

## SURGICAL ASPECTS OF HYPERTENSION

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This paper will discuss: (1) the development of hypertensive surgery, (2) physiological effects of surgery, (3) selection of patients for surgery, and (4) the results of surgery.

### 1. Development of Hypertensive Surgery.

The operation of splanchnic section for hypertension was suggested in 1923 by Danielopolu. However, the first attempt to modify the course of hypertension, and hypertensive cardiovascular disease, was made by Adson. In 1924, he performed a periarterial sympathectomy upon the left femoral artery of a patient in the terminal stage of malignant hypertension. In the following year, after the demonstration by Royle and Hunter that lumbar ramisectomy was a more effective way to denervate the lower extremity, Adson performed a bilateral lumbar ganglionectomy. Because periarterial sympathectomy had little effect on blood pressure, in 1930 the operation was extended to include splanchnic section for hypertension.

Since these experimentations four significant surgical procedures have developed and are employed today.

Subdiaphragmatic sympathectomy was introduced by Adson and Craig in 1934. It is a two stage bilateral procedure in which the upper two lumbar ganglia, the great, lesser and least splanchnic nerves and a portion of the celiac ganglia are resected.

Supradiaphragmatic sympathectomy and splanchnicectomy was described by Peet in 1935. The original procedure consisted of a one stage bilateral supradiaphragmatic splanchnic resection with excision of the tenth through the twelfth dorsal sympathetic ganglia.

In 1940 Smithwick combined the infra-diaphragmatic technique of Craig with the supra-diaphragmatic technique of Peet. He believed that the minimal procedure should be the removal of the sympathetic trunk from the second dorsal to the first or second lumbar inclusive, with resection of the splanchnic nerves in a two stage manoeuvre. Ray has since performed bilateral excision of the seventh dorsal through the second lumbar ganglia as a one stage procedure without significant increase in mortality.

Grimson in 1941 felt the need for an even more radical procedure and described a method for total paravertebral sympathectomy. This consisted of a three stage transpleural excision of the sympathetic chain from the level of the first or the second thoracic through the third lumbar ganglia with adjacent splanchnic nerves.

Since their introduction, numerous modifications in technique and approaches have been suggested. The Smithwick procedure is the most popular employed today. The more

extensive sympathectomy, suggested by Grimson, is used frequently in large clinics and teaching institutions, and is more generally reserved for good risk patients of the younger age group and in those patients with significant anginal symptoms.

Adrenal resection with sympathectomy has been performed by various workers. However, the results published by Jeffers et al are no better, so far, than those obtained in sympathectomy alone. It is thought by some that as soon as the remaining adrenal gland substance functions or hypertrophies, so that replacement therapy is no longer necessary, the effect of adrenal resection no longer operates.

## 2. Physiological effects of Surgery.

The physiological rationale of these operations is similar, to denervate a large vascular area (the splanchnic bed) in an effort to decrease the peripheral resistance to blood flow, and to decrease the magnitude of reflex variations in blood pressure. The various procedures differ only in the extent to which this effect is accomplished. It has been found that in some cases no significant change in blood pressure occurs and in the majority, where a marked lowering had taken place, there is a tendency for the blood pressure levels to return toward preoperative values. Concomitantly, it has been observed that patients may be improved for years from the viewpoint of the cardiovascular system, and relief of symptoms, and may also have their life expectancy increased significantly. This improvement, however, is not as marked

as in the cases where the blood pressure has remained significantly lowered. Its explanation is thought to be either abolition or great reduction of reflex elevations of the blood pressure, which should greatly reduce the mechanical stress and strain on the cardiovascular system. This favourable effect appears to last for many years, and is independent of the change in basal blood pressure levels.

Besides these known physiological effects of splanchnicectomy, there are two presumed effects—one, inhibition of reflex secretion of epinephrine and, two, stabilization of blood flow through the denervated viscera. The second presumed effect is thought to act by exerting a favourable influence upon the elaboration of pressor substances by viscera in response to periods of ischemia, if such a mechanism actually exists in man.

## 3. Selection of Patients for Surgery.

Proper selection of patients for the surgical management of hypertension has been and still is, but to a lesser extent, a difficult problem. Attempts to evaluate the extent, and the degree, of systemic and cardiovascular involvement in essential hypertension has led to the formulation of numerous classifications, which have proved of definite value in predicting life expectancy in untreated groups. The classification most widely employed is that of Keith, Wagner and Carter (1939), which emphasizes the importance of retinal changes. Comparisons between treated and untreated groups have been reported and these studies

demonstrate that a certain group of hypertensives will be benefited by surgery. However, no criteria has, as yet, been found which give the surgeon confidence that a given patient will respond favourably to operation. Accordingly to current thought the indications for surgery are:—

1. The appearance of hemorrhagic and exudative lesions in the ocular fundi, with a high diastolic pressure, but before nitrogen retention has occurred. Renal function must be adequate.
2. The recurrence of one or several episodes of transient paralysis or parasthesia.
3. The presence of intractable, incapacitating headaches.
4. Signs of progressive damage to heart or kidneys.
5. Old hemiplegia with severe hypertension.
6. Chronic congestive failure in which the patient is considered a good operative risk.

**The contraindications for surgery are:—**

1. Age 55 or older.
2. Nitrogen retention in the blood in the absence of cardiac failure, or urinary excretion of less than 15% of intra-venously injected phenol red during the first 15 minutes.
3. Recent coronary occlusion or intractable cardiac failure with arrhythmia.
4. Recent cerebral hemorrhage.

Prior to consideration for surgery, every patient should undergo thor-

ough studies for evaluation of cardiovascular and renal function. Blood pressure responses should be assessed by sedation and cold pressor tests. Adrenolytic drugs should be used to exclude pheochromocytoma.

#### 4. Results of Surgery.

What has been the effect of surgery on survival, blood pressure, cardiac status, symptom relief? What are the untoward effects of the operation and what is the cost of such treatment? How does the patient feel about surgical therapy? To answer these questions reference will be made to the work of various authors and to information obtained from a review of fifty cases of essential hypertension treated surgically at the Victoria General Hospital, since 1948. It is very difficult to compare results of operations from different clinics. Here the aim will be, primarily, to indicate trends.

#### Survival. (See table 1)

This table shows the mortality in various series of surgically treated patients. Smithwick and White have compared their surgical series with a similar series treated medically. The best controlled series is that of Paul White. One hundred cases were selected from his private practise and all were checked preoperatively and postoperatively by him. Everyone of the patients had important cardiovascular complications. Fifty were operated on by one surgeon, Smithwick. The medically treated control group of fifty observed at about the same time by White was comparable in age and sex, and in the severity of cardiovascular complications.

In the sympathectomized series there were thirty-eight men and twelve women. In White's opinion, 44% of these showed definite improvement 3-7 years after surgery, 24% were dead by the end of this time. In the control group there were thirty-seven men and thirteen women. Only 10% of those medically treated showed definite improvement, while 82% were dead at the end of seven years.

#### **Blood pressure.** (See table 2).

This table illustrates the effect of surgery on blood pressure. The percentage of good results varies from 28% to 64%. Table 3 shows a breakdown of the blood pressure response in the Halifax group—32% having good results and 68% poor results at the time of review. It was noted that following surgery there was a marked fall in both the diastolic and systolic blood pressure (78/50) and that this fall was more marked than that obtained with the sodium amytal test preoperatively (60/28). However, with the passage of time both the systolic and diastolic pressures gradually returned to near preoperative levels. The average in twelve patients 5 to 6 years postoperatively was 13/4 m.m., less than the average preoperative values.

#### **Cardiac Status.** (See table 4).

The effect of Surgery on cardiac status as shown by the electrocardiogram is indicated in the next table. In Morrissey's series, and in the Halifax group, 60% and 65% of patients respectively showed improvement.

#### **Symptoms.** (See table 5)

The next slide shows how symptoms were modified by surgery. The improvement in headache is a striking feature. In all the patients it was virtually complete immediately after operation. This relief persisted in practically all cases irrespective of the postoperative blood pressure levels. Good results are to be noted in the relief of dizziness, visual disturbances (blurring, spots and diplopia), angular pain and parasthesia. The results are very poor in the relief of dyspnea. Only 7% of cases showed some improvement.

#### **Complications.** (See table 6).

The complications following lumbo-dorsal sympathectomy in the Halifax series are shown in the next slide. Postural hypotension following surgery was present in various degrees for a period of 6 to 9 months in 67% of patients. In 10% of cases it persisted one or more years after operation. Its effects were noted on sudden movements and on getting up quickly in the morning, and, according to the patients, could be avoided if care were taken. Approximately 33% complained of cold hands, wound pain and excessive sweating in the upper body. Loss of the function of ejaculation was present in 90% of males. Residual damage to the lungs due to atelectasis, hemothorax, hydrothorax, pneumothorax and chylothorax was noted on fluoroscopic examination in the last followup period.

#### **Cost of L. D. S.** (See table 7).

An estimate of what the cost of the surgical treatment of essential

hypertension would be today, was made on the basis of information obtained from the Halifax group. The table shows a candidate for surgery must expect to spend, on an average, 54 days in hospital. The cost of hospital and medical care will be at least the figures indicated since they do not include the cost of private nursing care and allow only for the minimum in X-ray, drug, laboratory and operating room expenses. The average post operative period after which the patient is able to return to work is ten months. However, 50% will be working in seven months, or less, after discharge from hospital.

**Patients attitude to Surgery.** (See tab' a 8).

The next table shows that 87% of patients in the McGregor's group and 91% in the Halifax group felt the operation was decidedly worthwhile.

It is interesting to note that two patients in the Halifax series had pregnancies since their operation; one had two children and the other one. Similar observations have been made by Morrissey and D'Abreu, each of whom have had four such cases in their respective series.

An attempt has been made to review the surgical aspects of hypertension. In conclusion:—

1. Surgical therapy should be reserved for a certain group of hypertensives. According to Evans and Bartels— "we are loathe to consider this type of operation, lumbodorsal sympathectomy, with its prolonged uncomfortable convalescence as a prophylactic operation for benign hypertension, but urge it on patients under 50 years of age with spastic, exudative and hemorrhagic retinal arteriolar changes, moderate cardiac damage, signs of early nephrosclerosis and labile blood pressure."

2. The operation should never be performed when there is evidence of renal failure as shown by an accurate non-protein nitrogen of the blood or blood urea nitrogen.

3. Sympathectomy, followed by a medical regime such as a salt-free diet, if necessary, is the most successful treatment there is today of severe, or progressive, hypertension of unknown origin.

TABLE 1  
EFFECT ON SURVIVAL

Author	Cases	Follow	No.	% Dead
Craig 1949	130	5 yrs.	11	8
Grimson 1953	110	5-13 yrs.	22	16
		10-13 yrs.		
Smithwick 1953	1266S 467M	5 yrs.	241	19 54
Peet 1954	257	5- 7 yrs.	57	22
White 1950	50S 50M	3- 7 yrs.	12	24 82
Halifax 1954	46	1- 6 yrs	3	6.5

TABLE 2  
EFFECT ON B. P.

Author	Cases	Follow	% Good Results
Craig 1949	100	5 yrs.	51%
Grimson /53	172	recent to 13 yrs.	64%
Peet 1954	230	5- 7 yrs.	55%
Evans and Bartel /49 (Poppen)	173	1- 3 yrs.	47%
Smithwick 1953	1266	1- 5 yrs.	45%
Roy 1949		1- 6 yrs.	60%
Longland 1954	76	3 yrs.	28%
Halifax 1954	41	1- 6 yrs.	32%



TABLE 3

EFFECT ON B. P. 1 - 6 yrs.

1 normal	}	13 - 32%
4 good - over 20 mm. drop		
8 improved up to 20 mm.		
21 unchanged - plus 10 mm.	}	28 - 68%
7 worse		

TABLE 4

EFFECT ON CARDIAC STATUS

as shown by pre and post operative electro-cardiogram.

	Number	Improved
Morrissey (1953)	33	20 (60%)
Halifax (1954)	32	21 (65%)

TABLE 5

EFFECT ON RELIEF OF SYMPTOMS

	No.	Comp.	Mod.	Nil.
Headache	39	31 100%	8	—
Dizziness	23	13 78%	5	5
Vision	24	13 83%	7	4
Anginal pain	11	3 54%	3	5
Parasthesia	7	5 71%	—	2
Vomiting	5	5 100%	—	—
Dyspnoea	27	— 7%	2	25

TABLE 6

POST-OP. COMPLICATIONS

Postural Hypotension:—	
6 - 9 months	27 - 67%
1½ - 6 years	4 - 10%
Wound pain	15 - 37%
Excessive sweating	11 - 27%
Cold hands	17 - 42%
Wound infections	6 - 15%
Spontaneous collapse	3
Hemothorax	3
Hydrothorax (massive)	2
Tension pneumothorax	1
Chylothorax	1

TABLE 7

COST OF LUMBODORSAL SYMPATHECTOMY

Stay in Hospital:—	
Average 54 days — Range 28 - 89 days.	
Cost (Public Wards)	\$402.00
Hosp. & (Semi (six bed)	760.00
Med. (Semi (two bed)	841.00
(Private)	949.00
(Private (bath)	1003.00
Time from discharge until return to work.	
Average 10 months — Range 1½ months to 2 years.	

TABLE 8

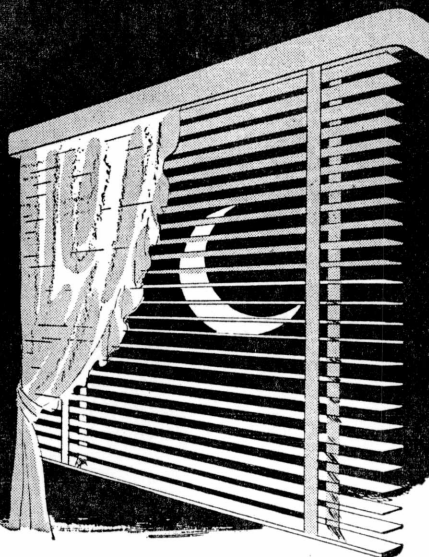
PATIENTS ATTITUDE TO SURGERY

	No.	W	N	U
McGregor 1952	53	46 (87%)	2	5
Halifax 1954	24	22 (91%)	1	1
W—worthwhile				
N—not worthwhile				
U—undecided				

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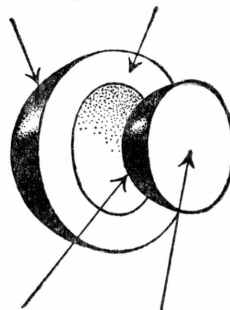
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