

ANAESTHETIC AGENTS AND TECHNIQUES FOR RENAL HOMOTRANSPLANTS

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RESULTS OF renal homograft procedures in this clinic have been encouraging¹ Several inquiries concerning techniques used for anaesthesia for these patients have prompted the writing of this note concerning the procedures used for the first 50 patients in the University of Colorado series A previous report dealing largely with para-anaesthetic considerations has been published²

Donors of kidneys were studied to make certain that they were healthy Anaesthesia for donors, therefore, did not have to differ from what the anaesthesiologist would ordinarily use for nephrectomy, with three possible variations First, this procedure requires considerably more time than standard nephrectomy does, second, the surgeons have consistently requested that the electrocautery be available, and third, moderate hypothermia has been used in several cases A well-standardized hypothermic technique has been developed which allows for these variations^{3 4 5}

Recipients have all been severely ill Physiologic derangements have included uraemia, fluid and electrolyte imbalance, congestive heart failure, severe hypertension, hypertensive encephalopathy with convulsions, retinal haemorrhage and oedema, pulmonary oedema and anaemia Most patients have had repeated dialysis with the artificial kidney, and a few have had a history which included cardiac arrests

Surgery in addition to actual placement of the graft has been frequent During progressive development of surgical and immunological techniques for control of the recipient, the greater part of the surgery prior to the transplant has gradually been eliminated Early in the series, however, thymectomy, splenectomy, and nephrectomies were performed in an earlier operation At present the splenectomy, nephrectomy, and implantation of the donor kidney are performed in one operative procedure Post-transplantation problems which have required additional anaesthesia include drainage of abscess, removal of a rejected kidney, gastrointestinal haemorrhage, and removal of a few kidneys and spleens in separate procedures after implantation of the donor kidneys

The procedures and agents utilized to care for implantation of renal homografts are presented in Table I Procedures and agents employed for pre- and post-transplantation anaesthetics are listed in Table II

Any of several anaesthetic techniques or agents or combinations thereof may be used successfully The surgeons require a quiet and well-relaxed patient The recipient requires analgesia The procedures have been selected to provide these conditions, taking into account the status of each individual patient A single major anaesthetic agent or procedure was employed for only half the

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TABLE I
ANAESTHESIA FOR RENAL HOMOGRAFT
(50 patients had 56 kidneys implanted in 55 procedures)

Technique or agent	As only major technique or agent	With halothane	With fluroxene	With cyclopropane	With meperidine and nitrous oxide
Spinal	1	11	4	1	
Continuous epidural	1	7	4		1
Halothane	21				
Fluroxene	2				
Cyclopropane	2				
	<hr/> 27	<hr/> 18	<hr/> 8	<hr/> 1	<hr/> 1
Supplementary drugs administered					
Curare or gallamine	31*				
Prostigmine	12				
Thiopentone	35				
Vasopressor	37				
Succinylcholine	16				

*16 of these also had spinal or epidural

TABLE II
ANAESTHESIA FOR PROCEDURES RELATED TO RENAL HOMOGRAFT
(21 patients had 39 procedures)

Technique or agent	As only major technique or agent	With halothane	With fluroxene
Spinal	3	4	
Continuous epidural	1	2	1
Halothane	8		
Fluroxene	8		
Cyclopropane	11		
Nitrous oxide	1 (analgesia only)		
	<hr/> 32	<hr/> 6	<hr/> 1
Supplementary drugs administered			
Curare or gallamine	10		
Prostigmine	5		
Thiopentone	14		
Vasopressor	16		
Succinylcholine	13		

homograft implantations. For the related procedures, four-fifths could be done using a single agent or technique. The duration of the surgical manipulation was the most significant factor here, for the related procedures consumed an average of 2 hours and 45 minutes, while the homografts required an average of 5 hours and 45 minutes of anaesthesia.

It must be remembered that electrolyte status of the recipient is certain to be abnormal. The artificial kidney is known to produce a decrease in cholinesterase concentration⁶ so the use of succinylcholine has been avoided in the recently dialysed patient. Even so, one patient who received this drug was apnoeic and required artificial respiration for an hour post-surgery. A patient, not involved in transplanation, who received 10 mg of succinylcholine to relieve muscle spasms

during dialysis in our clinic had an immediate cardiac arrest. Analysis of his blood revealed a zero cholinesterase level. An explanation of the pathophysiology involved may be afforded by the following facts: (1) Dialysis decreases the cholinesterase level. This would accentuate the effects of succinylcholine. (2) Succinylcholine produces cardiac arrhythmias by some unknown method.^{7,8} One mechanism suggested has been a derangement of potassium ion concentration. Dialysis which deliberately lowers the potassium ion concentration would allow an already poor situation to deteriorate. (3) Succinylcholine has been shown to increase the plasma level of the potassium ion at the expense of tissue potassium.⁹

The possibility of poor excretion by a diseased kidney of barbiturates and relaxants, especially gallamine, has given us some concern. The renal homografts, however, have begun normal urinary excretion within minutes of receiving an arterial blood flow almost without exception, so particular caution in this respect has not proved to be imperative.

The only recognized complication of anaesthesia in these 94 anaesthetics was in a patient who developed a bilateral pneumothorax immediately post-operatively when an incorrectly oriented ventilation-measuring device acted as a one-way valve, permitting inflation but not deflation. Satisfactory recovery followed removal of air.

SUMMARY

1 A compilation of the anaesthetic agents and procedures chosen for patients accepting renal homografts is presented.

2 The effect of artificial renal dialysis on the concentration of cholinesterase is emphasized.

3 Careful application of any agent or procedure is of more importance than is the choice of any particular anaesthetic.

RÉSUMÉ

Voici un rapport sur les façons de procéder en anesthésie au cours des 50 premiers cas de greffes rénales humaines à l'Université de Colorado.

Les donneurs de reins sont des personnes en santé et, en conséquence, l'anesthésie pour ces cas ne diffère pas de celle que nous employons pour les néphrectomies ordinaires. La seule différence est que, chez plusieurs malades, nous avons pratiqué une hypothermie légère.

Les receveurs ont tous été gravement malades. Nous avons observé de l'urémie, un déséquilibre de l'eau et des électrolytes, de la défaillance cardiaque congestive, de l'hypertension marquée, de l'encéphalopathie hypertensive, de l'œdème et des hémorragies rétiniennes, de l'anémie et de l'œdème pulmonaire. La plupart des malades avaient subi des dialyses répétées avec le rein artificiel et quelques-uns avaient une histoire incluant plusieurs arrêts cardiaques. La chirurgie a consisté, en plus de la mise en place de la greffe, en une thymectomie, une splénectomie et des néphrectomies. A la suite d'une transplantation, les circonstances qui ont nécessité une anesthésie additionnelle sont un drainage

d'abcès, l'exérèse d'un rein rejeté, une hémorragie gastro-intestinale et l'exérèse de reins et de rates au cours d'opérations différentes après la transplantation rénale. Les façons de procéder et les agents employés dans chacun de ces cas sont mentionnées dans les deux tableaux.

N'importe laquelle des nombreuses techniques anesthésiques, n'importe lequel des agents ou des associations d'agents peuvent être employés avec succès. Les chirurgiens exigent un malade calme et bien relâché. Le receveur a besoin d'analgésie. L'équilibre électrolytique du receveur est à coup sûr anormal. On sait que le rein artificiel entraîne une diminution des cholinestérases, c'est pourquoi nous nous sommes abstenus de donner de la succinylcholine aux malades dialysés récemment. Nous nous sommes posé des questions sur la possibilité d'une mauvaise excrétion des barbituriques et des myorésolutifs, spécialement la gallamine, par un rein malade. Le soin apporté à l'administration d'un agent est plus important que le choix d'un anesthésique en particulier.

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