ANAESTHESIA AND RENAL TRANSPLANTATION:
AN ANALYSIS OF FIFTY-SIX CASES

D. A. LOGAN, HELEN B. HOWIE AND J. CRAWFORD

SUMMARY

Fifty-six operations for transplant of a kidney have been performed in the period 1969–72. The results of the operations compare favourably with those of most other centres. We have analysed the case records with special reference to the techniques and problems of anaesthesia. Four patients presented complications which were considered to be associated with anaesthesia. It is concluded that patients of this type need not present a difficult challenge to the anaesthetist although a high standard of practice is important.

Renal transplantation is an established method of treatment for chronic renal failure (Salaman et al., 1969). The operation is usually performed in central hospitals and the Western Infirmary, Glasgow, serves the West of Scotland. Our policy is to accept for transplantation regular dialysis patients, in the age group 15–50 years, who do not have contraindications such as chronic infection or lower urinary tract abnormalities.

Bell et al. (1972) have reported that their success rate with the first 33 cases at the Western Infirmary was 82% one year after operation, falling to 80% at two years. This compares favourably with the figures of Calne et al. (1972) [59%], Woodruff et al. (1969) [66%] and Sheil et al. (1971) [62%], all reporting on results at one year after operation.

By the end of 1972, the total number of operations in the Western Infirmary was 56. In view of continuing good results, we have analysed the anaesthetic case records with a view to establishing what, if any, were the contributions of anaesthesia to these results and to document the anaesthetic problems which occurred.

Patients and anaesthesia.

Of a total of 56 operations, 53 were for cadaver donor transplant and 3 patients received the kidney of a sibling. Three of the operations were second transplants. There were 32 males (age range 16–46, mean 30 years) and 24 females (age range 16–46, mean 29 years). Bilateral nephrectomy and splenectomy were performed some time prior to the transplant procedure in 22 patients and during it in 3 patients.

Table I lists the causes of renal failure. All recipients had been maintained on haemodialysis before transplantation; patients at home were dialysed thrice weekly and those in hospital twice weekly. Before operation, packed cell volume and serum electrolytes were estimated. Preoperative dialysis was carried out in most cases unless routine haemodialysis had been performed within the preceding 36 hours. Washed red cells were transfused before operation if the packed cell volume was below 20%. Table II shows the results of haematological and biochemical measurements on the day of operation.

<table>
<thead>
<tr>
<th>TABLE I. Primary disease(s) of patients requiring transplantation.</th>
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<tbody>
<tr>
<td>Chronic glomerulonephritis                               35</td>
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<tr>
<td>Chronic pyelonephritis                                   13</td>
</tr>
<tr>
<td>Acute glomerulonephritis                                  3</td>
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<td>Polycystic kidneys                                       3</td>
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<tr>
<td>Malignant hypertension                                  3</td>
</tr>
<tr>
<td>(Cushing's disease, post-adrenalectomy)                  1</td>
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<tr>
<td>Hereditary nephritis                                    1</td>
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<table>
<thead>
<tr>
<th>TABLE II. Haematological and biochemical measurements on the day of operation.</th>
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<tr>
<td>Mean</td>
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<tr>
<td>-----------------</td>
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<tr>
<td>Hb (% of 14.8 g)</td>
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<tr>
<td>PCV (%)</td>
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<tr>
<td>Urea (mg/100 ml)</td>
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<td>Na (m.equiv./L)</td>
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<td>K (m.equiv./L)</td>
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<td>Cl (m.equiv./L)</td>
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<td>HCO (m.equiv./L)</td>
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The majority of patients in this series had Cimino-Brescia fistulae and were not on long-term anticoagulant therapy. Those receiving anticoagulants or who were dialysed immediately before surgery were given an appropriate antidote.

Thirty-five per cent of the patients were hypertensive according to the criteria of Samuel and Powell (1970), showing a raised diastolic pressure, left ventricular enlargement and retinopathy, but only 9 were receiving antihypertensive drugs at the time of transplantation.

In the first 18 months of the programme, a team of three consultants administered all the anaesthetics. Later, the work was shared by eight consultants and five senior registrars. Figure 1 shows that the operations tended to occur between the late evening and the early hours of the morning. Early in the series, 3 patients had stomach tubes passed, but this practice was discontinued since there was usually an adequate time delay to allow gastric emptying.

All patients received a general anaesthetic. Twelve patients received no premedication, 5 received atropine alone, 14 received a narcotic analgesic alone and 25 received atropine or hyoscine with a narcotic. These differences were purely the result of the anaesthetist’s personal choice. However, when atropine was excluded, a problem of profuse salivation was noted at the termination of anaesthesia. An inhalation induction was used in one patient who had a history of pericardial effusion. All other patients had a relaxant plus N₂O/O₂ and differed only in the adjuvant given. These were an opiate alone (17 patients), opiate and halothane (19 patients), halothane alone (17 patients), trichloroethylene (1 patient) and neuroleptanalgesia (2 patients). Frequently, halothane was used to assist in reducing labile blood pressures.

Blood pressure was measured with an oscillotonometer and pulse rate was recorded for all patients. Twenty-six patients had e.c.g. monitoring and one had an oesophageal stethoscope inserted.

Intubation was facilitated by the use of suxamethonium in 39 patients. The remainder were intubated when a non-depolarizing muscle relaxant had become effective.

Longer-term muscle relaxation was achieved with tubocurarine on 46 occasions and pancuronium on 10 occasions. Two patients received both drugs. Gallamine was not used. Inadequate relaxation was noted in one patient who had received pancuronium and who subsequently received 55 mg of tubocurarine. This case will be discussed later.

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**Intra-operative and postoperative problems.**

One patient had marked hypertension (arterial pressure 280/140 mm Hg) which was uninfluenced by the addition of halothane 2% to the inspired gas. Four patients, all receiving methyldopa before operation, developed hypotension during anaesthesia. The lowest recorded systolic pressure was 60 mm Hg which returned to the preoperative level at the end of anaesthesia. Blood loss was usually estimated to be less than 750 ml but on 4 occasions it exceeded 2 litres. Hypotension associated with haemorrhage occurred in 6 patients who required 2–4 units of blood each.

One patient who did not have a stomach tube passed regurgitated at the end of the anaesthetic but the pharynx was cleared successfully without allowing bronchial soiling.

After the operation, all patients were nursed in the renal unit. Intravenous opiates were used for analgesia. Oxygen was administered for 12 hours using an Edinburgh mask and chest physiotherapy was commenced within the first few hours. Two patients, after returning to the renal unit, developed ventilatory insufficiency associated with profuse salivation. Neostigmine and tracheopharyngeal suction resulted in adequate ventilation.

Two patients had to be admitted to the respiratory intensive care unit:
Case report 1.

An overweight and tall (198 cm) man with malignant hypertension had a bilateral adrenalectomy for Cushing's disease on a previous occasion. Later, for bilateral nephrectomy before transplantation, he required 110 mg tubocurarine for adequate muscle relaxation. For his transplant operation, he was premedicated with papaveretum 20 mg, hyoscine 0.4 mg and anaesthesia was induced with sodium thiopentone 300 mg. Pancuronium 6 mg failed to produce adequate muscle relaxation for intubation which was achieved by the addition of tubocurarine 30 mg. During the course of the 4-hour operation, he required an additional 25 mg of tubocurarine and halothane 2% was added to the inspired gas intermittently. He failed to breathe spontaneously at the end of the procedure in spite of having been given neostigmine 5 mg and was ventilated mechanically for a further 12 hours at the end of which time spontaneous ventilation was adequate.

Case report 2.

A small 30-year-old lady was known to be sensitive to a wide number of drugs, including pethidine and morphine. She had an uneventful anaesthetic for renal transplantation during which she was given tubocurarine 35 mg. There were no apparent difficulties in recovery from neuromuscular blockade but on return to the renal unit she was seen to be ventilating inadequately. Arterial blood-gas analysis revealed a Pco2 of 54 mm Hg. Her trachea was intubated again and she was ventilated for a further 12 hours before being allowed to breathe spontaneously. She required a second transplant operation, and was premedicated with promethazine 25 mg. On this occasion, she received tubocurarine 15 mg for a procedure lasting 3 hours. There were no difficulties at the end of anaesthesia and no recurrence of her previous postoperative problems.

In this series, 2 patients have died although neither death occurred in the immediate postoperative period. One patient developed cerebral moni-lasis and died 2 weeks after transplantation; the other patient died from congestive cardiac failure while undergoing haemodialysis a year after rejecting her transplanted kidney.

Fourteen transplanted kidneys have failed in this series giving a 75% graft survival rate. Rejection accounted for 12 of these, the other causes of failure being renal artery thrombosis (1), and primary non-function (1). The anaesthetics employed in these were:

- relaxant + opiate 3 patients
- relaxant + halothane + opiate 3 patients
- relaxant + halothane 6 patients
- relaxant + neuroleptanalgesia 2 patients

Thus no particular anaesthetic technique in this very small series can be incriminated.

DISCUSSION

The graft survival rate for this series of patients is favourable when compared with the world average of 52% at 1 year and 41% at 2 years (Murray, Barnes and Atkinson, 1971). We believe that the preoperative preparation of the patients has contributed significantly to the successful overall results.

The major problems for the anaesthetist in surgery of this type are those of a patient with chronic illness, severe anaemia, hypertension and moderate metabolic acidosis. Haemodialysis is effective in correcting the electrolyte and fluid disturbances but will not improve the anaemia and may not correct the hypertension. The serum potassium may increase dramatically during the course of an anaesthetic in the presence of transfusion and hypoventilation and may need immediate treatment (Slawson, 1971).

The patients in this series were anaemic. Preoperative correction of anaemia was performed on patients with a packed cell volume of less than 20% by transfusing one or two units of washed red cells. To obviate the risk of circulatory overloading, this was often carried out while the patient was receiving pre-transplant dialysis. Despite this violation of the principles of oxygen availability, none of the patients showed clinical evidence of hypoxia. Periods of hypotension, likely to be associated with a low cardiac output, are an additional worry although there were no obvious sequelae in the patients who exhibited this.

The hypertensive patients continued to receive antihypertensive therapy up to the time of operation. The one patient who was markedly hypertensive during anaesthesia did not respond to halothane, in the presence of tubocurarine, given in an attempt to reduce his systolic pressure from 280 mm Hg.

Our policy has been not to correct the moderate metabolic acidosis and there were no difficulties encountered which seemed to indicate correction. Postoperatively, these patients remained acidotic until their kidneys functioned. The acidosis was controlled in the meantime by haemodialysis.

Persisting neuromuscular blockade occurred four times. The problem may have been anticipated in view of the large doses of neuromuscular blocking drugs. The use of a peripheral nerve stimulator might have proved valuable in the three patients which required further attention on return to the renal unit.

Judged by the absence of signs from daily chest X-ray and frequent clinical examination, chest infection did not occur in any patient in the immediate period after operation; but broncho-pneumonia occurred in 2 patients one month after surgery. Vigorous chest physiotherapy may have played an important part in the care of these patients. Spence and Alexander (1972) have suggested that postoperative pneumonia is rare if the standards of airway care are good.
The circumstances attending the acquisition of cadaver kidneys, the time required for tissue typing and the undesirability of prolonged organ storage commonly combine to make transplant surgery a nocturnal event. These are lengthy operations and, if carried out frequently, may bring a significant additional work-load to an anaesthetic service, even in a large hospital. Improvements in techniques for organ preservation are obviously desirable.

ACKNOWLEDGEMENTS

We would like to thank Prof. P. R. F. Bell and Dr J. D. Briggs for their criticisms and valuable advice in preparing this report, and Mrs M. MacLeod for secretarial assistance.

REFERENCES


ERRATUM

The reference "(Slawson, 1971)" on page 71, column 2, line 11, should read "(Slawson, 1972)".

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