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THE USE OF SPINAL ANESTHESIA TO CONTROL SYMPATHETIC OVERACTIVITY IN HYPERTHYROIDISM * †

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THE fact that hyperactivity of the adrenal glands takes a conspicuous part in the syndrome of hyperthyroidism has been stressed by a number of writers, among them Crile (1); Bartels, Stewart and Johnson (2); Maddock, Coller and Pedersen (3). Crile and Bartels et al. advocated the use of spinal anesthesia for the control of this hyperactivity.

Rea (4, 5), of the surgical staff of the University of Minnesota, has previously reported upon the use of spinal anesthesia to assist in the control of this condition. In one communication he described the treatment of postoperative thyroid crisis by the use of spinal anesthesia, and in another more recent one he reported a series of twenty cases of hyperthyroidism at the University of Minnesota Hospitals in which spinal anesthesia was used as an aid in the control during the operative period.

It is the purpose of this paper to recount briefly the basis of the use of spinal anesthesia in this field and our impressions of the results, together with a few suggestions as to the technic. It is not our purpose at this time to go into the matter of preoperative preparation by all of the means which we now have at hand. Suffice it to say that all of the patients have had the benefit of preoperative rest, sedation, high caloric diet especially with high carbohydrate and high protein content, Lugol's solution and thiouracil since it has been available. Increase in body weight has been obtained whenever possible before surgery and an attempt has been made to reduce the pulse rate and the

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basal metabolic rate to normal or nearly normal levels. Whenever it has seemed that the best possible improvement has been attained it has been decided what type of surgical procedure should be carried out, whether ligation, lobectomy or subtotal thyroidectomy. It has been only for the cases which have not been brought under sufficiently satisfactory control by the usual measures that spinal anesthesia has been considered as a part of the operative management.

Spinal anesthesia is not administered with the purpose of providing or even assisting the anesthesia for the surgical procedure. The purpose is solely to anesthetize that part of the sympathetic nervous system which innervates the adrenal glands and, therefore, to reduce the secretion of epinephrine both immediately before operation and as a result of the increase of thyroxin in the circulation as a result of manipulation of the gland. It is our custom to anesthetize all of the apprehensive and rather toxic patients with intravenous sodium pentothal in their rooms without the patient knowing that the day for operation has arrived, if it is possible to achieve this deception. While asleep under the sodium pentothal the patient is taken to the operating room. For most of these patients the anesthesia is then continued with some inhalation agent, usually cyclopropane but occasionally ethylene. For the few patients who have been especially resistant to the preoperative treatment spinal anesthesia is added. Upon the patient's arrival in the operating room and while he is still under the sodium pentothal anesthesia, the spinal anesthetic is administered. The patient is then placed in the operative position and inhalation anesthesia begun. The following is a description of the first case which we managed in this way.

CASE REPORT

C. G., aged 41 years, was admitted to the University of Minnesota Hospitals, October 11, 1941. He gave a history of dyspnea, and fatigability since the winter of 1940 to 1941. Rather marked irritability had been noted by his wife about eight months previously. He noticed a mass in his neck and pounding of the heart approximately three months prior to admission. In spite of an increased appetite, he had lost 35 pounds in the past year. He had noticed tremor of the hands for approximately two years.

On admission, the patient's temperature was 98.8 F., pulse 100, respiration 20, and blood pressure 138 mm. systolic and 60 mm. diastolic.

Physical examination revealed a well-nourished, well developed white man who was rather hyperactive. There was mild exophthalmos of both eyes and the thyroid gland was diffusely enlarged and firm. No bruit was heard. The heart was of normal size and the tone was forceful; no murmurs were heard. The lungs were clear to auscultation and percussion and there were no abdominal masses. A fine tremor of both hands was present. There was a staring expression of the eyes and definite lid lag.

The patient had received Lugol's solution, ten drops three times a day, since September 28, 1941. He had also been given phenobarbital, 1½ grains

three times a day, and thiamine chloride, 1 mg. four times a day. Some difficulty was experienced in raising his caloric intake sufficiently, but with a 5,200 calorie, high carbohydrate, high protein diet, his hunger was relieved and he began to gain weight. Basal metabolic rate, September 18, 1941, was plus 84 per cent; October 2, 1941, plus 74 per cent, and October 12, 1941, plus 51 per cent. The basal metabolic rate never went below this level at any subsequent test. His pulse rate was not excessive and consequently it was thought that lobectomy should be attempted.

October 28, 1941, pentothal was given intravenously in his room and he was taken asleep to the operating room, where inhalation cyclopropane anesthesia was instituted. At the beginning of the operation the blood pressure was 140 mm. systolic and 80 mm. diastolic and the pulse 120 per minute. After making the skin incision in the neck, his blood pressure was 180 mm. systolic and 90 mm. diastolic, but the pulse was still 120 per minute. On cutting through the platysma muscle and retracting the strap muscles of the neck, the blood pressure was found to be 220 systolic and 100 diastolic and the pulse 160. Some of this untoward reaction was thought to be due to the cyclopropane, so this anesthetic was discontinued and only oxygen given. However, since the patient did not improve, the skin incision was closed and the patient transferred back to his room.

The patient had quite a stormy time for the first few postoperative days. Because of this reaction, it was decided to give him a course of deep radiation therapy to the thyroid gland; he received 500 r/air to the anterior thyroid region and 250 r/air to the right and left lateral thyroid areas over a period of nine days from November 5 to 14, 1941. His basal metabolic rate November 7, 1941, was plus 53 per cent. He became somewhat restless and did not seem to acquire a mental and physical calmness during this time.

November 17, 1941, the patient was operated upon again. Anesthesia was induced with intravenous pentothal sodium in his room. In the operating room 75 mg. of procaine hydrochloride was given intraspinally in the second lumbar interspace. Anesthesia, as determined by pinching the skin with a Backhaus forceps, was obtained to the third intercostal space. Inhalation ethylene anesthesia was then given and a bilateral subtotal thyroidectomy performed.

The patient had a surprisingly smooth operative course. The blood pressure was maintained at about 140 mm. systolic and 80 mm. diastolic and the pulse between 100 and 120. Postoperatively, his condition was good and, except for a hematoma in the wound, his course was uneventful. He was discharged, November 30, 1941, with instructions to report for check-up examination to the outpatient clinic. When he was seen January 16, 1942, his basal metabolic rate was plus 35 per cent, his weight was 215 pounds, and he looked and felt well. April 16, 1942, his basal metabolic rate was plus 12 per cent, his weight 220 pounds, and he was doing moderately heavy work.

Since the twenty cases reported by Rea in July 1944, four other patients have been operated upon at University of Minnesota Hospitals under this regime with similar operative and postoperative results. The typical picture is that the blood pressure and pulse run a more even and less elevated course than we expect in even less toxic patients under the usual regime without spinal anesthesia. The awakening is quieter, the patients seem more content and less mentally active.

The technic of the spinal anesthesia must be so planned as to produce anesthesia up to approximately the fifth or perhaps the fourth thoracic segment. In some of our earliest cases we were inclined to be too conservative, with a result that anesthesia did not extend as high as desirable and we still had too much sympathetic and adrenal activity. Procaine has been the drug of choice principally, I believe, because of our desire to be conservative. In several of the early cases only 80 mg. was given. Gradually we became braver and increased the dose to 100, 120, and even in one or two cases to as much as 150 mg. We at first used the second lumbar interspace but soon learned that we must use the first in order to be sure of obtaining high enough anesthesia. In fact, in order to make sure that the level is obtained, we have found it advisable to raise the head and neck on a rather high pillow and tilt the head of the table slightly downward in order to encourage the solution to extend well up into the thoracic concavity without continuing up into the cervical region. As soon as skin anesthesia has developed up to the fourth or fifth rib, the patient is placed in any position which the surgeon desires. During the last year we have chosen pontocaine rather than procaine in several cases and we have diluted it with dextrose solution in order to increase the specific gravity and to make the technic described effective. We are inclined to believe that the added duration of anesthesia with pontocaine is of considerable benefit to these toxic patients.

Probably the greatest problem and that which has been argued most among ourselves is whether or not to use ephedrine or other pressor drug for the control of blood pressure. At first, because the very purpose of the spinal anesthesia was to check the adrenal activity, it was thought that the introduction of ephedrine would nullify the purpose of the procedure. In two instances very severe falls in blood pressure levels occurred within ten minutes after the introduction of the spinal anesthetic. Neither blood pressure nor pulse could be determined. Even in these instances no ephedrine was given. The patient was put into the Trendelenburg position and intravenous fluids speeded up. After a rather worrisome time the blood pressure level and pulse rate returned to normal. After these cases the original conviction of the writer was increased, that the blood pressure in these patients should be cared for in just the same way as in any other patients receiving spinal anesthesia. It is my belief that the use of ephedrine or neosynphrin in just sufficient doses to maintain the blood pressure at the same or a little lower level than existed preoperatively does not nullify the beneficial effect of the spinal anesthesia. The spinal anesthesia still prevents hyperadrenalism and the dose of our pressor drug if chosen carefully does not replace this excess. During the last year, therefore, we have used ephedrine in 20 to 40 mg. doses as a prophylactic and have used when necessary ephedrine 6 to 12 mg. with neosynphrin 0.3 to 0.6 mg. to maintain an adequate blood pressure level.

With this modification of our original technic it seems that the course has been even smoother.

In another hospital in Minneapolis thyroidectomy had been canceled because, although the basal metabolic rate had been brought down to plus 30 per cent, a retest on the morning of operation had shown a rise to plus 90 per cent and a pulse rate of 160. The writer suggested to the surgeon that, inasmuch as this patient had already had the benefit of two weeks of careful preparation, the likelihood of further improvement was not very good and that a spinal anesthesia might be advisable as an aid in the management. The patient had been told already that she would not be operated upon until after several days of further care. She was given sodium pentothal on the pretext of obtaining a laboratory specimen of blood, and after the administration of spinal anesthesia the blood pressure level decreased to 130 mm. systolic and 80 mm. diastolic and the pulse to 100. There was practically no increase in either of these during the operative procedure and the patient made an uneventful recovery.

Stuart C. Cullen, director of anesthesia at the University of Iowa, has kindly given me notes on several patients who have undergone similar care under his supervision. Three of these patients were operated upon with this type of management, with results very similar to those described. His favorite general anesthesia technic is to use avertin supplemented with nitrous oxide. Two of Cullen's patients did not have spinal anesthesia at the time of operation but had severe postoperative thyroid crises, one twelve hours and the other thirty hours postoperatively. Each developed rapid pulses, 130 to 160, and temperatures of 103.8 and 104. They were given spinal anesthesia for the treatment of the crisis, one receiving 150 mg. and the other 130 mg. of procaine. The pulse rate dropped to 100 in one case and 115 in the other, the temperatures to 101.2 and 101.6. The blood pressures were reduced about 20 points and gradually returned to previous levels. Both patients looked much less toxic. One proceeded uneventfully to recovery. The other had somewhat recurring symptoms, but an infection was soon discovered and recovery was uneventful following the drainage.

My most vivid recollection of the effect of spinal anesthesia during a postoperative crisis is the case of a 16 year old girl who had been operated upon elsewhere and had made a good recovery, returning home upon the seventh or eighth day. During the next two or three days she became ill and was brought to the University Hospital with a pulse rate of 160; blood pressure 160 mm. systolic and 100 mm. diastolic; skin, red, hot and dry; eyes, glaring; temperature, 103. Soon after her arrival she was given 120 mg. of procaine in 2.5 cc. of spinal fluid between the first and second lumbar spinous processes. Anesthesia was obtained to the fifth thoracic segment, blood pressure was lowered to 120 mm. systolic and 80 mm. diastolic, and the pulse rate

was reduced to 110. In twenty minutes she looked relaxed and in repose, her eyes assumed a normal appearance, her fright disappeared and she conversed calmly and rationally. She soon went to sleep. Her temperature came down to 99 in a period of a few hours. She made an uneventful recovery.

This series of cases is too small to carry any definite authority, but to us it has been clinically impressive. Whereas thus far we have elected to use spinal anesthesia only for extremely toxic patients, it is possible that we will find it of advantage for patients who are not in such extreme need. At any rate, we believe it is a procedure which merits further consideration and investigation.

SUMMARY

Evidence has been presented by a number of investigators that hyperadrenalism takes a considerable part in the syndrome of hyperthyroidism.

Spinal anesthesia to the level of the fifth, or possibly the fourth, thoracic segment seems to have a beneficial effect upon patients in thyroid crisis and thyrotoxic patients undergoing operation upon the thyroid gland.

REFERENCES

1. Crile, G. W.: Trans. Third Internat. Goiter Conf. and Am. Assn. for Study of Goiter, 1938.
2. Bartels, Stewart and Johnson: Transactions Am. Assn. Study of Goiter, p. 133, 1940.
3. Maddock, Collier and Pedersen: Transactions of American Society for the Study of Goiter, p. 61, 1936.
4. Rea, Charles E.: Some Problems in the Preoperative and Postoperative Care of Patients with Hyperthyroidism; Experience in Treatment of Goiter at University of Minnesota Hospitals, *Minnesota Med.* 26: 570-574 (June) 1943.
5. Rea, Charles E.: Unsolved Problems in Preoperative and Postoperative Care of Patients with Hyperthyroidism, *J. Tennessee M. A.* 37: 10-14 (Jan.) 1944.
6. Rea, Charles E.: A New Plan in the Operative Treatment of Patients with Severe Hyperthyroidism, *Surgery* 16: 731-738 (Nov.) 1944.

COMING EXAMINATIONS

The Annual Meeting of the American Board of Anesthesiology, Inc., will be held at the Waldorf-Astoria, New York, N. Y., June 13, and the Oral Examinations, June 14 to 17, 1945. Secretary: Paul M. Wood, M.D., 745 Fifth Avenue, New York 22, N. Y.