ACTA MEDICA IRANICA
vol. XVII. 1974, p. 93-112

Anaesthetic and Surgical Management in Pheochromocytoma Report of Seven Cases'

B.S. Oskoui., M.K. Oskoui.,

Since 1886, when Frankel described pheochromocytoma as a clinical entity, and, even though more than one thousand cases of the disease have been identified (3), it still sustains some sort of curiosity in the scope of medical novelites.

In a previous article (11), we reviewed a vast amount of Medical Literature pertaining to the disease. The essence of the present article, is to report our experiences on some seven cases of pheochromocytoma, of which all underwent operation successfully.

At the conclusion, we report a case in which the clincal diagnosis was that of pheochromocytoma, but the patient died, following a procedure of retroperitoneal pneumography. Unfortunately, an autopsy was unobtainable on this patient.

Case No. 1.

A. S., a 31 year old male, with a complaint of crises of headahes and palpitation during the previous few months, was admitted to our hospital in the February of 1968. The crises had mostly been whilst the patient was active, and for this reason, he had been enjoying a lazy time recently. The blood pressure was 200/90 mm. of mercury, and the pulse rate was 120 per minute upon admission. E. C. G. revealed hypertrophy of the left ventricule.

* (Associate Professor in Anaesthesiology, of Teheran University).
** (Associate Professor in Surgery, of Teheran University).

Fonduscopy showed vaso-constriction in the vesselles of the retina. Regitine Test showed positive result, and the catecholamines of the urine were some 1400 microgrammes during 24 hours urine. Retroperitoneal pneumography revealed a large tumor on the left kidney, which had deplaced the kidney downwards.

With a diagnosis of pheochromocytoma the patient was scheduled for left adrenalectomy. Before beginning the anaesthesia, two connulas were placed into the veins, and solutions containing Regitine and Noradrenaline were connected. During extirpiration of the tumor, the blood pressure rose to 270/30, but in the remainder of the operating time, the blood pressure was kept at 200/100 with Regitine drips, i. v. .

Following the removal of the tumor, the blood pressure dropped to 80/60, subsequent to which with the aid of a Noradrenaline infusion. it was brought to 100/80, and was stabilised at the given level. After a few hours, the Noradrenaline was discontinued, and the blood pressure dropped rapidly; consequently the Noradrenaline was recontinued for a few more hours. The patient had an uneventful recovery. Histological report confirmed pheocromocytoma. One year following the operation, the blood pressure was 130/80, and there were vast improvements in the vessels of the retina.

This patient had no preoperative, perparation and had only received standard premedications.

Case No. 2.

H. D., a 23 year old male was admitted to our hospital in the August of 1968, with complaints of headache, general weakness, rightsided haemiparesia, and right facial paralysis. His past history showed that he had been hospitalised for a comatouse state with hemiplesia one year previously. Since that time, he had experienced crises of headache. His general condition was good, and his blood pressure was 165/120. During a crisis, the blood pressure rose to 230/125. An E. C. G. taken at that time, and examination of the fondus of the eyes, appeared to be normal. A V. M. A. taken, showed

25.5 mg. in 24 hours of urine. The retorperitoneal pneumography revealed a large tumor on the right kidney.

The patient experienced a crisis on the preoperative day, which was treated with Regitine. On the moning of the operative day he received 10 mgm. of Inderal orally, and 30 mgm. of Cortisone i. m.. Premedication consisted of 100 mgm. Pethedine, 0.5 mgm. Atropine, and 50 mgm. Phenergan.

The anaesthesia was started with Thiopenton, Gallamine, Halothane and Oxygen, and was maintained with Ether and Oxygen. The patient's blood pressure was 150 systolic at the beginning. 2.5 mgm. of Regitine was injected i.v. and the transfusion was started. A kidney incision was performed. During the operation, whenever the systolic pressure rose to 170 mm. or higher due to manipulation of the tumor, 2.3 mgm. Regitine was injected i.v..A total dose of 10 mgm. of Regitine was injected i.v. during operation, and three pints of blood were transfused.

Following the removal of the tumor, the blood pressure dropped to 95 systolic, with Mephentermine 'wyamine', it rose to 115. There was an obivous vasodilation of the vessels of the hands at the completion of the operation. Mephentermine was continued for a few hours as a drip, postoperatively, it was then discontinued and the blood pressure was then found to be stable, being 120/80. .On the first post-operative day the blood pressure was 140/80. The patient experien;ed no crises post-operatively. Histological report confirmed pheochromocytoma.

Case No. 3.

S. T. M., a 19 year old male, was brought to the Emergency Room, in November, 1969, because of complaints of dizziness, palpitation and excessive sweating. The patient was unable to walk because of the dizziness and fainting spells, whilst in the errct position. He could not even get a sitting position. The patient was thin. His blood pressure was 200/100 in the supine position, 100/30 in the sitting position. For one year previously the patient

had had a history of spells of severe headaches, palpitation and excessive sweating. The patient conducted a normal life in between these spells. One particular occasion, his blood pressure had been checked by a physician whilst he was experiencing a particular spell, and it was recalled as being "Very high".

Previous to his admission he had been taking a high dose of Hydromet and Serpasil, (Serpasil 0.5 m. T. I. D., and Hydromet 250 mgm. T. I. D.).

On the second day of his admission the blood pressure was as follows:-

In supine position 170/95

In sitting position 115/45

In standing position, no blood pressure could be obtained.

The patient was found to be very thirsty, and his urinary output was very high. At times, during the course of the day, he experienced spells of sweating, flushing and palpitation, and most probably, faintness.

The pressure on the abdomen, or renal region caused the systolic blood pressure to rise to 240 mm.

Some two weeks following his admission to the hospital, his condition was somewhat improved. Hydromet and Serpasil had been discontinued since his admission, his blood pressure in the supine and sitting position was 170/120, and whilst standing or after walking was 100/70.

Still the patient experienced spells of headache, dizziness, palpitation, excessive sweating, coldness of the extremities, flushing of the face and, at times, vomiting some three or four times daily. His blood pressure would rise to 30-45 mm. systolic and 10-20 mm. diastolic, during these spells, and at times his blood pressure rose as high as 240/150.

Regitin test taken was positive, V. M. A. was 20 mgm. in 24 hours of urine. Catecholamine was 321 microgrammes in 24 hours of urine. Blood urea 64 mgm./lit. Fonduscopy and Na. and K. of the blood were within the normal limits.

In angiography, the right adrenal gland was enlarged. Retroperitoneal pneumography revealed the right adrenal gland to be four times larger than the left one.

With a diagnosis of pheochromocytoma, the patient was transferred to the Surgical Ward for the removal of the right adrenal gland. The patient was given preoperative perparations as follows:- 30 mgm. Inderal and 1. 5 mgm. Serpasil, orally, daily, for one week prior to surgery. During this week, he was also given 700 cc. of blood. Following this preparation course, his pulse rate slowed down to 100 per minute, (from 120 per minute), and a crisis occurred only once each day which, was very mild. Premedications were: Pethedine, 70 mgm., Phenergan, 25 mgm. and Atropine 0. 5 mgm. i. m., one hour preoperatively.

Induction was with Thiopentone and after 120 mgm. Gallamine the trachea was intubated. The blood pressure was 140/80, and the pulse rate was 120 after induction. For maintenance of the anaesthesia, Halothane was started, but after some 25 minutes, the blood pressure dropped to 95 systolic. The Halothane was discontinued and Ether was substituted, again, the blood pressure became stable, at 120/80, but whilst palpating the tumor it rose to 160/90. During the removal of the tumor, it rose again to 210/130. The pulse rate this time was 140. At the same time Regitine 7. 5 mg. was administered in divided doses. The estimated blood loss was 350 cc. 1100 cc. of blood, and 500 cc. of Periston were given until right adrenal had been removed. Then the blood pressure dropped to 90/60, but with a rapid infusion of 1000 cc. of Ringer's solution, it became 120/80, as it had been previously, and was stable.

The surgical incision used, was that of a right kidney incision.

The patient left the operating room awake, in a good general condition, with a blood pressure of 120/80, and a pulse rate of 120. Histological examination confirmed pheochromocytoma. (Fig. 1) the tumor weighed 30 grammes.

In the two weeks following the operation, there was no crisis, the blood pressure was 125/75, and the pulse rate was 120. Urine catecholamine was however, still elevated. The patient has since gained some 7 kg. in weight. A year following the operation the blood pressure was 120/70 and the patient

had none of his previous complaints.

Case No. 4:

S. F., a 45 year old female, weight 60 Kg. was admitted to the hospital in January, 1970. For five years previously she had had flushing spells, anxiety, palpitation, headache and a high blood pressure. Her usual blood pressure was 200/120, and during the crisis was 300/170. Her pulse rate was 120, per minute. Hb. 15 gr./lit., Urine catecholamine was 384 micro-grammes in 24 hours of urine. A V. M. A. showed 2. 2 mg. in 24 hours urine. Retroperitoneal pneumography revealed a possible enlargement of the right adrenal gland.

The patient was given preoperative preparation for two days prior to the operation, and received the following medications:-

1—Inderal, 90 mgm. orally, daily (30 mgm. T. I. D.)

2—Regitine, 15 mgm. i. m. daily (5 mgm. T. I. D.)

3—700 c. c. of blood daily (350 + 350)

The patient was ordered to have absolute bed rest.

As a result of the preparation, there was no crisis, the pulse rate dropped to 100, and the blood pressure was stabilised at 210/120.

Premedication was as follows:- Pethedine, 50 mg., Phenergan, 50 mgm., and Atropine 0. 25 mgm., i. m., one hour preoperatively.

When the patient was brought to the operating room, the blood pressure was 210/130, the pulse rate was 100 and irregular. Induction was given by means of 400 mgm. of Thiopenton and with 100 mgm. of Gallamine the patient was intubated. At this time, the pulse became regular. For maintenance, Ether was started, and the blood pressure went to 240 mm. systolic. Halothane was therefore substituted, but within a few minutes the systolic. pressure dropped to 125 mm. the Halothane was therefore discontinued and the patient was put under the Ether again.

The pulse rate was 120, and the systolic blood pressure was 210 during the remaining part of the operation. Except during the palpation of the left adrenal, when the blood pressure rose to 240/160. At this time, 6 mgm. of Regitine was administered in a divided dose. The patient received, blood 350 cc., Ringer's solution 600 cc., and G/W 5%, cc. during the operation. The estimated blood loss was 350 cc.

The surgical incision used was that of a Transverse Abdominal Incision. The right adrenal gland appeared to be normal, but palpation of the left adrenal gland raised the blood pressure to 240 mm. systolic. and it was enlarged. A left adrenalectomy was therefore performed. The tumor weighed 25 grammes and histological examination confirmed pheochromocytoma.

The post-operative course was uneventful. After ten days, there had been no post-operative crises. The blood pressure at this was 210/150. Two months later the patient was admitted to the hospital again and abserved for a week. Her blood pressure was 210/150 but no crises were observed.

Case No. 5:

M. B. N., a 12 year old male, weighing 25 kg. with a past history of paroxismal headache for one month previously, was admitted to the hospital in February, 1970. The patient's blood pressure was 200/140, the pules rate was 128. Regitine test proved to be positive. Urine catecholamines were 111 microgrmmes, and V. M. A., was 5. 56 mg. in 24 hours urine.

The patient had a family history of an elder sister of 16 year of age who, whilst undergoing an operation of the purpose of adrenalectomy for pheochromocytoma, had died in the operation room, seven year previously.

On a retroperitoneal pneumography the right adreanl gland was enlarged quite distinctly.

Preparation for the operation was begun three days preoperatively. Each day the patient received: Regitine 2 mg., i. m. twice a day, Inderal, 10 mgm. orally three times a day. In these three days altogether the patient «received 600 cc. of blood and 300 cc. of Ringer's solution. The patient's pulse rate decreased to 98 per minute. The blood pressure was however, variable, the lowest reading being 60 mm. systolic, following one dose of Regitine, and the highest reading being 280 mm. systolic, during a spell, on the night previous to the operation, The pulse pressure was very low, and at times it was impossible to obtain the diastolic pressure with the aid of a stethoscope.

In the operating room, previous to the induction of the anaesthesia, the pulse rate was 110, irregular, and very weak. The blood pressure was 110 mm. systolic, and the diastolic pressure was unobtainable. The patient's extremities were very cold, but were not cyanotic. Induction of the anaesthesia was carried out with Thiopentone, 200 mg. and Gallamine, 60 mgm., the trachea was intubated following oxygenation. The pulse rate became 150 per minute and very weak, the blood pressure was unobtainable, the extremities became cyanotic. With the administration of blood and fluid, the quality of the pulse was improved, but the rate was still 150 per minute. The blood pressure was 110 systolic, but the extremities were still very cold and cyanotic. It appeared that the patient was in an extreme state of vasoconstriction. Halothane was then started, slowly, and after twenty minutes the pulse rate was 120 with a good quality, the blood pressure was 120 systolic, and the colour of the extremities was much improved.

The operation was started by a Transverse Abdominal Incision. At this time the blood pressure rose to 200 mm/150, and the pulse rate was 140. Regitine, 2 mg., i. v., and Inderal 2 mgm. i. v., were given, which lowered the pulse rate to 120, and the blood pressure to 140/90. These readings were stable for the remaining part of the operation. The right adrenal was enlarged, and was duly removed. The left adrenal appeared to be normal in size. At the end of the operation, the blood pressure was 90/60, and the pulse

rate was 110, and stable post-operatively. The estimated blood loss was 200 cc. During the complete procedure, the patient received 350 cc. of blood, and 1000 cc. of electrolite solution and plasma expander. The patient had an uneventful recovery, and no further crises occurred post-operatively. The pulse rate was 110 and the blood pressure was 90/60, and was stable.

Histological examination confirmed pheochromocytoma. Patient was seen three year following the operation. He had no complaints and his blood pressure was 90/60.

Case No. 6:

A. B., a 50 year old male was admitted to the hospital because of bouts of headache, profuse sweating, vomiting and a decrease in his eyesight, but even with treatment of hypertension the blood pressure could not be controlled.

The following tests were carried out upon the patient's admission: Regitine test was positive. V. M, A. was 24 mg. in 24 hours of urine. A glucose tolerance test showed a diabetic curve. The urine was found to be positive for sugar. Examination of the fondus of the eyes revealed spasme in the arteries, hemorrhage and exudate at the area in both sides. An angiogram revealed a large tumor in the right adrenal gland.

The patient was hospitalised in the medical ward for 1.5 months. He was then visited by the anaesthetist in preparatist in for surgery, with a diagnosis of pheochromocytoma of the right adrenal. At that time the patient was very weak, and was unable to sit for any lenght of time. The patient's muscles were also very weak, he was unable to hold a glass to drink water, and was unwilling even to talk.

The patient had crisis of headache and discoloration of the tips of the fingers, which lasted for 2 — 4 minutes on each occasion, and occurred a few times daily, the blood pressure changed between 150/100 — 300/170, and the pulse rate from 80-90.

The patient had been on a salt-free diet with Dichlorotride for the previous 1.5 months. It appeared that the patient had hypovolelia and some disturbances in the blood electrolites. The patient was put on a free salt diet, and the Dichlorotride was discontinued, and Serpasil and Aldomet were administered one tablet T. I. D., plus 500 cc. of Ringer's solution, the blood chemistry, on the following day was:-

K. - 3.5

Na. - 109.6

Hgb. - 14 grm.

Hct. - 48 %

There was a considerable change in the patient's general condition within a few days, and the patient stated that he felt mush better. Upon examnaination the patient was found to have orthostatic hypotension, the systolic blood pressure dropped from 170 to 110, (from sitting position, to a standing position). The patient was taking 35 mg. of Inderal daily, and 5 mg. of Regitine was ordered to be injected whenever his blood pressure rose above 220, (it was necessary to use this four times during two days.)

350 cc. of blood, and 500 cc. of Ringer's solution were also administered.

The patient's general condition had much improved within a few days, and his muscular weakness was far better. The blood pressure was not yet under control, however.

On the day previous to the operation, the following drugs were administered:-

Regitine, 10 mg. i. m. - each 3 hours.

350 cc. blood

Ringer's solution, 500 cc.

Inderal, 90 mg.

A free diet was allowed

Absolute bed rest was ordered.

During the 24 hours following these administrations the blood pressure was between 150/100 - 135/80, and was controlled. The pulse rate was 80.

On the day of the operation, the premedications administered were:- 100 mg. Pethedin, 50 mg. Phenergan, 0-5 mgm. operation.

The anaesthesia was started with 400 mg. of Thiopentone and 80 mg. Succinyle- Choline, in a mixture. Fasciculation was mild, The trachea was intubated. Anaesthesia was continued with N 2O, Oxygen and Ether.

A Right Transverse Abdominal Incision was used to enter the abdominal cavity. After 15 minutes Halothane was used to replace the Ether. In seven minutes, the blood pressure dropped from 150/90 to 60/40. The Halothane was therefore discontinued, and the bag was washed out, the blood pressure then returned to 200 maximum, and the pulse rate was 110. Ether with N 2 O × O 2, was started again and continued. 2 mg. Regitine was adinistered. The blood pressure then came down to 170/110, and the pulse rate was 114, these were stable for the following 30 minutes. Removal of the gland was very difficult, because of some adherance to the Inferior Vena. The blood pressure became fluctuate, between 170-140, and the pulse rate was 110, even with 14 mg. of Regitine (in divded doses) it was still uncontrol lable. Halothane was started. and 10 mg. (2 + 4 + 4) Regitine was administered. The blood pressure was then under control at 150-180 systolic but the pulse rate was 130. 2 mg. Indered was then injected (1 + 1), and the pulse rate came down to 110, This procedure took one hour, and it appeared that we would be unable to remove the adrenal from the entered incision. The patient was therefore put into the kidney position and a Kidney Incision was made. As soon as the adrenal vein was ligated, the blood pressure dropped from 180 to 110, and the pulse rate from 110 to 100. The Halofhane was then discontinued and 100 mg. of Cortisone was injected. The centeral venous pressure was being taken during the operation, this fluctuated between 21 cm. and 25 cm. of water, however, following the ligating of the adrenal vein, the venous pressure dropped to 12 cm. and later to 14 cm.

Three pints of blood were administered to replace the blood loss, and a total amount of 2400 cc. of Electrolite and plasma expander solutions were also infused during the operation.

The immediate post operative blood pressure was 140/70, the venous pressure was 10 cm. of water, the pulse rate was 96. On the evening of the operation, the readings were as given above, and the extremities were pink and warm.

On the post-operative day, the venous pressre was 3 cm. of water.

The post-operative period was uneventful. Some 18 days following the operation, the blood presure was between 160-170, and was stable. A.M.V., showed 11 mg. in 24 hours of urine. The patient had no crises. The tumor weighted 100 gr. Histological exmination confirmed pheochromocytoma. Patient revisited after 6 months he had no complaints, and his blood pressure was 150/80.

Case No. 7:

B. T., a 28 year old male was admitted to the hospital in May, 1973, complaining of polyuria and polydypia. He had the history of hypertension for the previous 7 year, and had further been suffering form diabetes for the last three year. The patient's blood pressure ranged between 170/110 to 220/130 mm. of mercury for which he was treated with Aldomet and Serpasil. His diabetes was hardly controlled with oral antidiabetics. There was no history of diabetes, nor hypertension in his family Regitine test proved to be positive. Catecholamines in 24 hours of urine were 880 micrognammes. V. M. A. in 24 hours of urine was 9.5 mgm. In angiography the right adrenal gland was enlarged. (Fig. 3) Chest x-ray was negative. Hb. 17.5 gramme %, E. K. GG. revealed a negative T waye. The pulse rate was 90 per minute. Blood sugar was 230 mg. % and urine was two plus positive for sugar whilst the patient was on oral antidiabetics. With a diagnosis of pheochromocytoma, the patient was scheduled for surgery.

The preparation for the patient was as follows:- whilst still on Aldomet and Serpasil (3 tablets daily), Inderal 40 mgm. oral per day was started, 48 hours preoperatively. Regitine was started 32 hours preoperatively in doses of 5 mgm. i. m. every 5 hours. The patient was restricted to bed. He received 1000 cc. of Ringer's solution the day before the operation.

Premedication was carried out with Pethedin 100 mgm. and Atropine 0.5 mgm. Induction of the anaesthesia was with Thiopentone and intubation was carried out with Succinyle-Cholin, which was preceded with 20 mg. of Gallamine to omit fasciculations. The anaesthesia was maintained with nitrous oxide, oxygen and Gallamine. Respiration was controlled during the operation. The blood pressure and the pulse rate were controlled with 6 mgm. of Regitine and 3 mgm. of Inderal i. v. in fractional doses. Surgical incision was a Transverse Abdominal. After removal of the enlarged right adrenal gland, the blood pressure dropped to 120/70. The patient received 700 cc. of Ringer's solution and 350 cc. of blood during the operation. At the end of the operation the central venous pressure was 10 cm. of water. In the first 24 hours post-operatively, the patient received 3000 cc. of fluid. His blood pressure was stable on 140/70 and C. V. P. was 2-10 cm. of water. Three months following the operation the patient's blood pressure was 150/90 and his diabetes had been completely cured. The tumor weighed 35 grammes and the histological examination confirmed phechromocytoma. There were neoplastic cell in this tumor.

Discussion:

The preparation of the patients in these cases previous to surgery is a very important factor. An achievement of a blockade of Alpha and Beta receptors, and a correction of hypovolaemia preoperatively, enables one to avoid the use of vasopressor agents post-operatively, (case Nos. 3,4,6 & 7). If preparation is not carried out in the correct manner, and the result proves to be unsatisfactory, one should postpone the operation for a better preparation, and thus avoid any diffculties on the operating table. As in case No. 5, who did not receive sufficient Regitine preoperatively. Although we did avoid the use of vasopessor drugs on this patient post-operatively by administering 1159 cc. of fluid and blood to this 25 kg. child, in excess of the blood loss in the operating room.

Case No. 1., was given no preparation, and we used a Noradrenaline drip postoperatively, but the management of the patient with this infusion was extremely difficult. The general appearance of such patients is unsatisfactory, despite their normal blood pressure; they are pale, the extremities are cold, and also have a low pulse pressure. In such cases, there is the constant danger of necrosis, should the drip go in subcutaneous tissue.

Patient Nos. 3,4,6 and 7, had a very smooth immediate post-operative course. As was said, by one of our nurses at the time, "It looked more like a herniorgraphy, in comparison with the previous cases of pheochromocytoma with Noradrenaline drips, and the changing of the blood pressure with the rhythm of the flow, and the difficulty in discontinuing the drip".

The blockade of Alpha and Beta receptors was partial in our series to enable us to see the fluctuation of the blood pressure and pulse rate whilst the surgeon palpated the tumor, and thus helped to locate the tumor. However, due to a partial blockade of receptors, the fluctuation is limited, and is not dangerous to the patient.

For an Alpha blocker, Regitine, i.m. was used. The dose was varied according to the patient. The aim, was to prevent crises for at least for at

least 24 hours preoperatively, if this had not been aimed at, the fluid and plasma could have been lost from the vessel wall, and although we had administered blood or fluid prior to the operation, the patient would still have remained in a hypovolaemic state, as had occurred in case No. 5.

At the time we did not have Regitine Tablets, or phenoxybenzamine, which is preferred by most authorities, due to it's prolonged action and rare incidence of tachycardia.

Serpasil was administered in case No. 3, and it proved to be satisfactory. However, in case No. 6, Serpasil and Aldomet had no effect, consequently for the 24 hours previous to the operation we administered a high dose of Regitine.

There is the possibility that Guanethidine or Chlorpromazine could have been used for Alpha blocking, we did not, however, encounter such an experience.

We believe that the optimum duration for preparation is 2-3 days, during which time, the patient should have complete bed rest, and the blood pressure and pulse rate should be cheked hourly whilst the patient is awake, as this is a guide for the anaesthetist to decide upon the dosage aswell as the interval of the Alpha and Beta blockers. The patient should be placed on a free diet, and should be given forced fluid. It is usual for these patients to have approximately 1/2 or 1/3 of their normal blood volume (3). Consequently 1/3 of their estimated normal blood volume should be administered during the days of preparation.

The daily hematocrit is also a useful guide to choosing between a blood transfusion or the administration of electrolite solutions.

Inderal was used bring back the pulse rate to 80 or 90 per minute.

A small dosage of Atropin was used for premedication purposes and, with the administration of the Beta blocker previously, this dosage did not cause any tachycardia.

Thiopenton was used for the induction of the anaesthesia, in sleeping doses, in all cases. Callamine and Succinyle-Choline were used for the intubation in different cases. Succinyle-Choline is usually used with Thiopen-

tone to combat facciculation.

It was noticed that if the patient had been well prepared with Alpha and Beta blockers, the use of Halothane would cause an excessive drop of the blood pressure, In such cases Ether has been found to be very satisfactory (cases No. 3, 4, and 6). If, however, preparation is not carried out, or is not sufficient, (case No. 5,) the Halothane is then the agent of choice. In case No. 6, although the preparation was satisfactory, manipulation of the tumor caused an excessive rise in the blood pressure, and necessitated the use of Halothane to assist the Regitine in controlling the blood pressure.

We have found, from experience, that the anaestist should not have a prejudice for agent, and should choose the agent in accordance with the situation.

We noted congestion and marked vasodilation of the extremities duting the immediate post operative period. The central venous pressure, arterial pressure and urinary output are guides for fluid therapy, during the post-operative period.

operative period.

Among the symptoms of diseases, orthostatic hypotension was very remarkable in two of the cases, (case No. 3 and 6). We believe this to be due to hypovolaemia. This may have become exaggerated in case No. 3, due to the intensive use of hypotensive drugs, we believe this symptom to be rather common and the possibility remains that our other patients were not checked for this sign.

The Hematocrit may be elevated due to :-

1 — A low plasma volume owing to an excessive secretion of catecholamines. (It should be borne in mind, that the patient could be anaemic despite the elevated hematocrit.)

2 — An elaboration of large amount of erythrocyte stimulating factors by the tumor (18).

The change in the colour of the fingers in case No. 6, was a very interesting sign. We had not seen encountered this sign, in any of the previous cases, and have never read of such a finding at all. As mentioned previously,

the tips of the patient's fingers became extremely pale for 2-4 minutes, and then resumed their original colour again. This occurred some 6-7 times during the course of a day. There was no existence of this sign post-operatively.

To perform the Regitine test, we began two intravenous solutions, the first, with a No. 18 needle connecting to a Ringer's solution, and the second with a No. 21 needle connecting to a 5% G/W solution. The Regitine was injected into the i.v. set of 5% G/W. In case of an excessive drop in the patient's blood pressure whilst increasing the Ringer's solution, we avoided the danger of hypotension without the use of Noradrenaline. In our opinion, this was a far more physiological approach.

It was noted that some of the patients (case No. 3 and 7), had a markedly elevated urinary output, especially following a crises. This may have been due to Glycogen release (catecholamine secretion), and glucosal duiresis.

Two of our petients, (case Nos. 3 and 5). continued to have tachycardia postoperatively, although they had a normal blood pressure, no crises and a normal V.M.A.

Although we encountered a difficulty with a Transverese Abdominal Incision in case (No. 6), we still believe this to be the incision of choice for the examination of both adrenal glands and the paraaortic area.

One patient, (which is not included in this series), had a fluctuating blood pressure from 200/100 to 300/120, with a positive Regitine test, catecholamines 350 microgrammes, and a V.M.A. 11 mgm in 24 hours urine. The patient died following a retroperitoneal pneumography. Although we were unable to obtain permission to perform an autopsy, and the result of retroperitoneal pneumography revealed no tumor, we still believe this case to be one of pheochromocytoma. An injection of retroperitoneal air had caused a severe crises. If the patient had been prepared with Alpha and Beta receptor blockers in advance of the test, the catastrophe may have been avoided.

Summary:

Our experience with seven cases of pheochromocytoma has been described. Preparation with Alpha and Beta receptor blockers, as well as the correction of hypovolaemia prior to operation, have been recommened. The Transverse Abdominal Incision has been selected as the incision of choice. The usage of Noradrenaline post-operatively, has been abandoned. The preparation with Alpha and Beta receptor blockers should be performed prior to retroperitoneal pneumography, or other traumatc examination.

Acknowledgement:-

As a number of the cases reported belong to Dr. H. Hashemian and Dr. H. Etebar, we would like to thank them for their kindness in allowing the review of their cases in this article.

Bibliography

1. Beenson P.B., Mc Dermott, W., 1967 **Textbook of Medicine**, Saunders Co. 2. 1333.

2. Cooperman L.H., Engleman K., Mann P.E., (1969), Anaesthetic Management of Pheo chromocytoma Employing Halothane and beta adrenergic blockade, **Anaesthesiology**, 28, 575.

3. Desmonts J.M., Tavenznier M., Delort N., Vaysse J., (1969) L'nnesthesia Dans La Chirurgie Du Pheochromocytom. **Anesth. & Analg.** 26, 837.

4. Gandelle D.L., Meyers R.T., (1964). Pheochromocytoma Anesthetic and Surgical Consi derations. **J.A.M.A.** 187, 12

5. Hashemian H., (1966) Pheochromocytoma, **The British Journal of Clinical Practice.** 20, 129.

6. Hickler, R.B., Thorn G.W., (1972) Pheochromocytoma. Harrison's **Principles of Internal Medicine.** Sixth Edition. 518 McGraw-Hill Book co.

7. Jenkins M.T., (1963) **Anesthesia for Patients with Endocrine Disease.** 91-100 Davis Co. Philadelphia.

8. Mackenzie A., Pearson D.T., (1967) Management of a Patient Presenting with Pheochromocytoma. **Brit. J. of Anaesthesia.** 39, 592.

9. Mornex R., (1970) Diagnostic Des Pheochromocytoms. **Annals of Med. Internal.** 21, 313

10. Murphy M., Prior F.N. Joseph S., (1964) Halothane and Blood Transfusion for Pheochromocytoma. **Brit. J. Anaesthesia.** 36. 813.

11. Oskoui M.K., Oskoui B.S., (1972) Pheochromocytoma. M.E.J. Anesth. 3,6.

12. Pertsemlidis D., Billow S.E., Siegel W.C., Kark A.E., (1969) Pheochromocytoma: Pheochromocytoma:
1 - Specificity of Laboratory Diagnostic Tests.
2 - Safeguards during operative remeval. **Annals of Surgery**, 169, 376.

13. Rollanson W.N., (1964) Halothane and Pheochromocytoma. **Brit. J. Anaesth.** 36, 251

14. Ross E.J., Prichard B.M.C., Kaufman L., Robertson W.I.G., and Harris B.J. (1967) Preoperative and Operative Management of Patient with Pheochromoytoma **Brit. J. Med. 1, 191.**

15. Sadove M.S., Cockin L.M., (1970) Pheochromocytoma, Total Patient Management. **Surgical Clinics of North America.** 50, 174.

16. Sharyat S., Sadr. A.M., and Shafiie A., (1971) Pheochromocytoma: Report of 11 cases. **Mactab Adl. J. 8.1.** (Persian).

17. Stein R.B., Harovitz R.E., (1971) Pheochromocytoma Following up for 21 years Without Therapy. **J.A.M.A.** 215, 1818.

18. Steinwald O.P. Doolas A., (1969) Pheochromocytoma **Surg. Cl. of N. America** 49, 87.

19. Tashayod E., Oskoui M.K., (1968) The value of transfusion and Adrenolitic drugs in treatment of Pheochromocytoma. **Teb. Omooi. J.** (persian) 8. 109.
