

APGAR, VIRGINIA, AND PAPPER, E. M.:
Pheochromocytoma: Anesthetic Management During Surgical Treatment.
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"Patients with pheochromocytoma pose several challenges of theoretical and practical importance. The problem of the relationship between hyperfunction of chromaffin tissue and hypertension is brought forward in this lesion. Secondly, only hypertension which is caused by a pheochromocytoma can be cured completely by surgical treatment. Finally, the presence of large quantities of circulating epinephrine and arterenol (nor-epinephrine) in the blood of these patients poses serious and difficult problems in anesthetic management. These have a significant bearing on the current high operative mortality rate (approximately 20 per cent). Since pheochromocytoma is an uncommon lesion which has so many facets of interest, a review of the literature was undertaken together with a summary of the experience gained in the operative management of this disease at the Presbyterian Hospital [New York City]. Criteria for inclusion in this survey were signs and symptoms of hyperadrenalemia and a proved pheochromocytoma at operation or autopsy. Patients without these criteria were excluded from consideration. . . .

"Examination of all reported cases in the literature in which operation was performed was completed to summarize the currently available information concerned with anesthetic management. Some difficulty was presented by multiple reports of the same case. One patient, M. M., has been the subject of five different papers, while another, J. L., has been reported on four times. Of the 91 patients reported to date, 15 were subjected to other operative procedures before the correct diag-

nosis was made. In addition there are records of 16 other patients in whom pheochromocytoma was found at autopsy and in whom an unrelated operation had recently been performed. Fifteen of these 16 patients died from two to 48 hours postoperatively in irreversible shock. One patient died several months after an uneventful thyroidec-tomy. The mortality rate in the group of patients suspected of having pheochromocytomas was 24 per cent, while in the unsuspected group it was slightly over 50 per cent. This difference in mortality demonstrates clearly the need to avoid unrelated surgical manipulations in patients with pheochromocytomas. . . . In over half of the cases in which operation was performed for pheochromocytoma, the type of anesthetic agent or technic was not mentioned. . . . In 22 patients ether was the principal anesthetic agent, and in five patients cyclopropane was utilized, usually in combination with ether. Spinal anesthesia was administered seven times. Ethylene was reported used three times, vinyl ether (vinethene) twice, tribromethanol 'several times' and thiopental sodium (pentothal) twice. The relationship between mortality and morbidity and anesthetic agent or technic cannot be defined clearly from the data available. . . .

"In the group of unsuspected pheochromocytomas, proved at some subsequent time, the type of operation unrelated to the correction of this disease was as variable as the choice of anesthesia. The usual postoperative history was one of severe and irreversible circulatory collapse, with death in from two hours to two days. . . . Our own experience with pheochromocytoma includes 12 operations on 10 patients for the removal of the tumor. Eight of these survived. Four other patients with unsuspected pheochromocytoma were operated on for other lesions. All died, and the tumor was found at

autopsy. In addition, exploration has been performed in 14 patients without demonstrating the tumor at operation. Our cases are included in the previous total figures, while two of the pheochromocytoma cases and four of the unsuspected cases have not been previously reported. In six other cases in our clinic pheochromocytoma has been found at autopsy, but since no symptoms of hyperadrenalemia were present, they have been omitted from this series. . . .

"The greatest pitfall in anesthetic management is the development of anoxia, which stimulates secretion of the adrenal medulla even more than the abnormal situation already present. . . . Anoxia in any form must be scrupulously avoided if uncontrollable tachycardia and hypertension usually followed by circulatory collapse are to be avoided. The patients are peculiarly sensitive to any stress placed on circulatory dynamics. For example, they tolerate postural changes poorly. This disability has been so remarkable that anesthesia is now induced and maintained in the position of operation, usually the supine for a transperitoneal approach. The excessive quantities of circulating medullary hormone are potential causes of fatal cardiac arrhythmias in the presence of anesthetic agents likely to sensitize the myocardium. For these reasons, cyclopropane and chloroform are avoided. There are two major surgical problems which concern the anesthesiologist. The first of these is the possibility of traumatic pneumothorax, which is dangerous when uncontrolled in the patient with pheochromocytomas. An endotracheal airway is considered an essential safeguard in all explorations. Secondly, the technical details of extirpation are of importance. The tumor must be isolated from the systemic circulation by a minimum of manipulation to avoid flooding with

epinephrine and arterenol. The selection of anesthesia is perhaps less important in some respects than meticulous attention to detail in order to avoid the physiological upsets discussed previously. Spinal anesthesia has not appeared desirable because of its potentiality for producing hypotension and the lack of protection against pneumothorax. Cyclopropane is not safe because of the large quantities of circulating epinephrine. The use of thiopental sodium and nitrous oxide oxygen is inadequate for relaxation without curare. We have been loath to use curare because of its histamine-like properties, an objection that may be more theoretical than actual. A safe method which satisfied most requirements appears to be a tranquil induction with thiopental sodium followed by maintenance with ether through an endotracheal airway. There have been no serious consequences of the 'sympathomimetic' qualities of ether. Pre-medication should not be heavy but otherwise is not of direct importance. . . . An intravenous drip is mandatory prior to the establishment of anesthesia. Benzodioxan (10 mg. in 1 cc.) is available and may be needed to reduce a paroxysmal hypertension occurring during surgical manipulation. It is rapid in action and is therefore preferable to dibenamine. After excision of the tumor, the removal of autogenous epinephrine and arterenol may result in marked hypotension. For this phase of the procedure, arterenol (4 mg. per liter) or neo-synephrine (20 mg. per liter) infusions are utilized. These drugs are satisfactory pressor agents and have less cardiac effect than epinephrine, a desirable property. The rate of flow is adjusted to maintain a moderate hypertension during operation. It can usually be reduced postoperatively."

A. A.