ANAESTHETIC MANAGEMENT OF PATIENTS WITH PHAEOCHROMOCYTOMA

A review of 102 cases

J. M. DESMONTS, J. LE HOUELLEUR, P. REMOND AND P. DUVALDESTIN

SUMMARY

A total of 102 patients with phaeochromocytoma who underwent surgery by the same team between 1964 and 1976 were allocated to three groups according to the anaesthetic protocol used: (1) balanced anaesthesia and control of hypotension with noradrenaline; (2) anaesthesia with halothane and replacement of blood volume; (3) neuroleptanalgesia (droperidol and phenoperidine) and replacement of blood volume. None of the patients in any of the three groups received adrenergic inhibitors before anaesthesia. Comparison of the results in the three groups revealed that the major factor responsible for reduction of operative mortality to almost zero was control of hypotension by replacement of blood volume rather than by the use of noradrenaline following resection of the tumour, whereas the type of anaesthetic agent used was of secondary importance.

Phaeochromocytoma is an uncommon cause of arterial hypertension accounting for approximately 0.5% of all cases of hypertension for which investigations are undertaken (Gitlow, Mendlowitz and Bertani, 1970). Despite its rarity, phaeochromocytoma continues to be the subject of numerous investigations as a result of the severity of hypertension and because it may be cured by surgery.

Most of the commonly used anaesthetic techniques and agents have been used for anaesthetizing patients with a phaeochromocytoma (Desmonts et al., 1974). However, a comparison of the results in the literature is difficult, since most of the reports deal only with isolated cases. We have experience of 102 patients who underwent surgery between 1964 and 1976. Anaesthesia was performed by the same team using three successive protocols drawn up on the basis of our clinical experience. The analysis of our results and a comparison with those of other available series in the literature has enabled us to determine the factors responsible for reducing operative mortality to almost zero.

PATIENTS AND METHODS

Sixty female and 42 male patients with phaeochromocytoma, aged 12–78 yr (mean 42 ± 14 SD) underwent surgery between 1964 and 1976. In 86 patients the tumour was in the adrenal gland, in 11, it was extra-adrenal and it was malignant in five. The character-

istic paroxysmal arterial hypertension with normal pressure between the crises was present in only 30% of patients. The remainder had hypertensive crises superimposed on permanent hypertension. The duration of arterial hypertension is shown in table I.

<table>
<thead>
<tr>
<th>Duration</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1 yr</td>
<td>37</td>
</tr>
<tr>
<td>1–2 yr</td>
<td>21</td>
</tr>
<tr>
<td>2–5 yr</td>
<td>26</td>
</tr>
<tr>
<td>More than 5 yr</td>
<td>18</td>
</tr>
</tbody>
</table>

The extent of organ involvement by vascular disease associated with the hypertensive state was evaluated by e.c.g. and retinal examination (table II.)

<table>
<thead>
<tr>
<th>E.c.g. before operation</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>45</td>
</tr>
<tr>
<td>Left ventricular hypertrophy or repolarization disturbances, or both</td>
<td>53</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Retinal examination</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>29</td>
</tr>
<tr>
<td>Stages 1 and 2</td>
<td>41</td>
</tr>
<tr>
<td>Stages 3 and 4</td>
<td>17</td>
</tr>
<tr>
<td>Not performed</td>
<td>15</td>
</tr>
</tbody>
</table>

Renal function was evaluated by the creatinine clearance test in all patients and was always within normal limits.

Patients were allocated to three groups on the basis of the anaesthetic protocol used.

J. M. DESMONTS,* J. LE HOUELLEUR, P. REMOND, P. DUVALDESTIN, Clinique Chirurgicale, Hôpital Beaujon, 100 bd du Général Leclerc, 92110—Clichy, France.

* Present address for correspondence: Département d'Anesthésiologie, Hôpital Bichat, 170 bd Ney, 75877—Paris Cédex 18, France.
Group I consisted of 14 patients, 13 of whom underwent surgery between 1964 and 1966. One patient underwent surgery in 1969 and had malignant arterial hypertension with an arterial systolic pressure exceeding 300 mm Hg, refractory to treatment with phenoxybenzamine and propranolol. This patient underwent emergency surgery.

All the patients in this group received balanced general anaesthesia with thiopentone, tubocurarine and a narcotic. Hypertensive crises occurring before removal of the tumour were treated with phenolamine given either as a bolus injection i.v. or as an infusion. In three instances trimetaphan was used. Serious arrhythmias such as multiple ventricular extrasystole, bigeminal rhythm or ventricular tachycardia were treated with an infusion of procaimamide and i.v. propranolol in one patient. Hypotension following removal of the tumour was corrected by moderate replacement of blood volume and infusion of noradrenaline over a period of from several hours to several days.

Group II included 50 patients who underwent surgery between 1966 and 1972. Anaesthesia was induced with thiopentone and muscle relaxation was maintained either with an infusion of suxamethonium or with pancuronium. Halothane and increments of a narcotic (dextromoramide or phenoperidine) were used for maintenance of anaesthesia.

Acute episodes of hypertension were controlled by increasing the inspired concentration of halothane. Arrhythmias were treated with i.v. lignocaine. Hypotension was prevented by replacement of the intravascular volume, commencing before excision of the tumour and increasing the rate of infusion after removal. Noradrenaline 10–20 μg was infused in two patients to counter an excessively rapid decrease in arterial pressure.

Group III was composed of 38 patients who underwent surgery between 1973 and 1976. Anaesthesia was induced with a combination of droperidol and phenoperidine. Loss of consciousness was produced with thiopentone 50–100 mg and pancuronium was used as the muscle relaxant. Hypertensive crises were managed by infusions of phentolamine (seven patients) and by sodium nitroprusside (one patient). Arrhythmia was treated with i.v. lignocaine. Replacement of blood volume, which was begun at the start of the operation, was accelerated during removal of the tumour.

With one exception, none of the patients in any of the three groups received either α- or β-adrenergic blocking drugs. Six patients in group II received an inhibitor of catecholamine synthesis, α-methyltyrosine, for periods ranging from a few days to 2 weeks before anaesthesia. Premedication was the same for all patients and consisted of a combination of pethidine 1 mg kg⁻¹ and methylpromazine 0.5 mg kg⁻¹ without atropine.

Monitoring during anaesthesia was standard and comprised measurement of arterial pressure directly with an electromanometer connected to a cannula inserted into the radial artery, measurement of central venous pressure, measurement of urine flow through a urethral catheter and continuous e.c.g. monitoring. Two veins were catheterized and blood volume deficits replaced by solutions of modified gelatine, plasma or whole blood. The surgical technique was the same in the three groups and included, in addition to removal of the tumour, complete exploration of the abdomen through a generous midline incision.

RESULTS

Hypertensive crises before removal of the tumour

Hypertensive crises were defined as an increase in systolic arterial pressure to 250 mm Hg or more for a period of at least 1 min. The incidence was comparable in the three groups (table III).

<table>
<thead>
<tr>
<th></th>
<th>No. of patients with pressure &lt; 250 mm Hg</th>
<th>No. of patients with pressure &gt; 250 mm Hg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I (n = 14)</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Group II (n = 50)</td>
<td>31</td>
<td>19</td>
</tr>
<tr>
<td>Group III (n = 38)</td>
<td>23</td>
<td>15</td>
</tr>
</tbody>
</table>

Hypertension subsided spontaneously as soon as the surgeon stopped manipulating the tumour. Anti-hypertensive treatment with phenolamine, which was administered when the crisis lasted 1–2 min, was effective whenever used. Trimetaphan, used in three patients of group I, increased the instability of the arterial pressure and was subsequently abandoned.

In group II patients, the administration of halothane produced hypotension regularly before manipulation of the tumour. However, during dissection, systolic arterial pressure increased to a value greater than 250 mm Hg for several minutes in 19 patients but no further anti-hypertensive therapy was required.

The use of neuroleptanalgesia in group III resulted in greater stability of arterial pressure than with
halothane, but often at high values. In this group, of 15 patients whose arterial pressure increased to greater than 250 mm Hg, eight required antihypertensive therapy. One patient was treated with sodium nitroprusside which reduced the arterial pressure in less than 1 min.

**Arterial hypotension after removal of the tumour**

The degree of arterial hypotension after removal of the tumour varied according to the anaesthetic technique used (table IV).

A systolic arterial pressure of less than 70 mm Hg was observed in half the patients in group I; 11 in group I required noradrenaline. A decrease in arterial pressure to less than 70 mm Hg was observed in only seven patients in group II and this was managed easily by increasing the rate of fluid replacement. Two patients required noradrenaline 10-20 μg. Only one patient in group III had a decrease in systolic arterial pressure to less than 70 mm Hg, as a result of severe haemorrhage which occurred when the tumour was being removed. In general, group III patients exhibited a more gradual decrease in arterial pressure following resection of the tumour than patients in the first two groups. The volume of infused fluids, in addition to compensation for blood loss, ranged from 500 to 3000 ml in groups II and III (mean: 1100 ± 500 ml SD before resection, 1200 ± 700 ml SD after resection).

**Intra-operative arrhythmia**

These were of various types: sinus tachycardia, nodal rhythms, multiple ectopic ventricular beats, bigeminal rhythm, ventricular tachycardia and fibrillation (table V). In group I, severe arrhythmias were observed in five patients, with reversible circulatory arrest in two, in one of whom the arrest occurred following slow i.v. injection of propranolol 3 mg. In group II, serious arrhythmia occurred when the tumour was manipulated in 36 of the 50 patients. These disturbances required i.v. injection of lignocaine which was regularly effective in this situation. Easily reversible circulatory arrest of short duration occurred in two patients. In group III, only three patients had arrhythmia which was corrected by lignocaine in two patients and by excision of the tumour in one. Sinus tachycardia, occurring in virtually all patients, required no treatment when haemodynamic tolerance was adequate, and disappeared following removal of the tumour.

**Complications after operation**

The frequency of complications after operation was high in group I (table VI).

**TABLE IV. Minimum systolic arterial pressure following removal of the tumour**

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of patients with pressure &gt; 100 mm Hg</th>
<th>No. of patients with pressure between 70 and 100 mm Hg</th>
<th>No. of patients with pressure &lt; 70 mm Hg</th>
</tr>
</thead>
<tbody>
<tr>
<td>I (n = 14)</td>
<td>1</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>II (n = 50)</td>
<td>31</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>III (n = 38)</td>
<td>26</td>
<td>11</td>
<td>1</td>
</tr>
</tbody>
</table>

**TABLE V. Arrhythmia during operation**

<table>
<thead>
<tr>
<th>Tachycardia &gt; 150 beat min⁻¹</th>
<th>Multiple ectopic ventricular beats.</th>
<th>Bigeminal rhythm</th>
<th>Cardiac arrest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I (n = 14)</td>
<td>10</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Group II (n = 50)</td>
<td>30</td>
<td>36</td>
<td>2</td>
</tr>
<tr>
<td>Group III (n = 38)</td>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TABLE VI. Complications after operation**

<table>
<thead>
<tr>
<th></th>
<th>Group I (n = 14)</th>
<th>Group II (n = 50)</th>
<th>Group III (n = 38)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute pulmonary oedema</td>
<td>4</td>
<td>2</td>
<td>—</td>
</tr>
<tr>
<td>Acute renal failure</td>
<td>2</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Hemiplegia</td>
<td>1</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Encephalopathy</td>
<td>—</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>1</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Death</td>
<td>4</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>
The most common complication was acute pulmonary oedema with or without cardiovascular collapse, which was encountered in four patients in group I. In two patients, cardiovascular collapse was responsible for acute renal failure, requiring haemodialysis in one of them. One patient developed hemiplegia which, fortunately, recovered completely, and one patient sustained a myocardial infarct diagnosed on the basis of electrocardiographic findings.

In group II, acute pulmonary oedema was observed in four patients following excessively rapid i.v. infusions, but this responded to appropriate therapy.

In group III, one patient with malignant hypertension (stage 4 retinal changes), secondary to a malignant phaeochromocytoma, developed coma for 3 days, probably as a result of hypertensive encephalopathy.

Four deaths occurred in this series (group I) of which three were in the early part of the period of study. One patient with an intrahepatic malignant phaeochromocytoma died during surgery as the result of the rupture of a hepatic vein causing a massive air embolism. Two other patients succumbed to cardiocirculatory failure: one, during the first day after operation with acute pulmonary oedema, and the other following a period of anuria secondary to cardiovascular collapse which lasted for more than 24 h. This patient died on the 11th day after operation, of systemic infection following two sessions of haemodialysis. The last patient was referred for emergency surgery because of the inability to control malignant hypertension with phenoxybenzamine and propranolol. Anaesthesia was induced with thiopentone and tracheal intubation was performed following i.v. suxamethonium. At the end of the induction phase, atrioventricular block occurred, followed shortly after by circulatory arrest. Resuscitation was successful but anoxic sequelae persisted, leading to death 20 days after surgery. Since this accident, 80 patients have undergone surgery with no mortality.

**DISCUSSION**

The reduction in operative mortality to almost zero in patients with non-malignant phaeochromocytoma is the result of our increased knowledge of the pathophysiology of these tumours. In considering the reasons for this improvement, we have examined several factors: the preparation of patients, the management of anaesthesia and the treatment of intra-operative haemodynamic disturbances.

**Preparation of patients**

Preoperative preparation of patients with pharmacological blocking agents is regarded as the major factor in the reduction of morbidity.

Pharmacological blockade of adrenergic receptors may be of two types. The α-blocking agent used initially to prepare these patients for surgery was phentolamine (Goldfien, 1963) which was subsequently abandoned because of its short duration of action. It was replaced by phenoxybenzamine, the duration of action of which is 24–48 h (Ross et al., 1967; Crout and Brown, 1969; Perry and Gould, 1972). Patients were treated for periods of a few days to 1 or 2 weeks and therapy was discontinued 24–48 h before surgery. The advantage of phenoxybenzamine is that abrupt variations in arterial pressure are avoided during the operation and volume-expanding fluids may be infused before removal of the tumour. This drug also has disadvantages (Harrison, Bartlett and Seaton, 1968; Katz and Wolf, 1971; Vaysse et al., 1971; Deoreo et al., 1974) as it may mask a tumour during exploration of the abdomen. Sudden arterial pressure changes represent a useful sign to the surgeon looking for ectopic tumours. While the administration of adrenergic inhibitors may reduce the incidence of hypotension following removal of the tumour, if hypotension does occur it is difficult to treat if pharmacological blockade is complete. In fact, blockade is incomplete since all investigators discontinue treatment 24–48 h before surgery so that hypertensive crises occurring on manipulation are not always avoided. Comparison of variations in arterial pressure in phenoxybenzamine-prepared and unprepared patients has not revealed any clear differences in our series. Most patients prepared with phenoxybenzamine required an infusion of phentolamine to treat hypertensive crises occurring during surgery. Furthermore, the use of halothane, and subsequently neuroleptanalgesia allowed us to infuse sufficient fluids before resection of the tumour in all patients, even in the absence of preparation with phenoxybenzamine.

β-blocking agents, propranolol in particular, have been used either alone or in combination with phenoxybenzamine (Ross et al., 1967; Crout and Brown, 1969). However, its efficacy in preventing intra-operative arrhythmia has been questioned (Harrison, Bartlett and Seaton, 1968; Perry and Gould, 1972). In addition, both the negative inotropic effect of anaesthetic agents and the myocardial effects of sudden catecholamine withdrawal may be enhanced by β-blockade.
Structural analogues of tyrosine, such as α-methyltyrosine are competitive inhibitors of tyrosine β-hydroxylase. This drug has produced good results in patients with malignant phaeochromocytoma for which complete surgical resection was not possible (Engelman et al., 1968; Tcherdakoff et al., 1972). Engelman and his colleagues (1968) observed greater haemodynamic stability during operation in patients prepared with this drug. It was not found effective in preparing patients for surgery by either Jones and co-workers (1968) or ourselves. Indeed, six patients of group II prepared with α-methyltyrosine exhibited arterial pressure variations during surgery comparable to those of unprepared patients.

The administration of volume-expanding fluids before operation has been advocated also (Deoreo et al., 1974) to correct the reduction in blood volume, which may be as high as 30% in patients with phaeochromocytoma (Brunjes, Johns and Crane, 1960). However, Sjoerdsma and colleagues (1966) found that all their patients except those with malignant phaeochromocytoma had normal blood volumes.

Anaesthesia

Drugs used for anaesthesia should have weak sympathomimetic properties, to interfere as little as possible with the high circulating concentrations of catecholamines.

Substantial preanaesthetic medication should be administered to minimize the anxiety associated with transfer to the operating theatre. Chlorpromazine has been suggested because of its α-blocking properties (Bingham, Elliott and Lyons, 1972), but these properties are not very potent (De Blasi, 1966).

Spinal anaesthesia (Goldfien, 1963) and extradural anaesthesia (Bromage and Millar, 1958; Cousins and Rubin, 1974) have been used on a few occasions with satisfactory results. In practice, sympathetic blockade may enhance the sensitivity of receptors to catecholamines secreted during manipulation of the tumour and increase arterial pressure instability.

General anaesthesia is the usual choice of technique and most of the volatile agents have been employed at some time. Ether was considered as the anaesthetic agent of choice (Perry and Gould, 1972), but has been abandoned because of the risk of explosion. Halothane has been used for its hypotensive properties (Rollason, 1964; Cooperman, Engelman and Mann, 1967; Desmonts et al., 1969; Katz and Wolf, 1971; Scott et al., 1976). However, it sensitizes the myocardium to the effects of catecholamines and promotes arrhythmia (Katz and Epstein, 1968). The high incidence of arrhythmia observed in group II patients led us to replace this agent with neuroleptanalgesia. Methoxyflurane produces a lower incidence of arrhythmia (Crout and Brown, 1969), but is now unpopular because of its renal toxicity (Cousins and Mazze, 1973). Arrhythmias have been reported to be less common with fluroxene (Joas and Craig, 1969).

Of the neuromuscular blocking drugs, gallamine should be avoided because of its anticholinergic effect (Stoelting, 1973) and tubocurarine because of its histamine-releasing properties. Alcuronium and pancuronium appear to have more moderate haemodynamic effects (De Blasi, 1966; Zsigmond, Matsuki and Kothary, 1974). Suxamethonium has been used without problems for tracheal intubation even though it may trigger disturbances of rhythm (Stoner and Urbach, 1968).

More recently, neuroleptanalgesia has been used (Simone, Barusco and Coan, 1968; Clarke, Tobias and Challen, 1972; Remine et al., 1974; Stamenkovic and Spierdijk, 1976). Several investigators have used a combination of droperidol with either fentanyl or phenoperidine. The major advantage of this method in our experience has been a decreased incidence of arrhythmia and greater stability of the arterial pressure. Experimentally, the dose of adrenaline required to trigger arrhythmia is doubled following pretreatment with droperidol (Long, Dripps and Price, 1967; Bauer, Kreuscher and Menzel, 1971; Bertolo, Novakovic and Penna, 1972). Droperidol increases the refractory period of Purkinje cells (Hauswirth, 1968), and reduces ion exchange at this level (Kern et al., 1971).

Treatment of cardiovascular disturbances during operation

Hypertensive crises. Although the incidence of hypertensive crises is reduced by preoperative preparation with α-blocking drugs, crises still occur in virtually all patients when the tumour is manipulated. Treatment is necessary if the arterial systolic pressure exceeds 250 mm Hg for several minutes. These crises are tolerated fairly well by young patients, but those with severe and permanent arterial hypertension require rapid treatment of a hypertensive crisis.
Phentolamine has been the drug used most commonly for this purpose, because of its short duration of action. Sodium nitroprusside is an extremely short-acting anti-hypertensive agent, the effects of which cease 60–120 s after the infusion is stopped (Styles et al., 1973). It has been used with satisfactory results by several investigators (Katz and Wolf, 1971; Csanky-Treels et al., 1976; Stamenkovic and Spierdijk, 1976) and by ourselves in one patient.

Arrhythmia. A variety of arrhythmia of varying degrees of severity has been observed during anaesthesia of patients with pheochromocytoma. Supra-ventricular arrhythmia requires treatment if haemodynamic changes are produced. In contrast, ventricular arrhythmia should always be treated quickly to avoid progression to serious arrhythmia. β-blocking agents have frequently been used with success (Cooperman, Engleman and Mann, 1967; Ross et al., 1967). Their duration of action following i.v. administration is approximately 30–45 min and their actions may persist following removal of the tumour. The only patient in our series (group I) who was given i.v. propranolol during surgery developed cardiac arrest immediately following its administration, but fortunately this patient responded to closed-chest cardiac massage.

Lignocaine possesses less specific properties against catecholamine-induced arrhythmia (Cooperman, Engleman and Mann, 1967). However, its duration of action is short and its inotropic properties are negligible in a dose of 1 mg kg⁻¹. This drug has consistently produced remarkable results in our patients and we feel it is the anti-arrhythmia agent of choice in this type of surgery. In our experience, the use of droperidol has reduced the need for lignocaine. This is exemplified by the fact that only three patients out of 38 in group III had an arrhythmia requiring the administration of lignocaine.

Arterial hypotension following resection of the tumour. Replacement of blood volume is now recognized universally as the treatment of arterial hypotension following resection of pheochromocytoma. Generally, fluid is infused before removal of the tumour and the rate of infusion is increased following resection. The rate of replacement may be restricted by transient cardiac failure. Four patients in group II developed pulmonary oedema despite central venous pressure values within normal limits. Sudden withdrawal of catecholamine stimulation and the possible existence of adrenergic cardiomyopathy (Baker et al., 1972; Garcia and Jennings, 1972) may account for this transient heart failure. Monitoring pulmonary capillary wedge pressure by means of a Swan–Ganz catheter is a better guide to blood volume replacement than measurement of central venous pressure in patients with pheochromocytoma (Darby and Prys-Roberts, 1976). However, the risk of triggering arrhythmias on insertion of the catheter into the heart chambers raises the question as to whether this technique should be used in patients with pheochromocytoma.

The course of these patients after operation has been simplified considerably, at least in those with a single tumour, since replacement of blood volume has been substituted for the use of a noradrenaline infusion. Complications following surgery are still a threat, however, in patients with malignant pheochromocytoma when there are residual foci of tumour tissue (Gould and Perry, 1972) or when there is extensive organ involvement by vascular disease resulting from long-standing arterial hypertension. One female patient in group III with malignant arterial hypertension of about 10 years’ duration, related to multiple chromaffin tumours, developed encephalopathy which lasted 3 days and was secondary to persistent postoperative hypertension.

ACKNOWLEDGEMENTS

We express our thanks to Dr Richard Edelstein for the translation of the manuscript into English and to Miss Murielle de Marez for her secretarial help.

REFERENCES


TRAITEMENT ANESTHESIQUE DES MALADES SOUFFRANT DE PHEOCHROMOCYTOME

Résumé

Cent-deux malades souffrant de phéochromocytome, qui avaient été soumis à une intervention chirurgicale par la même équipe entre 1964 et 1976, ont été divisés en trois groupes suivant le protocole anesthésique utilisé: (1) anesthésie équilibrée et contrôle de l'hypotension par la noradrénaline; (2) anesthésie par l'halothane et remplacement du volume sanguin; (3) neuroleptanalgésie (droperidol et phénoperidine) et remplacement du volume sanguin. Aucun des malades de l'un quelconque de ces trois groupes n'a reçu de modérateur adrénergique avant l'anesthésie. La comparaison des résultats des trois groupes a fait ressortir que le principal facteur responsable de la réduction de la mortalité opératoire à zéro ou presque a été le contrôle de l'hypotension par le remplacement du volume sanguin plutôt que l'usage de la noradrénaline après résection de la tumeur, alors que le type d'agent anesthésiant n'a eu qu'une importance secondaire.

NARKOSEDURCHFÜHRUNG BEI PATIENTEN MIT PHÄOCROMOZYTOMEN

Zusammenfassung


TRATAMIENTO ANESTESICO DE PACIENTES CON FEOCROMACITOMA

Un análisis de 102 casos

Sumario

Ciento y dos pacientes con feocromacitoma quienes fueron operados por el mismo equipo entre 1964 y 1976 fueron divididos en tres grupos de acuerdo con el procedimiento anestésico empleado: (1) anestesia equilibrada y control de la hipotensión con noradrenalina; (2) anestesia con halotano y restitución del volumen de sangre; (3) neuroleptanalgesia (droperidol y fenoperidina) y restitución del volumen de sangre. Ningún paciente en cualquiera de los tres grupos recibió inhibidores adrenérgicos antes de la anestesia. Una comparación entre los resultados de los tres grupos indicó que el principal factor responsable de la reducción a casi cero de la mortalidad operatoria fue el control de hipotensión mediante la restitución del volumen de sangre en vez de emplear noradrenalina después de la resección del tumor, mientras que el tipo de agente anestésico empleado resultó de importancia secundaria.