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DETERIORATION AFTER MITRAL VALVOTOMY—II*

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Multifactorial Degeneration

The majority of patients with severe mitral stenosis can be divided into three main groups. There is a relatively large group in which surgical treatment is clearly advisable, and a smaller one with clear contraindications, such as age over 65, gross cardiac enlargement, intractable congestive failure, cirrhosis of the liver, or important incurable concomitant disease. In the third group the decision is more difficult because of various combinations of relative contraindications such as age over 50, atrial fibrillation, considerable cardiac enlargement, heavy calcification of the valve, aortic valvular disease, and associated mitral incompetence. The decision whether to operate or not is an anxious one because it must be assumed that the operative risk is above average and the chances of maintaining a good result are relatively poor. Yet without operation the outlook is hopeless. Unfortunately, a proper policy can only be determined in retrospect by actually observing the effects of surgical treatment in a large number of cases. Obviously the decision whether to advise treatment must be made on a balance of probabilities, but in this particular instance we feel more weight than usual must be given to the patient's own viewpoint once it has been appreciated that there may be only moderate improvement at best, and possibly little or none, and that there is a somewhat increased risk. Some patients will gladly accept this chance, but others prefer to continue their restricted lives for a limited period.

A combination of adverse factors may weigh the balance against advising operation at all or towards deciding, with otherwise so bleak an outlook, that the risk must be taken. The decision may be very difficult, and in order to try to get some factual information on this problem we have analysed a group of patients with multiple adverse factors who were treated by valvotomy for severe stenosis. There are obvious difficulties in making the assessment of each case on a "points" system because of variation between individuals in incidence, severity, and relative importance of each factor.

Seventy-eight patients qualified for this "multifactorial" group through having a combination of arbitrarily graded adverse features. Each had either (1) atrial fibrillation and heavy calcification and a cardiothoracic ratio of 60% or more, or (2) two of

these three features and in addition two or more of the following: age 50 or over, aortic valvular disease, mitral incompetence, tricuspid stenosis, congestive failure, or (if not in group 1) light calcification suggesting a rigid valve, or a cardiothoracic ratio of 55–59%. On this basis each patient had at least four relative contraindications to operation.

In order to include only cases with definite associated mitral incompetence only those in which reflux was confirmed at operation have been selected. A few severe cases were excluded despite the severity of their condition, as shown, for example, by a very large heart and congestive failure because they were in sinus rhythm and had no calcification or other valvular defects and therefore did not fit into the multifactorial grouping. Also a few patients who were thought to be relatively "good risks" despite a multiplicity of adverse factors have been included because each of these appeared to be mild.

The incidence of each factor is shown in Table XXX. Over half the 31 operative deaths in the whole series of 500 patients came from this multifactorial group, giving a mortality of 21%. This is certainly

TABLE XXX.—Multiple Adverse Factors (78 Cases)

Factors	No.	%
Atrial fibrillation ..	75	96
Cardiothoracic ratio $\geq 60\%$..	59	76
" 55–59% ..	19	24
Heavy calcification ..	43	55
Light ..	16	21
Age 50+ ..	20	26
45–49 ..	20	26
Aortic valvular disease ..	55	71
Mitral incompetence ..	38	49
Tricuspid stenosis ..	5	6
Congestive failure ..	45	58

a high figure, but it must be remembered that this group contains all the most severe cases in the series and the "medical" mortality for such a group without operation will also be high within a short period.

Nine of the 16 deaths were from cerebral embolism, and this is related to the high incidence of clot (30%). Five deaths were due to cardiac arrest or circulatory failure, both conditions being almost confined to seriously ill patients, and two were from traumatic mitral incompetence.

Of the 62 survivors, 26 have now been followed for more than six years, and it can be seen from Fig. 7 that "good" or "fair," that is to say worth-while, improvement has been maintained by the majority.

*The first part of this article appeared in last week's issue at p. 1027.

FIG. 7.—Progress of 26 patients with multiple adverse factors.

In summary, then, this "multifactorial group" is not difficult to recognize and the special problems can be defined as an increased operative risk and a decreased chance of obtaining a good long-term result. These factors must be balanced against the prognosis without operation, and since the outcome for the individual is not predictable more weight than usual must be given to the patient's own viewpoint.

Myocardial Factor

From this multifactorial group of 78 patients a subgroup of 23 patients has been extracted in whom the outstanding clinical features were considerable cardiac enlargement, chronic or recurrent congestive failure, and atrial fibrillation, all of which suggest myocardial damage. Half of them were aged 50 or more and half of the remainder were over 45; six had cardiac cirrhosis of the liver, suspected during life and subsequently confirmed by necropsy in five. Five of them died as a result of the operation, not from causes related to valvular defects or technical mishaps but from cardiac arrest, circulatory failure, or thrombus formation. Many of them also had heavily calcified valves or associated aortic valvular disease, but it would seem to be myocardial rather than mechanical factors which were important.

Only two patients in this group were classified initially as having a good functional result. Another, with an obvious recrudescence of rheumatic fever, improved greatly after two years and has remained well for the ensuing six years. The remainder were improved in some degree but were never graded better than "fair." Seven died in the following six years.

The operative achievement as judged by the degree to which the adherent cusps could be separated was similar to that obtained in the rest of the series, so that the unsatisfactory functional result cannot be attributed to an inadequate valvotomy.

In this "myocardial" group the operative risk is relatively high and the prospects of a good result are relatively low, so that it may well be questioned if surgical treatment should be advised in such patients. All that can be said is that 19 of the 23 patients survived the procedure and most of the survivors were improved to a worth-while degree for an average period of three years, and that the prognosis without operation is very poor.

Clot and Embolism

Clot was detected in auricle or atrium at operation for mitral valvotomy in 107 of the 500 patients in this series, giving an incidence of 21%. The incidence is

much higher in those with atrial fibrillation (48%) than in those with sinus rhythm (2.3%), and in those with a past history of systemic embolism (59%) than in those without such a history (15%), and in those with heavily calcified valves (40%) than in those without (15%). The incidence increases with age and is higher in those with large hearts.

Systemic embolism occurred in 23 (21%) of the 107 patients of this series in whom clot was detected at operation. Embolism in a patient with sinus rhythm is rare (1%) but occurred in no less than 10% of all those with atrial fibrillation.

Occasionally embolism is due to the displacement of fragments of calcified material from the mitral valve. In 16 of our 92 patients with heavily calcified valves in whom systemic embolism occurred, clot was also present in nine and it was not possible to distinguish which cause was responsible.

A comparison of earlier with more recent experience has shown a significant decrease in operative embolism. Various factors may have contributed to this, but these will not be analysed here because valid conclusions cannot yet be drawn.

In the present series of 185 patients followed for six years after the operation systemic embolism has occurred in 16. This appears to be a lower incidence than might have been expected if operation had not been carried out, but again valid conclusions cannot yet be drawn on this aspect of deterioration after valvotomy.

Subsequent Course

The fact that the natural history of rheumatic heart disease pursues its relentless course despite valvotomy is illustrated by subsequent events. Out of the whole group of 185 survivors of the operation, 22 (12%) have so far died during the following 6 to 11 years.

Of those still in sinus rhythm after the first operation, 33 (27%) have subsequently developed atrial fibrillation, and the proportion increases every year. Thirty-two patients have subsequently developed aortic systolic murmurs and 44 aortic diastolic murmurs. Fourteen patients have developed mitral systolic murmurs when none had been noted previously. Sixteen patients have had a systemic embolism and four pulmonary infarction.

As already mentioned, no less than 70% of those followed for nine years or more have developed stenosis of sufficient severity to necessitate a second valvotomy, and this is sometimes due not so much to re-fusion of the cusps as to progressive sclerosis of the valve.

These facts emphasize that valvotomy does no more than enlarge a narrowed mitral orifice and restore some mobility to the cusps. Unquestionably this is well worth while and essential for survival, but clearly more effort should be concentrated on the prevention of rheumatic fever, which is still the principal cause of valvular disease of the heart.

Traumatic Mitral Incompetence

In the group of 500 patients treated by valvotomy more than 12 months ago there were 97 cases with some degree of traumatic mitral incompetence as judged by an apical systolic murmur which was produced or increased at operation.

The incidence of palpable reflux at operation did not always correspond with the subsequent clinical signs,

probably because in some cases distortion of the valve caused temporary regurgitation and in others the heart-beat may have been too weak at the time of palpation to produce a palpable jet. Post-operative auscultation was therefore accepted as the criterion for incompetence.

Of these 97 patients, 72 have maintained good results so far and there is nothing to suggest that the systolic murmur reflects mitral incompetence of dynamic significance.

In 25 patients there has been some evidence that traumatic mitral incompetence may at least partly explain why post-operative improvement has been less than good. These 25 patients have been divided into two groups: group 1 (definite) comprises 14 cases in which there was no doubt that the incompetence was responsible for deterioration; and group 2 (possible) consists of 11 cases in which some degree of incompetence had been produced but other adverse factors were present which could have been responsible for most or all of the deterioration.

Group 1.—Six patients died from traumatic incompetence, three within a few days and three within a few months of the operation. Two patients were made worse and one was not improved despite adequate relief of the stenosis. Two patients had a disappointing result for two years and thereafter steadily improved, presumably as a result of compensation by the left ventricle.

Group 2.—Eleven patients had other factors which were certainly contributory and possibly accounted for all the disability. These included myocardial damage as shown by considerable cardiac enlargement before operation, severe pulmonary hypertension, a rigid or calcified valve with relatively poor function, aortic valvular disease, and systemic hypertension. Each of these may be responsible for dyspnoea or for congestive failure. Aortic valvular disease and systemic hypertension may be responsible for left ventricular hypertrophy and dilatation. In addition in a few patients it was reasonably certain that active carditis was present.

In summary it can be said that traumatic mitral incompetence in a series of 500 patients accounted for six operation deaths (1.2%) and eight poor results (1.6%) and possibly contributed to another 11 relatively poor results (2.2%). Thus incompetence was certainly not a contributory factor in more than 5% of the cases.

Influence of Operative Technique.—For the purpose of this analysis the patients have been divided into two main groups—those in whom the operation was performed only with the finger or knife, and those, in the latter part of the series, in whom the transventricular dilator was used. For completeness, the small group in which the transatrial (Dubost) dilator was used is included in Table XXXI, but the numbers are too small for any conclusions to be drawn. Two deaths occurred in the first group and four in the second group. It will be seen from Table XXXI that a higher incidence of

systolic murmurs resulted from use of the trans-ventricular dilator but no greater incidence of severe incompetence despite better valvotomies as judged by the extent of separation of the cusps. Finally, it has been shown that there is no correlation between the incidence of operative mitral incompetence and calcification of the valve.

Discussion

This analysis of our first 11 years' experience has clearly demonstrated that although surgical treatment may produce an important reduction in valvular obstruction improvement is often only temporary. In most cases rheumatic heart disease shows a relentless progression whether from activity of the rheumatic process or from the progressive fibrosis and sclerosis which follows activity. Also it is evident the rate of deterioration after initial good results is not steady but rather tends to increase steeply after five to six years. Time—that is to say, the duration of follow-up—is therefore a very important factor in assessing results. For this reason there is no profit in reviewing series of patients who have been followed for relatively short periods. When sufficient numbers from different units have been followed for 10 years it will be possible to determine more precisely what part surgical treatment has played in slowing the clinical course of patients with rheumatic heart disease. However, we have compared our results with those published in this country by Baker and Hancock (1960) from Guy's Hospital and in the United States by Ellis, Harken, and Black (1959) from Boston.

In many ways our analysis has been made in a similar way to that from Guy's. Their paper was published before restenosis had become such a major problem and before it was realized that in many cases deterioration would be attributable to this cause. In their review of published reports on the results of valvotomy up to 1959 it was concluded that after 12 months about 80–85% of patients who survived operation are improved and thereafter deterioration occurs at a rate of about 5% per annum, and that at the end of five years about two-thirds are still improved. In the Guy's series 30 of 200 patients (15%) had poor initial results and 51 (25%) deteriorated after one year. The Boston results were similar. Our experience is in close accord with these general statements and figures as regards both the rate of deterioration and the proportion of patients deteriorating. It is when the causes of such deterioration are analysed that our experience appears to differ in some respects. In particular, in the series from Guy's and that from Boston initial deterioration is closely related to inadequacy of valvotomy. Our figures do not support this correlation so well. Similarly, whereas their long-term results accord closely with the surgeon's report, in our experience this has not been the case. These findings were certainly surprising to us, but in whatever way the results are analysed the conclusion is the same.

Re-fusion of the cusps is due to the deposition of fibrin, and one possible reason for a lack of close correlation between the extent of valvotomy and subsequent progress may be the different rates at which this substance is laid down. Another possibility is the varying rate of development of the myocardial failure which is presumably responsible for recurrence of

TABLE XXXI.—Mitral Valvotomy (500 Cases). Operative Technique and Traumatic Mitral Incompetence

Technique	No. in Group	Systolic Murmur Produced or Increased Without Dynamic Significance	Traumatic Mitral Incompetence of Dynamic Significance
Finger or knife	215	19 (9%)	10 (5%)
Transatrial dilator	13	2	3
Transventricular dilator	272	51 (19%)	12 (4%)
Total	500	72 (14%)	25 (5%)

symptoms in patients found at operation to have a similar degree of obstruction at the mitral valve.

However, it is difficult to make close comparison between groups of patients who have been assessed by different observers and who have had operations carried out by different surgeons. It is probable that all surgeons tended to overestimate the extent of valvotomy in the early years and that with increasing experience came a better appreciation of what was actually achieved. Again, the duration of follow-up is a very important factor in any analysis, and it seems likely that with the passage of time long-term results will be progressively less related to the size of the mitral orifice left after valvotomy and other factors will play increasing parts.

The Myocardial Factor

The myocardial factor, whether active or inactive, is the most difficult to prove and to assess, but we are in agreement with many others that presumptive evidence for low-grade activity is often strong. It has of course often been pointed out that histological evidence for activity is frequently present at necropsy when unsuspected during life.

Whereas frank rheumatic fever developing between operations has been rare in our series and in that from Guy's, low-grade activity has been strongly suspected in about 15% of cases in both series. Criteria for such activity are not given in the Guy's paper. We have suspected its presence *when, in the absence of evidence for restenosis or of new or increasing disease* of other valves or some other factor such as anaemia or respiratory infection, there is general deterioration in the form of fatigue, malaise, dyspnoea, increasing cardiac enlargement, or congestive cardiac failure, particularly when such manifestations persist for a few months and then clear up. A raised sedimentation rate is sometimes but not usually present. In the Boston series, however, 38 (17%) of 228 patients were stated to have had active rheumatic fever in the years following valvotomy. The differences between British and American reports as regards the part played in deterioration by active carditis may well be due to differences in the criteria adopted.

Mitral Incompetence

In the Guy's series significant mitral incompetence (as judged by physical signs), whether pre-existing or surgically produced, was associated with poorer results, only 12 (28%) of 43 such patients maintaining a good result for five years. Unfortunately insufficient detail is given on what constitutes "significant incompetence" for strict comparison to be possible. In the Boston series the general conclusion is reached that pre-existing, operative, or subsequent mitral incompetence is an important factor in deterioration after valvotomy.

In our series a regurgitant jet, even if strong, when associated with *severe stenosis* was always thought to be *relatively* unimportant. In order to make reasonable comparison with the Guy's series we have taken patients with a palpable jet immediately before valvotomy together with those with a subsequent increase in the systolic murmur of at least two grades after operation. Of 62 such patients, 34 (55%) maintained a good result for five years compared with 89 (72%) of 123 patients without such evidence. However, as in assessing the importance of any one potentially adverse factor, it is necessary also to take into account the presence of

other associated adverse factors. Accordingly we have analysed those patients who did *not* have atrial fibrillation, heavy calcification, or cardiothoracic ratio $\geq 60\%$, and who were under 50 years of age.

In this group there were 26 patients *with* mitral incompetence and 16 (62%) of these maintained a good result for five years. There were 68 patients *without* mitral incompetence, and 59 (87%) of these maintained a good result. This gives no more than a rough idea of the possible significance of a regurgitant jet by itself, but, although obviously an undesirable feature, it is evident that many do well in spite of it. The reason for our apparently better results may be the inclusion of relatively minor degrees of mitral incompetence. On the other hand, all our patients had sufficient incompetence to produce a palpable jet.

Influence of Age

In the Guy's series it was found that the rate of deterioration in the third decade was more rapid than in the fifth decade and it was thought that this might be due to a higher incidence of active carditis or, alternatively, to a rather more optimistic outlook among younger patients. A similar analysis of our material does not show such a strong trend, but it is interesting that the younger people did not do better, as might have been expected.

Associated Adverse Factors

We have analysed four associated potentially adverse factors—atrial fibrillation, considerable cardiac enlargement, heavy calcification of the valve, and age 50 or over—as regards operative mortality and long-term results.

Probably none would consider the first of these to be a contraindication to operation, but many patients have been turned down on account of the second, third, and fourth. Yet our analysis shows that atrial fibrillation is by far the most important of the four as regards the operative risk.

In fact, cardiac enlargement and calcification of the valve when occurring alone apparently do not individually affect operative mortality at all. As an isolated factor an age of 50 and over is more difficult to analyse because almost all such patients are fibrillators and have one of the other potentially adverse features. Nevertheless, in the last six years the overall operative mortality of those aged 50 and over has been only 4% greater than that of the whole series, so that it is reasonable to assume that age *by itself* is not a contraindication to operation.

The interesting fact emerges that it is atrial fibrillation, the one feature which *itself* never seems to deter the physician from advising surgical treatment, which is of outstanding importance. The operative mortality in those without the other three adverse features is very much greater in those with fibrillation than in those with sinus rhythm (Table XI).

As regard long-term results up to six years the numbers available with each individual potentially adverse feature, occurring as an isolated factor, are too small for statistical analysis. Nevertheless the histograms show that in each case most patients do reasonably well for some years, and hence, in view of the fact that the operative mortality is no greater (except for fibrillation), they should be given their opportunity for improvement on the same basis as for the group as a whole.

We have also analysed the effects of aortic valve disease. *Severe* aortic incompetence has not been seen in association with *severe* mitral stenosis, and mild or moderate aortic incompetence has not affected operative mortality or results up to six years. Aortic stenosis has likewise not affected operative mortality or long-term results so far, but, if severe, aortic valvotomy was always carried out at the same time.

It has been shown in this series that various adverse features occurring individually in association with mitral stenosis do not apparently influence the operative risk or long-term results up to six years.

The five factors which we have analysed, however, are often found in various combinations in the same patient, and when more than two of these coexist the operative mortality and long-term prognosis are notably worse. In such cases the decision is much more difficult and ancillary methods of diagnosis are often unhelpful.

This apparent paradox must be due to the fact that the influence of several adverse factors is not only cumulative but must represent more than the mere sum of each considered individually. Such patients in fact have evidence of more severe involvement by the rheumatic process generally, including muscle damage. Atrial fibrillation itself is associated with a higher operative mortality, as discussed above.

It not infrequently happens that the rheumatic process chiefly involves one part of the heart as manifested, for example, by pure mitral stenosis, pure mitral incompetence, isolated aortic incompetence, or by severe myocarditis or pericarditis with mild endocarditis. Although some individuals do have poly-valvular defects, each of mild degree, a multiplicity of manifestations usually indicates severe involvement of the heart by the rheumatic process, and hence it is not surprising that, despite relief of severe mitral stenosis, such patients should do relatively poorly. However, if it is thought that severe mitral stenosis is present we believe that operation should usually be advised.

Summary

An analysis has been made of 500 patients who were proved to have severe mitral stenosis and who were treated by valvotomy, with particular reference to factors influencing the operative risk and to subsequent deterioration.

Over an 11-year period the operative mortality has remained almost constant at 6% despite a high incidence of important complicating features. Since the risk in the individual case cannot reasonably be assessed from the overall analysis of a large complex group each potentially adverse feature has been considered separately.

Systemic embolism continues to be the chief unpredictable hazard of mitral valvotomy, and accounted for 13 of the 31 deaths in the whole series.

Traumatic (operative) mitral incompetence was the cause of death in six cases. It appears to be the occasional unavoidable and unpredictable consequence of trying to produce adequate separation of the cusps in very sclerotic valves. The incidence of such incompetence has not been increased by the use of the trans-ventricular dilator.

Post-operative circulatory failure occurred in five cases. This is likely to develop in advanced cases with myocardial damage, as reflected in large hearts, peripheral oedema, and cardiac cirrhosis of the liver.

Cardiac arrest occurred in two cases and haemorrhage in three cases, but these complications are now rare.

In the first post-operative year 84% of those who survived the procedure maintained a good result. At the end of five years this proportion fell to 72%. Thereafter the rate of deterioration increased by about 10% per annum. At the end of eight years only 42% had maintained a good result uninterruptedly, and of the relatively few (37) followed for nine years only 20%.

The incidence of restenosis steadily increases year by year and the proportion of those "at risk" who have required a second valvotomy rose from 5% at the end of five years to 40% at the end of seven years and to 70% in the relatively small number followed for nine years. The average interval between operations (the first of which were all carried out by finger and knife alone) was six to seven years. No close relationship was found between the extent of the original operation or calcification of the valve and the incidence of restenosis. The mortality for second operations in 92 cases has been 2.4%. So far the results of the second operation appear less good than those after the first, but the follow-up period is too short to draw a fair comparison.

Subsequent deterioration is sometimes mainly attributable to a single dominant factor, of which restenosis is the most important, and sometimes to a combination of multiple adverse features, of which the most important are atrial fibrillation, cardiac enlargement, calcification of the valve, traumatic mitral incompetence, and an age of 50 years or more.

Atrial fibrillation was present in 197 cases (39%), and is *itself* an adverse factor because of a much higher operative mortality, mainly due to the incidence of systemic embolism. The effect of fibrillation on long-term results cannot yet be assessed because the total number of those who did not also have other adverse factors is too small.

Fifty-seven patients were aged 50 or over, but only seven of these did not also have fibrillation, a large heart, or calcification of the valve. The numbers, therefore, are too small for any conclusions to be drawn on the significance of age itself.

Heavy calcification of the mitral valve was present in 92 patients (18%). Calcification *itself* does not increase the operative risk, which is high only because of associated adverse factors, nor is there a higher incidence of traumatic mitral incompetence; but calcification is probably related to a higher incidence of systemic embolism. Good long-term results are fewer and are maintained for a shorter time, but the majority are improved for several years, and it is clear that surgical treatment should never be refused on account of calcification alone.

A cardiothoracic ratio of 60% or more was present in 111 cases (22%) and is thought to reflect myocardial damage. This *itself* is not responsible for a higher operative mortality. Long-term results will probably be poorer, but a larger number of patients who do not also have other adverse factors must be followed to be sure of the adverse effect of enlargement itself.

The physical signs of aortic incompetence were present in 262 patients and of aortic stenosis in 103 patients. Aortic valvular defects did not affect operative mortality or long-term results up to six years. Where the degree of stenosis was severe aortic valvotomy was carried out at the same time.

A group of patients with severe mitral stenosis but with multiple features has been analysed separately. Inevitably the operative risk was greater and the prospects of obtaining a good result were poorer, but the majority maintained worth-while improvement for some years. A subgroup with considerable cardiac enlargement, congestive failure, and atrial fibrillation were thought to have important myocardial damage and fared less well.

Some degree of traumatic (operative) mitral incompetence, as judged by auscultation, was produced in 97 (20%) of cases. In 72 of these there is nothing to suggest that the systolic murmur reflects mitral incompetence of dynamic significance. In 14 patients (2.8% of the whole series) it is thought that the incompetence produced was responsible for death or for subsequent deterioration, and in another 11 (2.2%) it is a possible contributory cause; but other adverse factors are also present which could be responsible. Since the introduction of the transventricular dilator there has been a higher incidence of systolic murmurs produced but not of traumatic incompetence of dynamic significance.

Clot was present in 107 of the 500 patients and systemic embolism occurred in 20% of those with clot. Clot is most likely to be present in those with atrial fibrillation, large hearts, calcified valves, and relatively advanced years. Embolism with sinus rhythm is rare but occurred in 10% of all those with atrial fibrillation. This incidence has fallen during the past five years. Subsequent embolism has occurred in 16 patients, but it is not yet possible to assess if this would have been greater without valvotomy.

It is concluded from this analysis that, although most patients with severe mitral stenosis are improved by valvotomy, surgical treatment is but an incident in the relentless progress of rheumatic heart disease, whether from activity of the rheumatic process or from the progressive fibrosis which follows activity.

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HIGH INTESTINAL OBSTRUCTION PRESENTING AS ACUTE RENAL FAILURE

BY

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Acute obstruction high in the small intestine produces early nausea and vomiting, severe fluid loss, marked imbalance of the body electrolytes, and minimal abdominal distension. Two such cases were referred to the Liverpool Renal Insufficiency Centre with the diagnosis of "uraemic vomiting" for consideration with a view to extracorporeal haemodialysis with the artificial kidney. Both patients were six to seven months pregnant when the vomiting started and miscarriage occurred spontaneously in each case, two weeks after the onset of the vomiting. Initially the diagnosis of intestinal obstruction had been thought unlikely as there was no abdominal distension, but as copious biliary vomiting persisted after the miscarriages, and oliguria was associated with a progressively increasing blood urea, transfer to the renal insufficiency centre was advised. Ultimately the symptoms in both cases proved to be due to a high intestinal obstruction situated in the jejunum, 3 to 4 in (7.5 to 10 cm.) below the duodeno-jejunal flexure.

On admission to the renal insufficiency centre both patients showed evidence of severe dehydration associated with a profound disturbance of the blood electrolytes. As a first measure of therapy they were placed on a standard basic regime (Ross *et al.*, 1961) and the fluid and electrolyte deficiency corrected by intravenous infusion of electrolyte solutions.

Case 1

A woman aged 34 began to vomit all she ate during the seventh month of her eighth pregnancy. Prior to this she had maintained perfect health and the previous seven pregnancies had been completely normal. Two weeks after the vomiting began she was delivered of a stillborn infant. However, the copious biliary vomiting persisted and two weeks later she became confused and was transferred to Sefton General Hospital. Intravenous therapy was initiated for a state of gross dehydration which was almost immediately followed by a diuresis. The blood-urea level fell rapidly (Fig. 1) and it was possible to improve the condition of the patient sufficiently to carry out a laparotomy three days later. Prior to the laparotomy it had been possible to demonstrate the site of the obstruction radiologically by injecting 15 ml. of 60% urographin down the Ryle tube, thus outlining the stomach, duodenum, and jejunum up to the site of the obstruction (Fig. 2).

The operation was performed through a left paramedian incision and the cause of the obstruction was found to be due to an intussusception in the jejunum about 4 in. (10 cm.) from the duodeno-jejunal flexure. At the apex of the intussusception was situated a primary carcinoma encircling the small intestine and producing a ring stricture. The growth had not metastasized and it was possible to resect the intussusception with the neoplasm, restoring the continuity of the small intestine by end-to-end anastomosis. Micro-