

Case No.	Age and Sex	Prev. Hist. (Yrs.)	Prev. X-ray	Prev. Haem.	Blood (litres)	Operation	Comment	Ulcer	Result
26	54 M	5	D.U.	—	2½	Same day	—	Into pancreas	R.
27	31 M	5	—	—	5	After 3 weeks	Continued to bleed	"	"
15	24 M	5	—	—	9	After 3 days	"	„(G.D.A.)	"
28	53 M	4½	Neg.	—	7½	After a week	"	"	"
29	47 M	15 (Perf.)	—	—	3	Same day	Massive haem.	„(G.D.A.)	"
30	67 M	5	D.U.	—	6	After 3 days	Continued to bleed	Small	"
31	42 M	1	—	—	3	After 3 days	Continued to bleed	"	"
32	62 F	4 (Perf.)	—	—	2	Same day	"	"	"

G.D.A. = Gastro-duodenal artery. R. = Recovered.

The Chronic Duodenal Ulcer Group

There were 41 patients in this group and eight were treated surgically. They all recovered after partial gastrectomy. Three of them were desperately severe cases whose recovery under medical treatment would have been very unlikely.

Case 30.—This patient, a man aged 67, did not start to bleed until the day of his admission, and when he arrived he was so collapsed that it was doubtful whether he would survive long enough to be transfused. No pulse was palpable and no blood pressure could be recorded. Four hours later he was fit enough for the theatre. Operation revealed the gastro-duodenal artery lying exposed in a duodenal ulcer crater in the pancreas. It was underrun and a gastrectomy was performed. He was very ill for some days owing to leakage from his stump, but soon made a rapid recovery. He received 6 litres of blood, most of which was required to replace what he had lost during the short time he was bleeding.

TABLE IV.—Acute Gastric Ulcers Treated Surgically

Case No.	Age and Sex	Dyspepsia	Prev. Haem.	Blood (litres)	Operation	Comment	Result
9	40 F	None	2	3	Next day	Had bled previously	R.
10	59 F	Slight	—	2	After 4 days	Continued to bleed	"
7	52 F	"	—	1½	After 2 days	Chronic ulcer suspected	"
6	43 M	4 years	—	2	Same day	"	"
8	40 M	3	Many	1½	" "	Had bled previously	"

R. = Recovered.

The Acute Ulcer Group

This common lesion of the stomach or duodenum was the cause of approximately one-third of the haemorrhages admitted to hospital. The diagnosis is not always correct, being based largely on negative evidence and subsequently confirmed in most cases by a negative radiograph. It is a lesion probably rapid in its development and similarly rapid in its healing. The vessels by which it bleeds are the arteries of the submucosa. Most of these vessels are small, and the involvement of a large vessel is probably a chance affair determined by the accident of the site of the ulcer.

TABLE V.—Operations for Haemorrhage Following Gastro-jejunoscopy or Gastrectomy

Case No.	Age and Sex	Date and Nature of Operation	Ulcer	Blood (litres)	Treatment (Same Day)	Result
13	49 M	1924, Gastro-jejunoscopy	Small Chr. G.U.	1	Gastrectomy	R.
14	42 M	1946, Gastrectomy	Large Chr. G.U.	3	2nd Gastrectomy	"
12	66 M	1916, Gastro-jejunoscopy	Large Chr. G.U.	½	Gastrectomy	"
11	63 M	1924, " "	Acute G.J. ulcers	2	G.J. undone	"

R. = Recovered.

As these ulcers respond so well to medical treatment, and as they would never require surgery if they did not bleed, operation should be undertaken only in order to save life or because a chronic ulcer is suspected. If they are operated upon, local excision would be the best procedure if one could be sure that there was only one ulcer and if it is likely to be technically easy. All the 48 patients in this group recovered. There were five surgical cases, four of them being treated by gastrectomy.

Gastro-jejunal Ulcers

The diagnosis of gastro-jejunal ulcer was made clinically in patients who had had a previous operation—either a short-circuit or a gastrectomy. This diagnosis was sometimes wrong, but it is used as a convenient one for this group, which presents a special problem for the surgeon, who has to weigh the fact that a chronic ulcer is almost certainly present and demanding surgery against the added difficulties and dangers of a complicated resection. Of the seven patients in this group three bled from the original gastric or duodenal ulcer for which the short-circuit had been performed and one from an acute jejunal ulcer. The recovery of the four surgical cases was largely due to early operation. They were all operated on very soon after admission.

Case 14.—This patient, a man aged 42, was known to have a large gastro-jejunal ulcer which had followed an inadequate gastrectomy for duodenal ulcer. He was extremely collapsed and actively bleeding when he was admitted. To make him fit for operation 2½ litres of blood were required. Exploration revealed an enormous gastro-jejunal ulcer which penetrated deeply into the pancreas. In the base of the ulcer was a large artery with a fresh thrombus in it. A further 2 in. (5 cm.) of stomach was resected, and a fresh anastomosis was formed. A year later he underwent his third gastrectomy (and vagotomy) for another ulcer, which this time eroded deeply into the liver.

Other Cases.—Two patients not included in the series were treated surgically. One had a large carcinoma and recovered well after a total gastrectomy. The other patient bled profusely a week after the suture of a perforated gastric ulcer. He died after a long, tedious resection.

Summary and Comment

For several years all patients suffering from haematemesis or melaena admitted to the Royal Berkshire Hospital have been treated in the surgical wards. In the last three years 135 patients with peptic ulcer haemorrhage have been so treated, with a mortality of 7.4%. Under the age of 40 there were no deaths, no women died, and no patient died from an acute ulcer. Thirty-three patients were treated by operation, with two deaths. Although some patients were treated medically and some by surgery the principle of treatment was the same in all cases, and no comparisons can or should be made between the medical and the surgical results. This principle was that each patient was considered as a potential surgical case and was operated upon as soon as his life appeared to be endangered by his complaint. If surgery is to be used in this way it is justifiable only if a low surgical mortality can be achieved. A low mortality is dependent on careful judgment in the selection of cases, adequate and efficient transfusion, and early operation.

It was in consultation with Dr. John Mills, director of the pathological department, that most of these patients were treated, and I would like to express my gratitude to him both for this help and for the efficient transfusion service that he maintains. I am also grateful to my colleagues, who allowed me to treat these patients in my wards.

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IONTOPHORESIS IN THE TREATMENT OF PERIPHERAL VASCULAR DISEASE

BY

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Among the methods of treatment designed to overcome vasospasm or to produce vasodilatation in peripheral vascular disease the use of choline derivatives is suggested by the work of Dale and Gaddum (1930) and Dale, Feldberg, and Vogt (1936). Acetylcholine is unstable and rapidly hydrolysed in the tissues (Renshaw *et al.*, 1938). Its action on the autonomic nervous system is a double one, producing both muscarine- and nicotine-like effects. Some of its esters do not share these defects, and in this study we have been able, using the method of ion transfer, to compare the actions of the anions of two substances: acetyl- β -methylcholine ("mecholy" and "amechol") and carbaminoylcholine ("carbachol," "doryl," and "moryl").

Pharmacology

The action of carbaminoylcholine, the official name of which is carbachol, resembles that of acetylcholine, but is more prolonged. The Simonarts (1934) showed that its nicotine-like action was stronger than in the case of acetylcholine. Fraser (1938) pointed out that its action on the cardiovascular system ~~was~~ ^{came} off in 30–40 minutes, though its effect on the gastro-intestinal tract and urinary bladder may persist for several hours.

Acetyl- β -methylcholine also has a relatively prolonged action, and Simonart (1932) showed that the methyl-group substitution deprived acetylcholine of its nicotine-like action. Its effects, in contrast to those of carbachol, are most pronounced on the cardiovascular system.

The method of ion transfer has been shown by Kovacs (1934), Saylor, Kovacs, *et al.* (1936), and Kramer (1937) to be superior in peripheral vascular disease to oral, subcutaneous, and intramuscular administration of compounds of this type. Montgomery, Holling, and Friedland (1938) determined by direct (plethysmographic) measurement the increased blood flow produced in the limbs of normal subjects by mecholy iontophoresis, and their results fully confirmed the belief that this treatment effected dilatation of blood vessels specifically in the treated part. It is a further advantage that such unwanted general effects as micturition, defaecation, salivation, and bronchial spasm are much diminished when parasympathetic stimulants are given iontophoretically.

Method

The technique of Kovacs, Saylor, and Wright (1936) has been employed throughout. Reinforced asbestos paper is saturated with a 0.5% solution of the substance to be used and wrapped round the leg or thigh. A malleable metal plate, connected to a positive galvanic pole, is placed over this and held in position with a rubber bandage. A large flat electrode moistened with normal saline is placed under the back and connected to the negative pole. The electrodes should not be applied over any raw or inflamed areas or over recent scar tissue. The skin should always be protected by the asbestos paper from direct contact with the metal electrodes, so that burns may be avoided.