PERITONEAL DIALYSIS IN SURGERY

MAUNG MAUNG AYE, A. K. KULATILAKE and R. SHACKMAN
Postgraduate Medical School of London, Hammersmith Hospital, London, Great Britain

Peritoneal dialysis is an eminently satisfactory method for correcting the biochemical state of patients in renal failure (Maxwell et al., 1959; Boen, 1961; Thompson et al. 1964). It is a slower, but much simpler procedure than haemodialysis, achieving the same result in 24-48 hours as haemodialysis would accomplish in 6 hours. Being a slower process it avoids the disequilibrium syndrome (Shackman et al., 1962; Kennedy et al., 1962), and it is also more effective when patients have been overhydrated and there is pulmonary or generalised oedema.

Using a technique* similar to that described by Maxwell et al. (1959), we have treated 73 (52 male, 21 female) surgical patients with renal failure in the 6 year period, 1959–August 1965.

In the earlier cases peritoneal dialysis was usually undertaken because there were difficulties of access to blood vessels but our present policy is to employ peritoneal dialysis as the first choice provided there are no contraindications. The majority of our patients managed by peritoneal dialysis have been treated during the past two years.

![YEARLY INCIDENCE OF PERITONEAL DIALYSIS](image)

* Nylon catheters supplied by Baxter Laboratories Ltd. and commercially prepared dialysis fluid supplied by Allen & Hanburys Ltd. were used.
Contraindications
Peritoneal dialysis was not employed in cases with abdominal wall or intra-abdominal sepsis, when there was an abdominal drainage tube, when intra-abdominal adhesions, the result of previous multiple operations were considered to exist, or when it was felt that the patient could or would not be co-operative.

Results
Of 54 patients treated by peritoneal dialysis alone, there were 23 survivors (mortality 57%). In another 19 patients haemodialysis was also required and only 2 survived. The low survival in this latter group of patients reflects the severity and gravity of their condition: some were treated by haemodialysis on admission because the blood urea was very high while in others the peritoneal dialysis was technically unsatisfactory.

Of the 48 deaths in the 73 patients only 10 could be directly attributed to uraemia, i.e. high blood urea, hyperkalaemia, acidosis, or uraemic pericarditis. It was the complications of the renal failure and the underlying surgical conditions which were responsible for death in the majority of these cases: in 38 the biochemical state at the time of death was relatively normal. Cardiac lesions, pulmonary oedema, sepsicaemia, peritonitis, bronchopneumonia, cerebral necrosis, generalised bleeding and widespread malignant disease were often significant in this respect, and in the majority of cases more than one factor was responsible for death; heart failure or cardiac arrest were responsible in 13 but this high incidence is accounted for by the fact that we treated 15 patients who developed acute renal failure after major cardiovascular surgery and 12 of these succumbed.

The mortality in young children and the aged was very high.

Fig. 2. The white column represents the total number of patients and the black column represents the number of deaths in that particular age group.

The miscellaneous group consisted of one patient with renal vein thrombosis, one with malignant lymphoma, and one with acute renal failure due to mismatched blood transfusion following abdominal hysterectomy.
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Surgical conditions requiring peritoneal dialysis

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cases</th>
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<td>Cardio-vascular surgery</td>
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<td>Genito-urinary surgery</td>
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<td>Severe trauma</td>
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<tr>
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</table>

The miscellaneous group consisted of one with renal vein thrombosis, one with malignant lymphoma, and one with acute renal failure due to mismatched blood transfusion following abdominal hysterectomy.

Duration

The duration of dialysis in these patients ranged from 1–19 days, but the majority were dialysed for 4–10 days.

Complications of peritoneal dialysis

Although peritoneal dialysis may be simple and effective there are difficulties and complications. The catheter may become blocked by fibrin and it is our practice to add 500 to 1,000 units of heparin to each litre of dialysis fluid to minimise this risk: when blockage occurs the catheter is syringed, and if this fails a fresh catheter is inserted. Small leakages around the catheter are not uncommon; in 2 of our patients the dialysis had to be abandoned because there was severe leakage. In 5 patients there was scrotal swelling due to subcutaneous leakage and tracking of the dialysis fluid which may occur even when the catheter is well inside the peritoneal cavity. In such cases we remove the peritoneal catheter and stop the dialysis for 2–3 days before inserting a fresh catheter at a different site and resuming the dialysis. We sometimes see blood staining of the dialysis fluid at the beginning of dialysis but it soon clears.

Sources of infection are often present in surgical patients with acute renal failure and cultures of the dialysate yielded bacterial growth in 18 of our cases: the commonest organisms were coliform and Staph. pyogenes, but mixed growths were also not uncommon. The presence of bacteria, however, is by no means synonymous with clinical peritonitis, although this diagnosis was made in 4 patients, 2 with pre-existing intra-abdominal sepsis.

The peritoneal dialysis was unsatisfactory in 8 cases, either because there was retention of dialysate, inadequate fluid return due to multiple adhesions, extravasation, or some leakage around the catheter.

There is always some degree of protein loss in the dialysate, and we encourage our patients to eat a 40 g protein diet whenever possible, especially when the blood urea is less than 200 mg%.

One patient with multiple old operation scars was referred to us with a small bowel fistula which developed following the use of a trocar for insertion of the catheter; and we have seen a peritoneo-colonic fistula probably the result of pressure necrosis by the tip of a catheter. Severe prolapse of a terminal colostomy during dialysis, necessitating abandoning the technique, has also been seen.

Diarrhoea, which ceased when the dialysis was stopped, was seen in 2 patients: only 2 others required analgesics for the relief of abdominal pain during the dialysis. Significant displacement of the catheter occurred in 2 of our patients: it fell out in both cases. We know of a case in which laparotomy was required to recover a catheter from the peritoneal cavity.
In another case there was a unilateral pleural effusion of dialysate. In 2 others, after open cardiac surgery, the dialysate came out through the chest drains, but the peritoneal dialysis was effective and the uraemia was well controlled.

There can be no doubt that peritoneal dialysis is an effective method for treating surgical patients with acute renal failure. To the inexperienced, its effectiveness and apparent simplicity is appealing but it is by no means suitable for all cases; it is impracticable in some, and it has its own peculiar, and sometimes serious, complications.

Indeed, surgical patients with acute renal failure are better managed in a Renal Unit where corrective surgery may be available at any time and the peritoneal dialysis is but one facet of their overall management.

REFERENCES

DISCUSSION

Dr. H. P. McDonald (New York): I should like to comment on the use of peritoneal dialysis for the treatment of patients after major surgery, particularly major abdominal surgery. As you know Teschan over five years ago popularized the concept of prophylactic daily dialysis. The experience of Alwall and Scribner subsequently with haemodialysis on a daily basis has been greeted with increased patient survival. The Mayo Clinic using haemodialysis with acute renal failure patients following cardiopulmonary by-pass surgery had a 90 percent mortality when the dialysis was used on an 'as indicated' basis. Our study from the University of Michigan on acute renal failure patients following cardiopulmonary by-pass showed a 70 percent survival with peritoneal dialysis when the dialysis was started as soon as the diagnosis of acute renal failure was made and continued throughout the period of acute renal failure.

The various contraindications for peritoneal dialysis that were previously mentioned are not really contraindications in our view.

1. We attempt to select a site in the abdomen for insertion of the catheter away from abdominal scars or previous surgery that might indicate intra-abdominal adhesions.

2. Peritonitis is no contraindication to peritoneal dialysis. We are treating patients at the present time with peritonitis by instituting peritoneal lavage in which specific potent antibiotics have been added to the wash fluid.

3. Peritoneal drains or leakage from the peritoneal cavity is no contraindication to peritoneal dialysis. We just put a mop on the floor and clean it up as it gets to the floor. The patient still receives the same benefit from the dialysis that is many times vital for his survival.

4. Serosal oedema occasionally occurs with peritoneal dialysis. This is rarely severe and usually disappears a day or so after the dialysis has been discontinued.

5. Patient cooperation is not really essential with peritoneal dialysis, just as with many other procedures, in the post-surgical patient. If a dialysis is indicated in order to improve the patient’s chance for survival, we simply strap the patient in bed and do the dialysis.

We have performed peritoneal dialysis in over 40 patients within the first day post-operative following major abdominal surgery with no dialysis complications. We have dialysed patients as long as 31 days consecutively with survival for acute renal failure and many patients for over 20 days with survival following post-surgical acute renal failure. It is interesting to see the course of the patients receiving around the clock peritoneal dialysis therapy throughout their acute renal failure until their kidneys open up. We feed them a regular diet and fluids ad lib. The patients are up and about and look dramatically different from the usual acute renal failure case that we had become accustomed to in the years gone by.

Dr. S. T. Boen (Amsterdam): In both papers, I believe the technique used is not very satisfactory for catabolic patients, for instance, post-traumatic and post-surgical patients. Dr. Jacobs mentioned he used 1 litre/hr, which means he will get a urea clearance at the highest of 11 ml/min. I would suggest in all post-traumatic cases and all post-surgical cases to use at least 3 litres of fluid per hour to reach a clearance of about 25 ml/min.

Prof. D. A. K. Black (Manchester): I think this group of papers raises a question, whether we are really using the right form of monitoring in these surgical patients. If the real dangers are from infection and from hyperkalaemia rather than from intoxication with nitrogen
products, then should we not be doing more frequent blood cultures and perhaps using electrocardiographic monitoring for the potassium hazard rather than relying on biochemistry entirely. As we heard earlier this morning, patients can die while we are awaiting results.

In particular relation to peritoneal dialysis I should like to ask, I think Dr. Aye, whether there is any evidence of increased infection after it and whether it is as efficient in removing potassium as the haemodialysis procedures?

Dr. O. KORALNIK (Geneva): About the fear of infection of the peritoneum as a contra-indication, we made 80 peritoneal dialyses. Sixty were done without an antibiotic and we never had peritonitis. We had some cultures but there was no clinical sign and when we gave an antibiotic—it was colomycin in cautious doses (colistin methane sulphonate)—it was as a prophylactic procedure but we really did not need it.

Dr. G. M. BERLYNE (Manchester): I am surprised that you do not consider peritonitis to be present when you have got organisms growing in the peritoneal fluid. We think that this is a good indication of peritonitis. You can have peritonitis, we are quite sure, with organisms, bacterial peritonitis rather than chemical, with bowel sounds and many of these patients will develop abscesses in the pelvis. We have since overcome this by using Ampicillin rather than a minute dose of tetracycline which was initially advised. The only organisms that we culture in patients without bacterial peritonitis are yeasts.

Dr. S. SHALDON (London): In our experience we have found that using acetate instead of bicarbonate or lactate has eliminated positive cultures in peritoneal dialysis fluid. The acetate has a distinct bacteriostatic effect. I think this might reduce the incidence of sepsis in some centres. It is no more expensive in the quantities used if you use acetate instead of bicarbonate or lactate.

Dr. O. KORALNIK (Geneva): Just about the remark of Dr. Berlyne, it happened several times that we had to dialyse a patient several times and we had—let us say—a coli bacillus, enterococcus or rarely pseudomonas in the outflow fluid at the end of the first peritoneal dialysis. We did not give antibiotic; 3 days afterwards we dialysed again and it was sterile. The second and third it was the same. It means that if you find a germ once it does not mean that it will develop. You leave the peritoneum 2 or 3 days and you do not find anything anymore. We do not use antibiotics in our patients on the chronic peritoneal programme.

Prof. D. A. K. BLACK (Manchester): There seems to be one small point here. In the patients who have had haemodialysis and peritoneal dialysis, I should like to ask the previous two speakers if they asked their patients which form of treatment they preferred. In my own experience with these techniques, on occasions the patients who have had both have invariably preferred the haemodialysis technique. The patient’s feeling about this is of some small consideration.

Secondly, in the list put up here in the table I notice there are quite a few peritoneal dialyses performed for what appear to be intoxications, presumably barbiturates. I am just wondering how valid is peritoneal dialysis treatment for intoxications, if any particular form of treatment is necessary other than forced diuresis and alkalization. If something more than forced diuresis and alkalization (which is extremely efficient) is required I doubt whether peritoneal dialysis is the alternative. I want to know what their opinions about those are, please.

Dr. H. TENCKHOFF (Seattle): In more than 300 peritoneal dialyses performed during the last 2 years we have had not a single clinical incidence of infection, except in one case where
there was bowel perforation with extensive intra-abdominal adhesions. This is in both chronic and acute patients. We have dialysed chronic patients up to 2½ years and never had positive cultures. On a few occasions there were diphtheroids cultured or *Staphylococcus epidermidis* but they grew in fluid media only and were not culturable on plates, so we think these are contaminations. There was never any clinical evidence of peritonitis in these patients and we have not seen pelvic abscesses.

The longest time we left the catheter in place was for a continuous dialysis in a post-traumatic unconscious patient over 3 weeks and 2 days. Even in this patient there was never a positive culture (and we cultured every second day), and around the stab wound, which was thoroughly dressed, we cultured only *Staphylococcus epidermidis*.

Considering the tolerability of peritoneal dialysis, our patients on chronic peritoneal dialysis prefer peritoneal dialysis, and the patients on chronic haemodialysis prefer haemodialysis—both being well adjusted to their treatments.

There are certain advantages, of course, to peritoneal dialysis and so far, as these patients do not have to worry about cannula infections and about their shunts, they think the longer dialysis is well compensated by these factors.

The Chairman: I think we have to close the discussion. Dr. Jacobs, any final remarks?

Dr. C. Jacobs (Paris): Just answering Dr. Black, we think that the effective results of peritoneal dialysis on potassium and acidosis are very fast and even faster than the results on urea. So we have no particular problem about managing or controlling the potassium level in the blood.

Dr. M. M. Aye (London): This is also our experience. In reply to Dr. Berlyne, we do not usually routinely treat positive culture because many of them are contaminants, we believe. Also, it is difficult to know when patients have peritonitis because quite often, even though they have some signs of inflammation, with the presence of fluid inside and running in and out, they do not really manifest what are typical signs or symptoms of peritonitis. But if the patient with positive culture has other signs or symptoms, like fever, present then we treat accordingly. We use the appropriate antibiotic for the organism.

We use 2 litres each hour.

Another point I should like to make, I have asked a few patients who had peritoneal dialysis as well as haemodialysis. One of the girls who is on a chronic dialysis programme told me that she preferred haemodialysis. Another patient on whom we did 2 or 3 peritoneal dialyses—a patient with chronic renal disease—did not refuse a second peritoneal dialysis.