# ANESTHETIC MANAGEMENT DURING HYPOPHYSECTOMY FOR FULMINANT "JUVENILE" DIABETES *†‡

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PROGRESSIVE vascular disease with resultant blindness and eventual renal failure is the lot of a high percentage of patients with the juvenile form of diabetes. There is abundant evidence that this type of diabetes is in a very real sense a pituitary disease, that is the pituitary makes excessive amounts of hormonal factors which tend to produce hyperglycemia and which, in the net, are "anti-insulin" in their effects. For this reason, total hypophysectomy has been carried out in five such cases.

The long-term clinical and metabolic changes in these patients are reported elsewhere (1). Here, some of the special problems in anesthesiology which this type of surgery presents will be discussed.

The anterior pituitary makes at least six hormonal entities: adrenocorticotropin, thyrotropin, two gonadotropins, growth hormone and prolactin. Of these, only ACTH is of critical importance in the surgical and immediate post-surgical period. The adrenal cortex is vitally concerned in response to various forms of stress, including surgery. It is therefore mandatory that one include corticoid hormones in the management of such patients before, during and after operation.

Immediate changes in the patient's condition during hypophysectomy are referable to adrenal insufficiency, the sequence of events being [1] decreased blood pressure, and [2] diminished urinary output. Later, there is a markedly increased insulin sensitivity. Late changes are attributable to diminished or absent thyroid and gonadal activity.

## GENERAL CONSIDERATIONS

The surgical approach is through a right frontotemporal incision beneath the frontal lobe to the sella turcica. The patient is recumbent with a small sandbag under the occiput flexing the head moderately.

Inasmuch as these patients, although young, have advanced severe arterial disease, they represent only fair surgical risks. This plus the position dictates the anesthetic problem. An endotracheal airway is required.

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Hypotension is to be avoided because of its attendant impairment in renal function and the possibility of cerebral damage. Extreme hypertension is potentially dangerous since arteriosclerotic plaques in the central nervous system circulation may give way with the resulting hemorrhage and hemiplegia or some other disaster. Death may result from cerebral vascular accidents, coronary occlusion or, more often, from renal failure. It is therefore paramount that during an operation of this length the renal filtration pressure be maintained at all times. Such changes are readily observed in the variable rates of flow from the urethral catheter inserted in all of these patients.

## DETAILS OF PROCEDURE

1. The patient is admitted on the metabolic service and is studied and treated until he is considered in optimal condition for operation. At the present time, candidates for surgical therapy must show progressive damage to the eyes and kidneys but a reasonable amount of renal reserve.

2. Beginning thirty six hours before surgery 50 mg. of cortisone acetate is given intramuscularly every 12 hours. This is continued for several days after operation.

3. All food is discontinued 18 hours prior to operation.

4. Eighteen hours before operation the continuous intravenous administration of 5 per cent glucose solution is begun. To this solution is added 2 Gm. each of KCl and NaCl per liter, 250 mg. terramycin, and the indicated amount of insulin. This procedure is continued throughout and immediately following operation. Administration of fluids is at the rate of 100 cc. per hour.

5. The anesthesia department is notified several days prior to the scheduled operation, and the patient is seen by the anesthetist at least 24 hours before operation. The anesthetist supervises the placement of the needle used for the continuous intravenous solution, usually in a vein of the forearm. An 18 gauge needle or a plastic cannula is used. Since fluid, insulin and electrolyte therapy has been under the supervision of the metabolic service, the anesthetist orders only the pre-anesthetic medication. We have used moderate or average premedication; more recently, patients are more lightly medicated. The least depression possible compatible with repose and absence of straining and coughing has been our goal.

6. When the patient enters the operating room, 100 mg. of hydrocortisone is added to each liter of intravenous solution. A second intravenous infusion is started, usually in an ankle vein with a 15 gauge Lewisohn needle.

7. Oxygen by mask is started when the patient is placed on the table and is continued while the pressure cuff is applied and the second intravenous infusion is begun. If the patient seems apprehensive, 50–100 mg. of pentothal® is given at this time.

8. Induction is slow with intermittent small doses of pentothal. Succinylcholine chloride, 30 to 50 mg., is used as a relaxant to avoid the drop in blood pressure commonly seen when *d*-tubocurarine is used. Rapid intubation with a cuffed tube liberally anointed with 5 per cent xylocaine® ointment is then accomplished. Transtracheal anesthesia is not employed nor is a cocaine spray used.

9. Anesthesia is maintained with nitrous oxide and oxygen, usually 4 liters to 3, supplemented with small doses of meperidine (demerol®) and pentothal sodium. The soda lime in the absorber is fresh at the start of the operation and the absorber is in the circuit at all times.

The blood pressure is checked regularly and maintained at a level near that of the patient's resting preoperative level, that is at 140 if it was 160 preoperatively.

The indwelling urethral catheter, which was inserted before the operation, is then opened and connected to a graduated flask. The rate and amount of urine flow is noted regularly by an internist from the metabolic service. He also frequently tests the urine for sugar. Blood sugar determinations are sometimes made during the procedure. Insulin is given intravenously according to the need for it as demonstrated by these tests.

10. Respiratory depression is avoided, but care must be exercised that anesthesia should not become so light that bucking or coughing results since the surgeon's task is a delicate one. Intermittent small doses of *d*-tubocurarine were used in three of our cases on the theory that autonomic blockade might be helpful. This did not prove so and the practice has been discontinued.

11. Drops in blood pressure are immediately reflected in the observed rate of urine flow from the urethral catheter.

12. Three units of blood are available and the first 500 cc are started when the scalp incision is made. Blood replacement during the operation was 500 cc. in three of our cases and 1000 cc. in three others.

## RESULTS

1. Six hypophysectomies on five patients have been performed to date. One patient had to be operated upon a second time because the gland was not completely removed during the first operation.

2. Table 1 indicates the severity of the disease in these five patients. Four patients were under 31 years of age, the other was 37.

3. There was a drop in blood pressure after induction of anesthesia in three cases. In one it was necessary to use levophed® for a brief period. One patient with an initial pressure of 180/110 mm. of mercury was maintained with a pressure ranging from 96/60 to 130/85 without apparent change in urine flow. The immediate postoperative course in the recovery room was uneventful at all times.

TABLE 1

| Case | Sex | Age | Blood Pressure, mm. Hg | Urine Albumin, mg. % | Blood Sugar on Admittance, mg. % | PSP | Fundi |
|---|---|---|---|---|---|---|---|
| 1. D. K. | F | 31 | 150/100 | 1,500 | 420 | 5%—15 min.<br>Less than 5%—30 min.<br>10%—1 hr. | KW 4 |
| 2. A. S. | M | 26 | 200/110 | 200 | 250 | 2.5%—15 min.<br>2.5%—15 min.<br>2.5%—1 hr. | KW 4 |
| 3. M. G. | F | 26 | 180/110 | 1,700 | 261 | | KW ?<br>Blind<br>Left |
| 4. J. L. C. | M | 31 | 150/95 | 95 | 266 | 5%—15 min.<br>25%—30 min.<br>20%—1 hr. | KW ?<br>Blind<br>Right |
| 4b. J. L. C. (Re-op.) | M | 31 | 175/98 | 91 | | | |
| 5. A. F. | M | 37 | 170/108 | 175 | 125 | | KW 3 |

4. Two patients died, 4 to 6 months postoperatively, of renal failure. The other three have shown a marked decrease in their insulin requirements, an apparent arrest in the progression of the arteriosclerotic changes, and one has had a remission of a troublesome anemia. It is still too early to permit complete evaluation of the results.

## SUMMARY

Five cases of hypophysectomy for juvenile diabetes are reported, not because they represent a new anesthetic technique, but rather to show the adaptation of our methods to new problems in physiology. We wish especially to emphasize the necessity for teamwork between the clinical physiologist, the neurosurgeon and the anesthesiologist.

## REFERENCE

1. Kinsell, L. W., Laurence, L., and Balch, H.: Diabetes. In Press.