



Surgical Treatment of Hypertension

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I. ABSTRACTSURGICAL TREATMENT OF HYPERTENSION

W. P. Ritchie

The surgical treatment of hypertension is still in a formative state. No true estimation of its value can be made as yet. Nevertheless, the results obtained are extremely interesting and to most investigators encouraging. The fact that the pathogenesis of hypertension has not yet been satisfactorily explained in no way minimizes attempts to formulate new methods of attack on a disease which has been so resistant to satisfactory medical treatment.

Surgical methods are being applied along 2 lines. The first consists of an attack directly on the suprarenal glands themselves either by denervation or subtotal extirpation. The second method is somewhat analogous to the management of Raynaud's disease and is directed toward the separation of the peripheral mechanism from the central vasomotor centers.

A. Separation of peripheral mechanism from central control.

(Adson, Brown, Craig, Peet, Heuer)

- I. Anterior rhizotomy.
- II. Splanchnic section.

Historical

Jean, in 1921, suggested section of the splanchnic nerves for the relief of pyloric spasm, hyperacidity and hypersecretion.

Danielopolu, in 1923, suggested section of the splanchnic nerves for hypertension.

Bruning suggested the same procedure in 1923.

In 1925, Rowntree and Adson performed bilateral lumbar sympathetic ganglionectomy on a patient with hypertension. The beneficial effects were transient. Later, attempts were made to relieve the headaches of hypertension by

cervical sympathectomy. The results were not encouraging.

Pieri, in 1927, performed unilateral resection of the splanchnic nerves for intestinal atony. He successfully resected the left splanchnic nerve of two patients suffering from arterial hypertension.

In 1930, Adson divided the right and left anterior and posterior roots of the spinal cord from the 6th thoracic to 2nd lumbar segments. The operation was followed by a definite improvement in the hypertensive state. Subsequent operations were carried out but only anterior rhizotomy was performed.

Heuer reported results of anterior rhizotomy in 1935.

In 1934, Craig performed splanchnic resection through a subdiaphragmatic approach. The 1st and 2nd lumbar sympathetic ganglia were also removed.

Peet resected only the splanchnics in 1935.

Pathogenesis and Rationale of Treatment

"The most acceptable theory of the etiology of essential hypertension is that the condition is of neurogenic origin."

It is not definitely known what neurogenic defect causes hypertension. Hypersensitivity or hyperirritability of the vasomotor centers is postulated.

Whether the disturbance is central or peripheral is not known.

Clinical evidence favors a central basis for the abnormality because (1) the vasoconstrictive disturbance is widely distributed, (2) analogies to other sympathetic disturbances of the central mechanism occur such as disturbances of heat regulating centers in certain lesions of the brain, (3) demonstrable pathological lesions in the arterioles, endocrine glands or sympathetic nerves in subjects with the earliest form of hypertension are

not found.

Prinzmetal and Wilson take exception to the view of central defect. They feel that vascular tonus is independent of the vasomotor nerves and that hypertonus must be regarded as intrinsic spasm of the blood vessels themselves. Consequently, procedures aiming at the relief of hypertension by sympathectomy do not abolish the intrinsic vascular tonus which is fundamentally responsible for hypertension.

The importance of the carotid sinus in hypertension has not been considered as yet in the surgical treatment of hypertension.

"The part played by pressor hormones is not clear but may be important."

Bradford showed, in 1889, that stimulation of the anterior roots of the spinal nerves from the 6th thoracic to 2nd lumbar segments caused a rise in blood pressure and a contraction of the kidney.

Another argument in favor of the rationale of interrupting the stimulation from a hyperactive center is the fact that with a standard stimulus (the local application of cold), it has been shown that in normal persons and those with diverse diseases the blood pressure momentarily increases--the increase averages 10 mm. Hg. systolic and 8 mm. Hg. diastolic, while in early hypertensive cases the increase is 3 to 6 times normal response.

It is suggested that the organic arteriole changes are primarily the effect of prolonged strain from the increased burden of hypertensive states and when they appear they tend to maintain the high level of the blood pressure.

As in Raynaud's disease, it is felt that demonstrable peripheral changes occur only after the disease has been present for some time and consequently the most favorable cases are those in which the hypertension is of short duration. As the abdominal viscera are composed of a large visceral bed, operation to relieve vascular spasm in this area

appears logical.

"Alteration of vasomotor control of arteries below the diaphragm was chosen as it was felt that the celiac and mesenteric arteries would lend themselves best to vasodilatation. By this alteration, it was hoped that a vascular reservoir for emergency might be prepared and that through this a sudden high change of arterial tension might be avoided."

Criteria for Measuring Therapeutic Measures in Hypertension (Brown).

One of the most important items in studying and treating hypertension is a well organized plan of observation.

Brown states that faulty conclusions have arisen from the lack of appreciation that blood pressure is not static but fluctuant.

The following criteria have been developed in an earnest attempt to interpret the effects of surgical procedures for the relief of severe forms of hypertension.

- (a) The range and mean of blood pressure for 24 hours.

Patient is hospitalized in bed for 24 hours.

Blood pressure is determined hourly.

During the second 24 hours, hourly readings are taken under conditions of moderate activity.

The readings are charted and two values are obtained:

- (1) The range in values for the systolic and diastolic pressure from a low basal to maximal.
- (2) The values of the systolic and diastolic pressures during the periods of rest and activity for 24 hours.

- (b) The maximal blood pressure or "ceiling".

In order to stimulate the blood pressure, the ice water pressor test is done while the patient is in the reclining and standing position. The test consists of placing the hands in water at a temperature of 4 to 5°C. The blood pressure is read at the end of 30 seconds and 60 seconds, and subsequently every two minutes following until the blood pressure returns to the previous levels. The normal is two minutes. At least 98% of patients with hypertension of the essential type exhibit excessive reaction to cold.

The test is repeated daily for 2 or 3 determinations. The rise and maximal point of blood pressure which results from this stimulation becomes a very accurate measuring rod of the maximal ability of the vasomotor system to react.

- (c) Retinal vessels.

Degrees of angiospasm can be estimated by the characteristic narrowing without thickening of the arteriolar coats.

- (d) Quantitative examination of the arterioles obtained by biopsy.

Portions of the pectoralis major muscles are removed before operation. The caliber of the lumen of the arteriole is measured and its relation to the thickness of the arterial wall is noted. Studies give important information regarding prognosis and permit of some prophecy on the ultimate surgical measures. Postoperative biopsies are also made for comparison.

- (e) Comparative studies are made 3 to 6 weeks following the operation in the same manner as before, i.e. hourly blood pressure readings, etc.

The use of spinal anesthesia as a test for operative results has not been found valid. It is felt that procaine is possibly absorbed and exercises a systemic medullary effect which complicates the picture.

Operations

- (1) Anterior rhizotomy.

In 1930, Adson divided the anterior and posterior nerve roots from the 6th thoracic to 2nd lumbar in a young man with a severe grade of hypertension. The result 4 years later was encouraging.

In 1935, Brown, Craig and Adson reported the physiological effects on 5 patients who had had the removal of the anterior spinal roots from the 6th thoracic to 2nd lumbar segments. Partial resection was done on 3 additional patients from the 9th thoracic to the 2nd lumbar segments.

All patients represented severe grades of hypertension of early and malignant form.

There was 1 death in a patient whose condition was complicated by an adenoma of the medulla of the suprarenal gland.

No attempt was made to evaluate the ultimate result as the authors felt this could not be justifiably done until 3 years had elapsed.

The criteria for evaluating effects heretofore mentioned were used.

Studies were carried out from 3 to 6 weeks after operation when the patients were up and about.

Blood Pressure

The mean values were from 35 to 100 mm. Hg. less than they had been before operation.

The variations in blood pressure were sharply diminished. The average reduction in vasopressor response to cold was 80 mm. systolic and 45 mm. diastolic.

When the subjects were recumbent, the levels of blood pressure were higher than when standing.

Abdominal binders would tend to raise the blood pressure when standing.

Renal Function

Two hundred cc. of water were given following the operation and the bladder was emptied in one hour. Sixty percent was excreted when the patients were recumbent and 10 percent when standing. Ultimately, the water was excreted but it took a longer period of time when standing.

Excretion of P.S.P. was not affected by changes in blood pressure due to a change in position.

Retinal Arteries

Wagener noted definite relaxation in the vasospastic state of retinal arterioles in 2 cases.

Regression of retinitis was noted 2 to 3 weeks after operation.

Sweating and vasodilatation

There was loss of sweating below the diaphragm.

There was excessive sweating of the upper part of the body.

The feet became dry as in lumbar sympathectomy.

Several patients stated that constipation had developed following the operation.

There were no demonstrable changes in gastric motility.

Untoward effects

Pain in legs for 2 to 3 weeks in 3 patients.

Some generalized weakness in all patients.

One patient had some urinary retention for several months.

Weakness of the abdominal muscles

was present but objective bulging of the rectus muscle was not seen.

Author's Comment

"In no case has complete resolution to 'normal' levels of blood pressure been obtained." It is concluded that possibly this is due to the organic changes already present.

Diminution in the transverse diameter of the heart could be demonstrated by teleoroentgenogram in 2 cases.

Selection of patients

"Subjects less than 50 years of age, who have a relatively short history of hypertension, who present a serious prognosis, who have adequate function of the kidneys and in whose blood pressure reaction there is a large spastic element as demonstrable by their response to the "cold" test-----are primary subjects-----. It is obviously unwise to submit patients to operation who have excessive hypertrophy of the tunica media, irreparable injury to the function of the brain, heart or kidney."

Heuer

Heuer reports 9 cases in which anterior rhizotomy was carried out.

The results are tabulated:

<u>Post-operative Blood Pressure</u>			
<u>Initial</u>	<u>1 Mo.</u>	<u>3 or more</u>	<u>Roots</u>
<u>B.P.</u>	<u>P.O.</u>	<u>Mos. P.O.</u>	<u>Sectioned</u>
192/120	130/82	124/92	6T - 2L
180/118	136/90	122/80	9T - 1L
218/138	146/94	140/92	9T - 1L
200/118	140/100	142/100	9T - 1L
220/144	120/80	144/94	9T - 1L
220/130	120/82		8T - 12T
219/124	160/105		7T - 12T
240/160	230/120		9T - 12T
*240/160	Died at end of operation.		

*Died 4 months after operation.

Heuer states that the disabilities of the operation have not been great.

The difficulties in evacuating bowel

and bladder, observed 24 to 48 hours postoperatively, have promptly disappeared.

The paralysis of the abdominal muscles has not been of consequence.

(2) Unilateral and bilateral resection of the major and minor splanchnic nerves.

The rationale and criteria for this operation are the same as for anterior rhizotomy.

(a) Anatomy

"The splanchnic nerves are composed of preganglionic fibers which emerge from the spinal cord through the anterior thoracic sympathetic ganglionated trunk by means of communicating rami. The fibers traverse the ganglion and make their exit by means of fibers given off by the 5th to 10th thoracic ganglia. The minor splanchnic nerve fibers arise from the last two dorsal nerves. The nerves enter the abdominal cavity through the crura of the diaphragm."

The nerves join the celiac plexus and in this manner connection is made with the stomach, liver, adrenals, pancreas, intestines and kidney.

Section of these nerves is carried out by Craig between the crura of the diaphragm. The sympathetic ganglia of the 1st and 2nd lumbar segments are resected.

(b) Results

Craig and Brown report the effects of splanchnicectomy in 5 subjects.

In 2 subjects, significant quantitative reduction in the pressor reaction to cold resulted.

In 1 case subjective and objective improvement was striking.

In 2 cases, the results were not encouraging but neither case was of the type postulated as a suitable case for relief.

The authors state that the

procedure is safe and no untoward effects have been noted.

Peet

Peet gives a preliminary report in 60 patients who had undergone splanchnic nerve section. All the patients had systolic blood pressures of 200 or over.

There were 3 postoperative deaths and 3 died subsequently.

Forty patients had been checked from 2 to 18 months postoperatively. Six (15%) were symptom-free and maintained a normal pressure, suggesting cure. Fifteen (37%) showed an appreciable drop in blood pressure with symptomatic improvement.

Of the 19 (48%) showing no fall in blood pressure, many had improved symptomatically, especially in regard to headache.

Peet feels that marked fundus changes are not contra-indicative for surgery.

He evidently does not resect the 1st and 2nd lumbar ganglia.

B. Suprarenalectomy (De Courcy, et al.)

Historical

Galata and Antonucci, in 1929, removed one entire suprarenal from a woman with a systolic pressure of 300. The blood pressure fell in the first three days to 210 and remained more or less stable around 200.

Monier-Vinard and Desmarest, in 1930, reported the removal of the right suprarenal in a woman reducing the systolic pressure from 320 to 220 where it remained for 2 months after which it returned to normal.

Pieri in 1932, after observing the effect of resection of the right and left splanchnic nerves in 5 cases of essential hypertension, performed suprarenalectomy in two cases. He removed one gland in each case. Neither case was

improved.

Rationale for treatment by supra-renalectomy.

The operation is based on the hypothesis that essential hypertension is due to a hyperplasia of the medullary tissue of the suprarenal glands under constant sympathetic stimulation which results in the secretion of excessive amounts of adrenalin with the blood stream.

DeCourcy refers to the work of Eisenberg and Wallerstein who collected in the literature 53 cases of pheochrome tumors one-half of which were accompanied by hypertension before the tumor was removed and in which the hypertensive attacks and all their associated symptomatology, vomiting, tachycardia, dyspnea and the like ceased abruptly after operation.

The view that hypertension is the result of pathological changes in the suprarenals was first suggested by Josue and Vaquez in 1904.

In 1907, Philpot reported the suprarenal medulla was enlarged in nearly every case of 27 persons with hypertension which he studied.

During the last decade, the view that pathological changes of the suprarenals had any connection with hypertension has been generally discounted by laboratory workers. Recently, however, DeCourcy states that the work of Goldziehr and Kure has assisted in making this view more tenable.

Goldziehr summarized the accumulated evidence pointing to changes in the medulla that serve as forerunners of hypertension, namely:

- I. Increased adrenalin content of the glands in states of hypertension.
- II. Hypertrophy of the musculatures of the suprarenal veins.
- III. Morphologic changes of the suprarenal cortex and diffuse hyperplasia of the cortex.

Kruse discovered a new method by which he is able to demonstrate that an increase in adrenalin is found in the blood of patients with hypertension.

DeCourcy feels that their views support his contention that the most rational method for the treatment of essential hypertension is the surgical excision of sufficient amounts of glandular tissue to relieve the excessive function of the gland itself.

He quotes Goldziehr as stating that only one-fourth of one gland is necessary to keep an animal alive indefinitely.

He feels that there is an analogy between the overactivity of the suprarenal due to suprarenalism and the overactivity of the thyroid in hyperthyroidism.

Procedure

The operation as done by DeCourcy is a two stage procedure removing about two-thirds of each adrenal at an interval of two weeks.

The portion removed includes both medulla and cortex and is taken from the part of the organ remote from the entrance of the blood vessels.

Results

He reports 6 cases. All showed symptomatic improvement. The average drop in blood pressure was 70 to 80 mm. Hg. systolic and 40 to 50 mm. Hg. diastolic.

C. Denervation of the Suprarenal Gland

This method, as advocated by Crile, is not primarily an attempt to treat hypertension. The technical difficulties and the absence of adequate reports on the results, as far as hypertension is concerned, tend to make this method the least favorably accepted of any.

Crile has carried this procedure out for neurocirculatory asthenia which he states is a pathological state of excessive stimulation of the adrenal sympathetic system. In 76 cases, 93.8% were improved.

In the treatment of 79 cases of hyperthyroidism, 95.6% were cured and in the application of this method to 37 cases of peptic ulcer, 93% were cured.

In established cases of hypertension, he does not advocate denervation but in early cases he states that it apparently arrests the progress of the disease.

Other investigators, among whom are DeCourcy and Heuer, have failed to substantiate this theory.

D. Other methods of surgical treatment

I. Radiation

Hutton advocates radiation of the pituitary and adrenal bodies under the assumption that the pituitary body and adrenal by spontaneous dysfunction, probably a hyperfunction, set-up an abnormal arteriole tension.

Ninety-six of 123 patients treated were definitely improved including in most cases a reduction in blood pressure and in all cases relief of distressing associated symptoms.

No corroborative reports have yet been noted. Evaluation of this type of treatment must certainly be held in abeyance.

II. Regional anesthesia

Abelson suggests the use of regional anesthesia. His inspiration for this work arose from verifications of Dogliotti's method of extradural intravertebral anesthesia.

Impressions

1. The surgical treatment of hypertension is still in a formative state.

2. The fact that the surgical procedures are based on theories not entirely established does not minimize the logic in their employment as the pathogenesis of hypertension is not established and the results obtained are suggestive and somewhat encouraging.

3. The value of denervation of the adrenal glands for hypertension is questionable.

4. Encouraging results have been obtained in anterior rhizotomy. The operation has as its main drawback the extensive surgical procedure that must be carried out to expose the anterior roots.

5. Splanchnic section has also given encouraging results. This operation is apparently a safer procedure than rhizotomy.

6. Too short a period has elapsed to really evaluate the results.

7. Peet's report of 60 cases is the largest and most encouraging but it is difficult to determine whether or not his cases have been as carefully controlled as those reported by Adson, Craig and Brown.

8. Postoperative complications are minimal. The kidney and bowel functions are not noticeably changed except for slight constipation in several cases.

9. Other complications, such as pain in the legs, slight urinary retention, and general weakness, have been minimal.

10. A preoperative and postoperative method of study as advocated by Adson, Brown and Craig is essential for a true evaluation of results.

11. Physiologists and cardiologists feel that a more extensive study on the carotid sinus should be made by the surgeon.

12. Surgical therapy in hypertension should be limited to those early cases of essential hypertension which show little or no organic peripheral change.

13. The general impression from informal discussions is that the efficacy and surgical treatment of hypertension still remains to be proven, and that its proponents are not advocating it as a definite cure but are guarded in their statements concerning its value. Nevertheless, this new procedure is worthy of further consideration.

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- II. OUR GUEST TODAY
- Alfred Washington Adson

III. MOVIETitle: Electro-StaticsReleased by: Department of
Visual Education

Science and Human Welfare."

We are proud of our representatives in this series and know that, weather permitting, they will receive large, appreciative audiences.

IV. LAST WEEK

Date: Jan. 16, 1936

Place: Recreation Room,
Nurses' Hall

Time: 12:15 to 1:15

Program: Movie - Strikes and Sparer
Influenzal Meningitis
Spinal Fluid Requests
Common Cold

Present: 101

Discussion:

Willis Thompson
R. W. Koucky
J. C. McKinley
H. S. Diehl
I. McQuarrie
R. E. Ellis
L. G. Rigler

V. FRIDAY NIGHTS

Dr. Walter C. Alvarez opens the Sigma Xi Lecture Series tomorrow, Friday night, at 8:15 P.M. in Northrop Memorial Auditorium. His topic will be "The Emergence of Modern Medicine from Ancient Folklore." This is the first of the 9th annual series of public talks and will be followed on successive Friday nights by:

Dr. Owen H. Wangensteen
"Benefactions of Surgery to Man"

Dr. E. T. Bell
"The Natural Defenses of the Body"

Dr. I. McQuarrie
"Endocrine Glands in Health and Disease"

This All-Medic series will develop the general theme, "Medical

VI. GOSSIP

There is a case of Kala-Azar in a Chinese graduate student in the Health Service. This reminds us of the case of Histoplasmosis of Darling unearthed by Cecil Watson from tissues removed from a patient dying in a local hospital. Histoplasmosis is a twin sister to Kala-Azar and very uncommon in this country at the time Dr. Watson made his report.....Bill Doctor died of coronary disease in Des Moines, Iowa recently. As Dr. William Doctor his name was the delight of B.L.T., famed deceased columnist of the Chicago Tribune. He loved to talk about Doctor Doctor..... Our guest today is also responsible for an item which delighted the columnists. In a recent congress in England "Time", the newsmagazine, called our guest "Handsome," the next neurological surgeon "Handsome," the next "Handsome" until the typesetter ran out of "Handsome." They acknowledged in a subsequent issue that the use of the word "Handsome" was justified in each instance. Now the columnists every once in a while tell us, "Do you know that neurological surgeons as a class are the handsomest members of the medical profession?" These remarks do not apply to those members of the neuropsychiatric group who do not practice surgery.....Mr. Middlebrook's office informs us that the University will not be responsible for suits brought against individual staff members in medico-legal litigation. Neither will they supply in an informal way any legal advice or defense. It is every man for himself. If insurance protection has not yet been obtained, it is advisable to do so..... Famed psychiatrist Meninger, reputed author of the statement that all surgeons are sadists, will speak at the Hennepin County Medical Society in the near future. He will speak on the prosaic subject (by comparison) of "Emotional Factors in Hypertension.".....We are indebted

to Dean Harold S. Diehl for the contribution from Robert Benchley today.....
 ...The discussion last week on "The Common Cold" was noteworthy for its sane, conservative, controlled viewpoint. It does not appear that the Health Service group will have to retract many statementsAlex Blumstein, whose name is really Yale Blumstein, usually has a philosophical gem to toss off even in the coldest weather. His recent one, attributed to Mencken, states - "Whenever you feel very strongly on any subject, always express it with a big smile on your face. If you find yourself wrong, it is very easy to say, 'I was only fooling'."

VII. HOW TO AVOID COLDS

From Robert Benchley's book:
FROM BED TO WORSE

1. Don't breathe through your mouth or your nose. These two orifices have been called "The Twin Roads to Germville" and, on a busy day, present a picture to the microscope similar to that of the Boston Turnpike. So long as people use their mouths and their noses to breathe through, we are going to have epidemics, plagues and eventual disintegration of the human race.

Your surgeon will be glad to fit you up with a small tube which can be inserted into the throat and worked with a nickel handpump. This will supply you with all the air you need for an ordinary day's breathing. Most of us get too much air anyway. Ordinary breathing air has been called "Nature's Exhaust," and the less we load ourselves up with it the better.

2. Avoid crowds. This applies to all times of the year. You never know who may be in a crowd, and mingling with one may result in your being reminded of an old fifty-dollar loan or a promise to drop in and hear someone sing. Even if no one in the crowd has a cold, there is always someone who wants to push or romp, and you are pretty sure to have your hat knocked off. A good way to avoid crowds is to stay right in your room all day

with the door locked.

3. Get plenty of sleep. When people come to awaken you in the morning, pull the covers up over your head and say: "Go away, I am avoiding a cold." When you have guests who hang around after midnight, excuse yourself politely by saying: "Now I will go in and get my preventive sleep. This is the season for colds, you know." If, during the afternoon, you feel drowsy at your work, just put your head over on your desk and take a little nap. Your boss will understand if you put a little sign up by your elbow reading: "Men asleep here. Cold prevention."

4. Change heads frequently during the day. Have an extra supply of heads in your room (or in a large bag, if you travel about) and, when you feel one stuffing-up, take it off and put on a fresh one.

5. Stay in a temperature of between 60 and 70 degrees. This can be done by jumping on board a train for Palm Beach and lying on the sand for a month or so. Be sure, however, to lie face up, with the arms outstretched, so that the sun can send its actinic rays across your chest and into your eyes. This is the hardest part of this rule to follow out. The temperature of the gambling rooms will be just about right in the evening, so you won't have to lie on your back there.

6. Don't dose up with patent medicines and nostrums. A sitz-bath of rock-and-rye twice a day, using ordinary care not to bruise yourself on the rock-candy, ought to be all the medicinal treatment you will need.

7. Eat a balanced diet. No proteins, no starches, no carbohydrates. Just a good steak with lyonnaise potatoes and asparagus now and then during the day. Remember the old adage: "Stuff a cold and stuff a fever."

8. No exercise. This is all-important. Exercise just stirs up the poisons in your system and makes you a hot-bed of disease. Sit, or lie, as still as possible, and smoke constantly.

If you can stand it, have somebody read aloud to you. If you can't stand it, scream, "Stop that reading out loud!"

9. If you think that you have caught cold, call in a good doctor. Call in three good doctors and play bridge.

10. And, above all, don't catch cold.