PRIMARY ALDOSTERONISM* A REVIEW OF MEDICAL LITERATURE FROM 1955 TO JUNE 1958

PIERRE DELORME, M.D.† and
JACQUES GENEST, M.D., F.A.C.P.,
F.R.C.P.[C], *Montreal*

THE SYNDROME of primary aldosteronism was first described by Conn in 1954,[1, 11] in the following terms: "In its fully developed state, it is characterized by the presence in the urine of excessive amounts of sodium-retaining corticoid, by severe hypokalemia, hypernatremia, alkalosis, and a renal tubular defect in the reabsorption of water . . . The clinical picture consists of intermittent tetany, paresthesia, periodic severe muscular weakness and 'paralyses', polyuria and polydipsia, hypertension and no edema".[1] In this paper, we wish to review all case reports of this syndrome since Conn's first description. The etiological, pathological, clinical and biochemical aspects and postoperative follow-up of 31 patients who underwent operation will be considered in order to describe the pertinent characteristics of this disease and to draw some practical conclusions. Cases where diagnosis was not established beyond doubt or the description of which was insufficient to allow comparison with others are not included.

ETIOLOGICAL ASPECTS

The total of 31 patients was composed of 12 men and 19 women (1.6 women to 1 man). The syndrome was encountered in patients from the ages of 11 years[25] to 63[21] but the peak incidence is between 30 and 45 (16 cases). Five of the cases were in children between 11 and 15 years of age.[25, 13, 27, 20, 30] Age incidence is approximately the same in both sexes. No familial incidence is reported.

TABLE I.—PATHOLOGY

I.—Adrenal glands (31 cases)

Type of lesion	*No. of cases*
Adenoma	22
Hyperplasia	3
Adenoma and hyperplasia	1
Carcinoma	2
Normal adrenals*	3

*Described as such.

II.—Kidneys (20 cases)

Type of lesion	
"Vacuolar nephropathy" (Typical of potassium depletion)	8
Arteriolar lesions	10
Nonspecific tubular lesions	3
Pyelonephritis	3
Normal kidney	4

*From the Clinical Research Department, Hôtel-Dieu Hospital.

Cet article est publié simultanément en français dans "L'Union Médicale du Canada". N.D.L.R.

†Fellow of the National Research Council, Ottawa.

PATHOLOGICAL ASPECTS (Table I)

1. *Adrenal Glands*

Primary aldosteronism is always caused by selective adrenal hyperfunction. Out of 31 cases, 22 were caused by adenoma, 3 by hyperplasia, 1 by adenoma and hyperplasia in the same gland, and 2 by carcinoma. In three patients, the adrenals were described as normal.

Typically, the adenoma is a small, spherical, and encapsulated tumour, with an average diameter of 1 to 4 cm. (the largest one reported had a diameter of 6 cm.).[27] It is located in the cortex of the gland, more or less bulging over the surface, and the cut section is brilliant yellow. Except for two cases of multiple adenomas of the same gland,[22, 25] the tumour was solitary.

The first[2] of the two carcinomas was a roundish tumour of 4-cm. diameter practically destroying the whole right adrenal. The left gland was normal. On cut sections, the gland was composed of a canary-yellow carcinoma, a normal medulla and a small amount of residual cortical tissue. Three months after surgical removal of this tumour, the patient died, after complaining again of the same symptoms. At autopsy, a huge retroperitoneal mass was found with metastases to liver, bone marrow and lungs. The left adrenal was half its normal size. The second malignant tumour reported[17] was a large mass weighing 1400 g., located at the upper pole of the left kidney and extending towards the midline and around the great vessels. The cut surface was extremely irregular though nodular and was made up of soft yellow tissue with darker brown areas. Post-mortem examination was not performed in this case.

To assess the clinical significance of histological lesions of diseased adrenals and the delimitation of the different zones is extremely difficult, even for a competent pathologist. It is worth while here to quote Ayres and co-workers on the histology of aldosterone-secreting adrenal adenomas: "We have discussed the findings in four cases of Conn's syndrome with several morbid anatomists, and the conclusion we have reached is that they cannot be distinguished microscopically or histologically from the glucocorticoid secreting tumours of Cushing's syndrome. Although some areas of large, pale, lipid-laden cells appeared to be arranged in a glomerulosa pattern, each cell is quite different from normal glomerulosa cells, and other areas of small deeper staining cells may be arranged in a fasciculata pattern. Thus, it appears that adrenal histology does not enable one to predict the function of these tumours".[39] For this reason, we will describe only briefly the microscopic appearance of the adrenal lesions.

(a) Hyperplasia (3 cases). In one case, there was no predominant zone.[34] In another,[30] the zona glomerulosa was prominent and increased in width. In the last case,[13] the fasciculata appeared wider than usual.

(b) Adenoma (22 cases). In five cases, the tumour looked like the zona fasciculata; in one case, like the zona glomerulosa; in three others, like the zona fasciculata in certain areas and like zona glomerulosa in other parts of the same tumour. In eight patients, no microscopic study of the adrenal was reported. In those cases of adenomas, one may find atrophy of a cortical zone in the homolateral or contralateral gland. In three cases, atrophy of zona fasciculata is reported; in eight others, there is no zonal atrophy.

(c) Carcinoma (2 cases). The first carcinoma[2] and its metastases were composed of three different types of cells but the report did not state whether or not these cells resembled normal cortical cells. The second one[17] is described as a well-differentiated carcinoma of the adrenal cortex with some giant cells and areas of necrosis without further details.

As we shall see in the clinical part, arterial hypertension is the cardinal sign of primary aldosteronism. A certain degree of correlation may be established between the age of the patient, the severity of the hypertension and the pathological picture of the adrenal gland. (1) Out of six cases reported in patients between 10 and 20 years of age,[25, 14, 30, 13, 29, 27] four out of the five (one author[29] does not specify the severity of his patient's hypertension) suffered from a malignant type of arterial hypertension. These are the only cases of malignant hypertension in this group of 31 patients. (2) Three cases of adrenal hyperplasia were reported. Two of them were in young patients[14, 30] with malignant hypertension; the third one was in a 46-year-old man with severe arterial hypertension.[34] (3) The three patients who had "normal adrenals" were young subjects below 20 years of age. The first of them had malignant hypertension;[13] the severity of the hypertension in the second was not specified;[29] the third one had benign hypertension.[27] (4) Adenomas were found in all age groups and with various degrees of arterial hypertension, but no malignant form of hypertension except in one case[25] where the patient was 11 years old and had multiple adrenal adenomas. This represents the only case of adenoma reported in a patient between 10 and 20 years of age. (5) The two patients suffering from adrenal carcinoma were respectively 60 and 35 years of age,[2, 17] and did not present a malignant type of hypertension.

Briefly, adrenal hyperplasia is usually found in young patients and associated with a malignant or severe type of hypertension. Primary aldosteronism with "normal adrenals" is reported only in patients below 20 years of age. Carcinoma is uncommon. Adenoma, the lesion most frequently seen, belongs to all age groups and is associated with arterial hypertension of varying severity.

2. *Kidneys*

There are no specific renal lesions in primary aldosteronism. Two main types of lesions are seen: first, "vacuolar nephropathy" (8 cases) which is characterized histologically by the typical vacuolar aspect of proximal tubular cells found in patients with hypokalæmia of long duration, and second, the arteriolar lesions (10 cases) which one finds usually with any severe arterial hypertension of long duration. Out of the 31 cases reported, only 20 included a histological description of kidney lesions.

3. *Muscles*

Before onset of therapy, the patient of Foye and Feichtmeir[2] had a muscle biopsy taken which showed degenerative lesions with partial loss of cross-striation and non-specific cellular infiltration. After administration of potassium, a second biopsy of the same muscle revealed a normal histological pattern.

CLINICAL ASPECTS

Primary aldosteronism is characterized clinically by the following three groupings of signs and symptoms:

1. Signs and symptoms of arterial hypertension: arterial hypertension, headaches, amblyopia.

2. 'Renal' signs and symptoms: polyuria, nycturia and polydipsia.

3. Neuromuscular signs and symptoms: (a) acute episodes of muscular weakness or paralysis, (b) spontaneous or latent tetany, (c) paræsthesiæ, (d) muscle cramps and pains.

TABLE II.—MODE OF ONSET (29 CASES)

	No. of cases
Acute episode of muscular weakness	7
Acute episode of muscular paralysis	2
Arterial hypertension	12
Headache	12
Polyuria, polydipsia and/or nycturia	10
Convulsion and loss of consciousness	1

Mode of Onset

These patients seek medical advice for any of four main reasons: (1) high blood pressure, (2) headaches, (3) polyuria and/or nycturia and/or polydipsia, (4) acute episodes of muscular weakness or paralysis.

High blood pressure with or without headache was the sole presenting feature of many patients.[9, 22, 20, 21, 8, 3, 19, 24, 34, 31, 17] The patient reported by Holten and Petersen[13] had, at the beginning, arterial hypertension with episodes of faintness and convulsions. Polyuria and polydipsia were the first symptoms for the patient of Foye and Feichtmeir;[2] these symptoms were followed, only eight months later, by episodes of muscular weakness and pains. The 17-year-old patient of van Buchem[12] had suffered from polyuria, enuresis and polydipsia since childhood; these were accompanied by arterial hypertension which was discovered when he was first seen. Bartter and Biglieri[27] de-

scribe the same type of onset in their 13-year-old patient. Paroxysmal muscular weakness with tetany was the earliest symptom in the case reported by Hellem.[4] Russell's patient[15, 16] had a short episode of muscular weakness of one week's duration involving both upper limbs; subsequently she was completely asymptomatic for a period of a little less than a year. Then the same symptom reappeared accompanied by polyuria and nycturia. A flaccid quadriplegia of two weeks' duration marked the onset of the disease in the patient of Milne and Evans.[35, 9]

TABLE III.—MAJOR SYMPTOMS (31 CASES)

	No. of cases
Polyuria and polydipsia and/or nycturia	26
Acute episodes of muscular weakness	22
Acute episodes of muscular paralysis	11
Headache	19
Paræsthesia	8
Muscular cramps and pains	7
Attacks of tetany	7
Amblyopia	4

TABLE IV.—MAJOR SIGNS (31 CASES)

	No. of cases
Arterial hypertension	31
Lesions of hypertensive retinopathy (exudates and/or hæmorrhages and/or papillœdema)	11
Muscular weakness	13
Spontaneous tetany	2
Chvostek's sign	4
Trousseau's sign	6
Tendon hyperreflexia	7
Tendon hyporeflexia	4
Muscular paralysis	2

CLINICAL PICTURE (Tables III and IV)

Headache, arterial hypertension, nycturia, polyuria, polydipsia and periodic muscular weakness are the symptoms and signs most frequently seen.

I. ARTERIAL HYPERTENSION AND HEADACHES

Headaches are of no special type. Arterial hypertension is a constant finding in all cases reported and it is the cardinal sign in this syndrome. It is both systolic and diastolic and of varying severity. There is no clinical means of differentiating it from the so-called essential type. Hypertensive retinopathy (hæmorrhages and/or exudates and/or papillœdema) was described in 11 patients. Four of them,[25, 14, 13, 30] all below the age of 20, had bilateral papillœdema and they were the only cases of malignant hypertension reported in this group of 31 patients.

II. POLYURIA, POLYDIPSIA AND NYCTURIA

Twenty-six patients suffered from one or more of these renal symptoms. Brooks and associates emphasize the fact that in their two patients the polyuria was solely nocturnal.[17] In four cases, these renal symptoms were accompanied by a marked "dry-mouth feeling".[6, 21, 26] Polyuria and polydipsia were intermittent in Skanse's patient.[20] Chalmers and co-workers[10] report that, in their patient, the polyuria and nycturia increased considerably during the episodes of muscular paralysis.

III. NEUROMUSCULAR SYMPTOMS AND SIGNS

(a) *Muscular Weakness and Paralyses*

Muscular weakness may be very slight[10] or quite severe and take the aspect of a true flaccid paralysis.[35, 9, 15, 16, 20, 7, 21, 10, 8, 31, 11, 36, 30] Of sudden onset, these episodes of muscular weakness or paralysis may happen any time during the day with no obvious trigger mechanism, except in two cases[35, 9, 1, 11] where exposure to cold seemed to induce the crises. These episodes may last from a few hours[20] to several days or weeks.[35, 9] Sites of paresis or paralysis are often scattered. Involvement may begin in one limb or in the muscles of the face[20] and then disappear after a while or, instead, spread to other parts of the body. It may also begin with a sudden quadriplegia or with dyspnœa[20] or dysphagia.[21] Some patients had paralysis of the muscles of the neck and were barely able to lift their head from the pillow.[10, 7, 21] Paræsthesiæ and muscular pains may accompany this muscular weakness.[15, 16] The frequency of these episodes is extremely variable. Russell[15, 16] reports a case where there was a one-year interval between the first and the second episode; on the other hand, another patient had approximately two attacks per week.[30] A few patients never experienced muscular weakness or paralysis during the course of their illness.[9, 13, 14, 27, 17] Others suffered from episodes of muscular weakness but without paralysis.[21, 24, 22, 6, 10, 3, 4, 25, 29, 34] Between these episodes of paresis or paralysis, patients are usually asymptomatic or some may complain of a persistent asthenia.[8, 31, 25] At the time of admission to hospital, 13 patients had muscular weakness; only two had overt paralysis.[35, 9, 8] No pyramidal or extrapyramidal signs accompany this paralysis or paresis.

(b) *Tetany*

Seven out of 31 patients suffered from tetany during the course of their illness.[1, 11, 7, 29, 3, 4, 30, 31] These attacks usually occur between episodes of paresis or paralysis. The tetanic spasms occur in the hands or both upper or lower limbs or start with a generalized tetanic state.[31] They may last from a few minutes to 24 hours and usually disappear without any treatment. In Genest's patient, a period of polypnœa was observed just before two such tetanic attacks.[30] On admission, only two patients had overt tetany.[7, 3] In six others, latent tetany was revealed either by the presence of Trousseau's sign[1, 11, 22, 20, 3, 24, 31] or Chvostek's sign[1, 11, 22, 21, 3] or by the forced hyperventilation test.[7]

(c) *Tendon Reflexes*

In most cases, normal tendinous reflexes are present. However, paralysis or severe muscular

weakness is usually accompanied by hyporeflexia or areflexia,[35, 9, 8, 2, 15, 16] and overt or latent tetany, by hyperreflexia.[1, 11, 22, 20, 7, 21]

(d) *Paræsthesia and Muscular Pains*

Paræsthesiæ are most often localized to the distal part of the extremities and may or may not be associated[20] with episodes of muscular weakness. They are intermittent and of short duration.[20, 7, 13, 8, 3, 4, 30, 31] Seven patients had muscular pains.[15, 16, 21, 2, 8, 3, 26, 31] Usually, these pains are experienced as muscle cramps or ill-defined myalgias.

IV. OTHER CLINICAL ASPECTS

1. *Fainting Spells*

Two patients fainted during the course of their illness.[13, 21] The 13-year-old patient of Holten and Petersen lost consciousness with generalized convulsions frequently, during which the electroencephalogram was abnormal. These episodes were not followed by muscular weakness. In the other case reported by Hewlett,[21] a loss of consciousness of 15 minutes' duration followed by mental confusion and neck-muscle paralysis occurred eight months before the patient's admission to hospital.

2. *Œdema*

Œdema is usually absent in primary aldosteronism. However, a few cases with œdema have been reported either associated with overt cardiac insufficiency[19, 22] or without obvious cause.[26, 17, 25] In these last three cases, there was a slight swelling of the retromalleolar[26, 17] or palpebral regions.[25] At this point, we must report the interesting case of Goldsmith *et al.*[28] This patient had symptoms of primary aldosteronism, of secondary aldosteronism (œdema) and of salt-losing nephritis. After surgical removal of an adrenal adenoma, the œdema and the signs of primary aldosteronism disappeared but the manifestations of salt-losing nephritis remained unchanged.

3. *Retardation of Growth and Development*

Van Buchem's 17-year-old patient showed, in addition to the usual clinical picture, a marked retardation of growth (bone age: 13 years) associated with the absence of beard, mustache, and axillary and pubic hair. Van Buchem attributes this stunting not to an endocrinological disturbance since the urinary levels of 17-hydroxycorticosteroids and 17-ketosteroids were normal, but to the deleterious effect of prolonged hypokalæmia on the cellular metabolism of a growing boy.[12]

4. *Cushingoid Features*

There were no cushingoid features reported in primary aldosteronism, except for a moderate degree of obesity with slight hirsutism noted in one case[24] and easy bruising noted in another.[21]

TABLE V.—BLOOD VALUES

	Normal	*Increased*	*Decreased*
Sodium	8	19	2
Potassium	0	0	31
Chloride	0	0	22
Calcium (total)	21	0	0
CO_2 combining power	5	24	0
pH	3	9	0
Blood sugar	15	3	0
Eosinophils	13	0	1

5. A few patients presented with vomiting and ill-defined muscular pains,[13] some with episodes of diarrhœa[10, 8] and others with a marked craving for salt and salty foods.[30]

LABORATORY FINDINGS

1. *Blood Values* (Table V)

(a) Hypokalæmia is a constant finding in all cases. The lowest potassium level was 1.4 mEq./l.[35, 9]

(b) Alkalosis is present in the majority of patients. It may be very marked (Conn's patient[1, 11] had a blood pH of 7.62 with a CO_2 combining power of 82 volumes % or 36.9 mEq./l.) or slight (in Hewlett's second case the CO_2 combining power varied between 28.2 and 31.2 mEq./l.; in his third case between 27.1 and 31 mEq./l.[21]) or absent (Genest's patient[30] had a venous pH of 7.35 and an arterial pH of 7.43 with a CO_2 combining power of 26 mEq./l.).

(c) Plasma sodium was increased in 18 patients out of 31, but may be normal or even decreased.[13, 34]

(d) Chlorides are usually at the lower limit of normal or decreased.

(e) Total and ionized calcium are normal in the cases where they were determined.

(f) Blood sugar is usually normal. However, Hewlett's first and third cases had a typical diabetic response to glucose administration, and his second case had a fasting blood sugar level well above the normal range.[21]

(g) Plasma magnesium measured in five cases was normal in two;[21] at the lower limit of normal in one,[34] and decreased in two.[3, 24]

(h) There was no eosinopenia except in one patient[2] where values of 72 and of 36 eosinophils per c.mm. were found.

2. *Electrocardiographic and Radiological Findings*

(a) Of 27 patients the electrocardiogram showed patterns suggesting hypokalæmia in 20. Two patients had signs of left ventricular hypertrophy with prominent "U" waves. In five other patients the E.C.G. either was normal[30] or showed signs of left ventricular strain or hypertrophy.

(b) An adrenal tumour was found in two cases[17, 27] out of 24 by plain films of the abdomen or intravenous pyelogram. The use of retroperitoneal air insufflation revealed an abnormal shadow suggestive of a tumour in 10 cases out of 22.

TABLE VI.—URINE

	Results	*No. of cases*
Specific gravity	Less than 1010	9
	From 1010 to 1015	8
	1015 and over	1
Water deprivation test	Normal response	5
	No change in specific gravity	15
Pitressin test	Normal response	2
	No change in specific gravity	10
Albuminuria	None	5
	Present	21
Urinary infection	None	15
	Present	4
Urinary pH	Alkaline	17
	Acid	1
	Neutral	2

3. *Renal Function* (Tables VI and VII)

The most important and most distinctive alterations of kidney function in primary aldosteronism are:

(a) Marked polyuria (mainly nocturnal in some cases[17]).

(b) Large urinary loss of potassium. This excessive waste of potassium is apparent in all the cases where potassium intake and output were measured. The ratio of potassium clearance to inulin clearance was 1.16 in the patient of Chalmers and Fitzgerald in spite of the fact that the plasma potassium level was only 1.9 mEq./l.[10] Eales and Linder[7] point out that a normal subject under ordinary circumstances excretes less than 15% and rarely more than 20% of the "glomerular-filtered" potassium; their patient excreted 35% of the filtered potassium at the beginning of her disease and 75% one year later.

(c) Alkaline urinary pH.

(d) Urine of low specific gravity. Half of the cases reported have a urinary specific gravity of less than 1010. No change in urinary specific gravity was noted after fluid deprivation or pitressin administration.

(e) Slight or moderate albuminuria in 21 cases out of 26. It is interesting to underline that urinary infection was noted in only 4 cases out of 19.

In patients with primary aldosteronism, renal function can be modified by three main factors: prolonged hypokalæmia resulting in the production of vacuolar nephropathy; pyelonephritis, the occurrence of which is enhanced by prolonged potassium depletion; and arterial hypertension of long duration giving rise to arteriolar lesions in the kidneys.

It is difficult therefore to attribute a change in renal function to any given factor, especially when different tests of measurement of renal function (clearances of urea, creatinine, inulin, mannitol and para-aminohippuric acid, phenolsulfonphthalein excretion) were used. Out of 27 patients, 16 had normal or slightly decreased renal function.

TABLE VII.—RENAL FUNCTION (27 CASES)

Author	*Year*	*Renal function*	*Renal lesions*
Conn	1955	Creat. clear.: 87 to 119 c.c./min. P.S.P. 50% in 15 min.	Marked arteriolosclerosis Vacuolar nephropathy
Milne	1956	Renal function: slightly impaired	None—normal kidney
Nassim	1957	Decreased G.F.R.	———
Milne	1954	Creat. clear.: 65 c.c./min.	Severe bilateral pyelonephritis
Russell	1956–7	Inulin clear.: 42 c.c./min. Diodone clear.: 200 c.c./min.	———
Skanse	1957	Creat. clear.: 98 c.c./min.	Vacuolar nephropathy
Crane	1956	Creat. clear.: Normal P.S.P.: 55% in 2 hours	———
Eales	1956	Creat. clear.: 125 c.c./min. Inulin clear.: 134 c.c./min. P.A.H. clear.: 793 c.c./min.	Slight vacuolar nephropathy Focal ischæmic atrophy and attempts at renal tubular regeneration—some arterioles showed hyalinization
Hewlett	1957	1. Mannitol clear.: 109 c.c./min. P.A.H. clear.: 412 c.c./min. 2. Mannitol clear.: 113 c.c./min. P.A.H. clear.: 262 c.c./min. 3. Mannitol clear.: 84 c.c./min. P.A.H. clear.: 443 c.c./min.	——— Atrophy and fibrosis of the tubules ———
Foye	1956	Creat. clear.: 81 c.c./min.	———
Van Buchem	1956	Creat. clear.: 96 c.c./min. P.S.P.: 80% in 2 hours	Thickening of the arterioles; dilatation of the tubules
Holten	1956	Creat. clear.: 60 to 90 c.c./min.	None—normal kidney
Chalmers	1956	Inulin clear.: 44.5 c.c./min. P.A.H. clear.: 220 c.c./min.	Vacuolar nephropathy Hypertensive nephrosclerosis with great thickening of the arteries
Mader	1956	Inulin clear.: 55.5 c.c./min. P.A.H. clear.: 445 c.c./min.	———
Fine	1957	Creat. clear.: moderately decreased	Vacuolar nephropathy Focal embolic glomerulonephritis
Hellem	1956	Creat. clear.: 34 c.c./min.	———
Hudson	1957	Creat. clear.: 110% of normal	———
Crane	1958	P.S.P.: 70% in 2 hours	Some arteriolar sclerosis
Bartter	1958	1. P.S.P.: 60% in 1 hour	Arteriolar sclerosis and focal thrombonecrosis
		2. Inulin clear.: 108 c.c./min.	Normal kidney
Genest	1958	Inulin clear.: 140 c.c./min. P.A.H. clear.: 560 to 680 c.c./min.	Vacuolar nephropathy
Siguier	1958	Mannitol clear.: 160 c.c./min. P.A.H. clear.: 380 c.c./min.	Vacuolar nephropathy
Brooks	1957	1. Creat. clear.: 78 c.c./min.	Focal ischæmic changes due to arteriosclerosis. Patchy deposition of calcium salts involving the walls of collecting tubules.
		2. Inulin clear.: 64 c.c./min. P.A.H. clear.: 267 c.c./min.	Histology consistent with malignant hypertension

TABLE VIII.—URINARY ALDOSTERONE, 17-HYDROXYCORTICOSTEROID AND 17-KETOSTEROID EXCRETION (27 CASES)

Author	*Year*	*Aldosterone*	*17-hydroxy*	*17-keto*	*Comment*
Conn	1955	Incr.	N.	N.	Adenoma
Milne	1956	N.	—	—	Adenoma
Nassim	1957	Incr.	—	—	Adenoma
Milne	1954	Incr.	—	—	Adenoma
Russell	1956-7	N.	—	N.	Adenoma
Mucio	1957	Incr.	N.	N.	Adenoma
Skanse	1957	Incr.	—	N.	Adenoma
Crane	1956	—	N.	N.	Adenoma
Eales	1956	Incr. & N.	N.	N.	Adenoma
Hewlett	1957	1. Incr.	—	N.	Adenoma
		2. Incr.	—	N.	Adenoma
		3. Incr.	—	—	Adenoma
Foye	1956	Incr.	—	N.	Carcinoma 17-keto-corticosteroid markedly increased
Van Buchem	1956	Incr.	N.	N.	Hyperplasia
Holten	1956	Incr.	—	N.	"Normal adrenals"
Chalmers	1956	Incr. & N.	—	—	Adenoma
Mader	1956	Incr.	Slight incr.	N.	Adenoma
Fine	1957	Incr.	N.	N.	Adenoma
Hellem	1956	—	—	N.	Adenoma
Hudson	1957	— ?	Upper limit of N	Upper limit of N.	Adenoma (moderate obesity, slight hirsutism)
Crane	1958	N. & incr.	N.	N.	Adenoma
Bartter	1958	1. Incr. & N.	N.	—	Hyperplasia
		2. Incr.	N.	—	Adenoma
Genest	1958	Incr.	N.	N.	Hyperplasia
Siguier	1958	Incr.	N.	N.	Adenoma
Brooks	1957	1. Incr.	—	Incr.	Carcinoma (17-keto-corticosteroid incr.)
		2. N.	—	N.	Adenoma

LEGEND: Because of the multiplicity of methods used, comparison of values obtained is useless. Therefore only the significance of the results is given.
Incr.: increased.
N. : normal.
— : not done.
— ? : done but the author does not mention the method used or the normal value.

In five cases,[4, 9, 10, 15-17, 35] where renal function seemed to be markedly altered, histology of the kidney showed either a marked arteriolar sclerosis and/or severe pyelonephritis and/or vacuolar nephropathy.

4. *Hormonal Studies*

(a) Urinary aldosterone

The urinary aldosterone output in 21 patients out of 24 was high. In three cases however, urinary aldosterone values were normal.[9, 15-17, 35] It is quite possible that high values might have been obtained in those on repeated determinations, for in other cases[7, 10, 26, 27] normal and high values were found.

(b) Urinary 17-hydroxycorticosteroids and 17-ketosteroids

Urinary 17-hydroxycorticosteroid and 17-ketosteroid excretions were normal in all patients with non-malignant lesions, except in two where there was a minimal increase.[3, 24] On the other hand, 17-keto-corticosteroids were well above normal in both cases of carcinoma and a normal 17-ketosteroid excretion was found in the first case[2] and increased 17-ketosteroid excretion in the second one.[17]

(c) Other urinary corticosteroids

In addition to these hormonal determinations, Genest *et al.*[30] have carried out extensive steroid studies. Repeated determinations for cortisone, hydrocortisone and their tetrahydro derivatives, for the tetrahydro derivatives of 17-hydroxy, 11-desoxy-corticosterone, etiocholanolone and pregnantriol were all within normal limits.

(d) Effect of ACTH

Conn[1, 11] in his papers points out the paradoxical effect of ACTH on urinary excretion of sodium and potassium. In his patient, 80 units of ACTH were given intramuscularly daily for five consecutive days. The sodium balance, which was slightly positive during the first two days, became negative on the third day with a marked sodium loss in the urine. Potassium balance followed the same pattern but to a lesser degree. The same observation has been reported by other authors.[4, 20, 26, 31] On the other hand, Eales and Linder[7] obtained sodium retention with diuresis of potassium on administration of ACTH. Using intravenous cortisone, Mader and Iseri[3] observed in their patient a marked urinary loss of sodium, chloride and water accompanied by a less important loss of potassium. The same results have been obtained with Δ^1-9α-fluorocortisone.[31] As pointed out by Siguier *et al.*[31] and Brooks *et al.*[17] there is here a striking parallel between sodium and potassium balance. The effect of ACTH is to produce a normal increase in 17-hydroxycorticosteroids and 17-ketosteroids in primary aldosteronism;[30] only Bartter and Biglieri reported a response below normal.[27]

In Genest's patient, aldosteronuria increased four-fold under ACTH;[30] Siguier *et al.*[31] and

TABLE IX.—CORTICOSTEROID CONTENT OF SOME REMOVED TUMOURS OR GLANDS
(In μg./g. of tissue)

	Normal Neher,[40] Hudson, Lombardo	*Adenoma Mader and Iseri,[3] Neher[40]*	*Adenoma Neher[40]*	*Adenoma Neher[40]*	*Adenoma Conn and Louis[11]*	*Hyperplasia Genest et al.[30]*	*Adenoma Eales and Linder[7]*
Cortisol	2.3 -5.5	9.0	3.5	4.0	—	30.7	0.2
Cortisone	0.04–0.39	0	less than 1.0	0	—	29.7	—
Aldosterone	0.05	1.4	1.05	1.08	8.7	3.64	5.6

Kennedy *et al.*[29] also report an increase but to a lesser degree. However, Eales and Linder's results are far less conclusive on this matter.[7]

(e) Corticosteroid content of removed tumours and glands

A few authors[1, 3, 7, 11, 14, 17, 19, 20, 30, 40] have analyzed the corticosteroid content of removed glands or tumours. Table IX sums up the results obtained in a few of these cases.[1, 3, 7, 11, 30, 40] In Genest's patient, in addition, adrenal gland incubation was carried out,[30] and the release of aldosterone by adrenal slices during eight hours' incubation was 11.6 μg./g. of tissue, as compared to 5.8 which was the highest aldosterone value obtained in a case of Cushing's.[30]

5. *Special Tests*

Sodium and potassium determinations in striated muscle[1, 10, 11, 14, 22] show an increase of intracellular sodium with a decrease of intracellular potassium. These findings are corroborated by other studies[3, 10, 26] which emphasize the increase of intracellular as well as of extracellular sodium and the decrease of the total exchangeable potassium (determined by the method of isotopic sodium and potassium dilution techniques). There is a decrease in sodium and chlorides and an increase in potassium in sweat and saliva of most patients.[1, 10, 11, 19, 20] However, this is not a constant finding since Hudson *et al.*[24] and Brooks *et al.*[17] have found values in the normal range. Romanelli *et al.* reported a normal pulmonary artery pressure in their hypertensive patient.[23] Van Buchem's patient[12, 14] had no free hydrochloric acid in his gastric juice, but, after surgical cure, the amount of acid rose to high levels.

VARIOUS MODIFYING INFLUENCES

1. *Modifications due to Dietary Changes*

By changing the dietary amounts of sodium and potassium, one may intensify or lessen the symptoms and signs in primary aldosteronism. However, taking into consideration our present knowledge of the physiological effects of aldosterone, it is difficult to interpret the results obtained.

(a) High potassium (up to 200 mEq./day) diet with normal sodium intake

With this diet, a few patients[2, 7, 15-17, 27, 29] have been markedly improved clinically and biochemically. On the other hand, in most cases the signs and symptoms showed a certain degree of resistance to potassium administration. The clinical and biochemical picture remained unchanged in the patients of Skanse,[20] Hellem[4] and Conn[1, 11] in spite of brief initial retention of potassium with an increased natriuresis. In other cases[3, 9, 26, 35] a marked clinical improvement was obtained but plasma potassium remained at or below the lower limit of normal. Potassium loads increased aldosteronuria in a few patients.[7, 27]

(b) Low sodium diet with normal potassium intake

With this regimen, Bartter and Biglieri[27] obtained a gradual reduction of urinary sodium to zero without any increase in urinary aldosterone. In addition, blood pH and plasma potassium remained in the normal range.

(c) Low sodium (25 mEq./day) diet with high potassium (270 mEq./day) intake

With such a diet, Brooks and co-workers[17] obtained a slightly negative sodium balance with a strongly positive potassium balance.

(d) High sodium diet with normal potassium intake

A markedly positive sodium balance accompanied by a strongly negative potassium balance was noted in Brooks and McSwiney's patient.[17] In spite of the high sodium intake, urinary aldosterone levels remained high in both patients of Bartter and Biglieri.[27] On the other hand, a marked natriuresis followed by a decrease in aldosteronuria and a negative potassium balance were obtained in Siguier's patient.[31]

2. *Modifications due to Administration of Specific Drugs*

(a) Acetazolamide. The administration of acetazolamide raised the urinary pH in the patients of Milne and Evans[9, 35] and of Russell.[15, 16] It produced in Eales and Linder's patient[7] a large increase in the amount of urinary potassium with an associated lowering of plasma potassium (from 3.22 mEq./l. to 2.66 mEq./l.) and was accompanied clinically by paræsthesiæ.

(b) Chlorothiazide. Used intravenously by Genest *et al.*,[30] at a dosage of 10 mg. per kg. of body weight, chlorothiazide induced a marked sodium, potassium and chloride diuresis in spite of the high aldosteronuria level in their patient. In addition, there was a 65% decrease in the glomerular filtration rate with a lowering of the filtration fraction from 25% to 15%.

(c) Spirolactone (Searle SC-8109). Given at a dosage of 1.2 g. per day during two days,[30] this aldosterone antagonist significantly increased the urinary excretion of sodium on the second day of its administration. In addition there was a slight decrease in urinary conjugated 17-hydroxycorticosteroids without any change in urinary levels of free cortisone, hydrocortisone and aldosterone.

(d) Intramuscular reserpine. On two occasions 2.5 mg. of reserpine was administered intramuscularly to Genest's patient.[30] The first administration, after a 24-hour latent period, resulted in a marked drop in blood pressure lasting two days and was accompanied by orthostatic hypotension. It was associated with a marked retention of sodium and chlorides and to a lesser degree, of potassium, without any change in aldosteronuria. A slight increase in the urinary cortisone and hydrocortisone levels was noted. The results from the second administration obtained after a 36-hour latent period were similar, except for orthostatic hypotension which lasted almost four hours and a more severe degree of sodium, chloride and potassium retention. No change was noted in urinary aldosterone, cortisone and hydrocortisone excretion values.

(e) Human growth hormone (S.T.H.). Five mg. of human S.T.H. was given twice at 12-hour intervals to Genest's patient.[30] No modification occurred in the urinary excretion pattern of sodium, potassium, chloride, aldosterone, cortisone, hydrocortisone, or free and conjugated forms of the 17-hydroxycorticosteroids.

(f) Posterior pituitary extract. Siguier[31] observed an increase in urinary aldosterone level after administration of this extract.

SURGICAL CURE AND POSTOPERATIVE FOLLOW-UP

1. Type of operation performed:

In most patients having a single adrenal adenoma, unilateral adrenalectomy or a simple adenomectomy when technically feasible provides an efficient and elegant means of complete cure. Surgical cure is achieved in bilateral hyperplasia either by bilateral subtotal adrenalectomy[12] or by bilateral total adrenalectomy.[30] When the adrenals appear grossly normal, bilateral subtotal adrenalectomy is advisable, although Holten and Petersen[13] and Kennedy *et al.*[29] did obtain good results in their two patients with unilateral adrenalectomy. In all instances, the best surgical approach is the anterior transabdominal route by which both adrenals can be seen simultaneously.

Before, during and in the first few days following surgery, most authors gave their patients large amounts of potassium orally or intravenously, and cortisone or one of its analogues, and/or ACTH.

2. Postoperative follow-up:

The postoperative course is conditioned by three main factors: the biochemical and clinical severity of the disease before surgery; the kind of treatment received by the patient before, during and after surgery; and finally, the type of surgical operation performed.

(a) *Postoperative follow-up of patients who underwent unilateral adrenalectomy*

Most patients belonged to this group. During the 12 to 20 days after surgery, they showed a marked potassium retention associated with a large natriuresis, which re-established the normal electrolyte equilibrium; while the alkalosis disappeared and the CO_2 combining power decreased to a normal level. The three patients of Hewlett *et al.*[21] showed a progressive drop of CO_2 combining power to values of 17.6, 23.1 and 19.6 mEq./l. in two to six months after surgery; in the last case, this was accompanied by hyperkalæmia. Relman's patient suffered from chronic hypoaldosteronism for many months after unilateral adrenalectomy.[18] Notwithstanding these exceptions, a rapid and progressive return of electrolyte balance and blood pH to normal was the rule.

In one of Hewlett's patients, the diabetic state was improved by unilateral adrenalectomy, and in another, the glucose tolerance, which was typically diabetic before surgery, improved after operation.[21] After a surgical cure, the urinary aldosterone level became normal[7, 13, 20, 22] or so low that it was impossible to measure.[1, 11, 21, 24, 29, 31] The 17-hydroxycorticosteroid and 17-ketosteroid urinary excretion usually was not modified. Electrocardiographic changes disappeared and electrolyte disturbances in sweat and saliva were completely corrected. Renal function tended to improve after surgery. It must be emphasized, however, that irreversible kidney damage will not be modified by operation.

1. Polyuria, polydipsia and nycturia usually disappear rapidly in five to 15 days.

2. The marked urinary potassium loss also ends quickly, as proved by Eales and Linder[7] and Chalmers *et al.*[10]

3. Urinary pH is back to normal in one or two weeks.

4. Albuminuria disappears in most cases in one to four weeks.

5. The concentrating power of the kidneys is restored to normal in one to seven months after the operation.

6. In patients in whom a more detailed study of renal function is performed after surgery,[7, 10, 13, 15, 16, 21, 22] a significant decrease in glomerular filtration rate and renal plasma flow, often associated with an increase of blood urea, can be reported during the first postoperative months. Very gradually, in two to twelve months, these abnormalities subside and renal function returns to normal.

In general, clinical symptoms and signs disappear after the operation. Blood pressure drops to normal levels most often during the first few days[6, 7, 10, 26, 31] or during the first month after surgery,[1, 11, 21, 24, 27] although in a few cases it took two months[21, 22] to even one year.[21] In two cases[10, 21] apparently cured by surgery, a moderately severe arterial hyperten-

sion reappeared six months later. Episodes of tetany, muscular weakness or paralysis, and a paræsthesia vanish completely after operation. With the exception of Foye and Feitchmeir's patient[2] suffering from a carcinoma, all patients who underwent surgery seemed definitely cured.

(b) *Postoperative follow-up of patients who underwent bilateral, total or subtotal adrenalectomy*

Two patients were treated by subtotal bilateral adrenalectomy.[14, 27] In van Buchem's patient[14] blood pressure and plasma electrolyte values quickly returned to normal levels; polyuria and polydipsia disappeared in a few days. Urinary aldosterone excretion level dropped to 10.4 μg./24 hrs. The concentrating power of the kidney was completely restored in two weeks. With 25 mg. of cortisone per day, this patient was in clinical and biochemical balance.

Bartter and Biglieri's patient[27] did not receive any drug after surgery, in spite of the fact that his urinary aldosterone level was very low. This patient was asymptomatic with a diet containing 20 mEq. of sodium per day. However, when sodium intake was increased, arterial hypertension appeared and when sodium intake was decreased to below 20 mEq./day, orthostatic hypotension occurred.

This striking parallelism between sodium intake and arterial blood pressure was also noticed in Genest's patient.[30] Indeed, in this patient, who underwent a total bilateral adrenalectomy, the arterial blood pressure in general closely followed variations in sodium intake. With 12 g. of sodium chloride and 30 mg. of hydrocortisone per day, sodium balance remained negative. Administration of 50 μg. of 9α-fluoro-hydrocortisone per day markedly increased the blood pressure (diastolic pressure of 140 mm. Hg) without modifying the sodium balance which remained negative except on the first day of administration. However, when d,l-aldosterone acetate was added to this regimen, at a dosage of 150 μg. per day orally, sodium equilibrium was reached.

SUMMARY AND CONCLUSIONS

Primary aldosteronism may be characterized in the following manner:

1. Slightly more frequently observed in women than in men, with a peak age incidence between 30 and 45 years of age.

2. Caused in most cases by an adrenal adenoma; though in young patients adrenal hyperplasia is more frequent.

3. Arterial hypertension, polyuria, polydipsia, nycturia, episodes of muscular weakness or of paralysis and less often tetanic crises are the main clinical features.

4. Hypokalæmia is a constant finding and may or may not be accompanied by hypernatræmia and alkalosis.

5. Urinary specific gravity is low and remains so even after fluid deprivation or pitressin administration. Urinary pH is alkaline.

6. Urinary aldosterone level is usually well above the normal range but in some cases may, exceptionally, be normal at certain times during the course of the illness. The urinary excretion of the 17-hydrocorticosteroids and of the 17-ketosteroids is not modified.

7. Surgery is the only definitive treatment.

As arterial hypertension clinically indistinguishable from essential hypertension may be the sole manifestation of this disease, plasma potassium determinations should be carried out in *every* hypertensive patient, whatever his age. The primary importance of recognizing this disease is that it belongs to that small group of causes of hypertension where a permanent cure may be achieved by surgical intervention.

ADDENDUM

A few comments should be made on the status of primary aldosteronism before Conn's description of it in 1955, and since June 1958.

It is quite likely that many cases reported as "potassium-losing nephritis with periodic paralysis" before Conn's description was published were in fact based on patients suffering from primary aldosteronism. Cases reported by Milne and Evans[9, 35] and Russell *et al.*[15, 16] are striking examples of this. The two patients of Luft *et al.*[33] had histories very suggestive of primary aldosteronism; moreover, an adrenal adenoma was found at autopsy in the first case, and in the second one both adrenals were well above normal weight (total weight for both, 19 g.). However, blood pressure was normal in both patients (the authors even spoke of hypotension in the second case, which also had œdema). The patient of Kjerulf-Jensen *et al.*[32] similarly had a history very suggestive of primary aldosteronism but, as in Luft's cases, the blood pressure was normal and œdema was present (cyclical in that case). Wyngaarden's patient[34] suffering from malignant hypertension associated with marked renal impairment, urolithiasis and necrotizing arteriolitis had adrenals weighing 20.5 g.

The review of medical literature presented above ends at June 1958. To our knowledge four other cases have since been reported.[37-39] The interesting features of each are as follows:

1. Diabetes was associated with primary aldosteronism in the patient of Sorce and Whitstone.[39]

2. The first patient of Cortes *et al.*[38] had arterial hypertension as the sole manifestation of the disease for five years. In both patients reported by Cortes *et al.* glucose tolerance, abnormal before surgery, returned to normal after operation.

3. The 44-year-old patient of Hilton *et al.*[37] showed adrenal hyperplasia at autopsy. In this patient an ACTH intravenous infusion (25 units) resulted in an abnormal increase in the plasma hydrocortisone level without any change in urinary excretion of 17-hydroxycorticosteroids but with a significant and abnormal increase in the urinary excretion of the 17-ketosteroids during the first three days after the infusion.

SECOND ADDENDUM (before going to press)

Another case of primary aldosteronism due to adrenal hyperplasia in a 10-year-old boy came to our attention.[41] The syndrome in this child was due to bilateral adrenal hyperplasia chiefly involving the zona fasciculata. This child presented a very severe hypertension accompanied by several episodes of hypertensive encephalopathy but without retinopathy and papillœdema.

REFERENCES

1. CONN, J. W.: *J. Lab. & Clin. Med.*, 45: 3, 1955.
2. FOYE, L. V., JR. AND FEICHTMEIR, T. V.: *Am. J. Med.*, 19: 966, 1956.
3. MADER, I. J. AND ISERI, L. T.: *Ibid.*, 19: 976, 1956.
4. HELLEM, A. J.: *Acta med. scandinav.*, 155: 271, 1956.
5. DUSTAN, H. P., CORCORAN, A. C. AND PAGE, I. H.: *J. Clin. Invest.*, 35: 1357, 1956.
6. CRANE, M. G., VOGEL, P. J. AND RICHLAND, K. J.: *J. Lab. & Clin. Med.*, 48: 1, 1956.
7. EALES, L. AND LINDER, G. C.: *Quart. J. Med.*, 25: 539, 1956.
8. CAMPBELL, C. H., NICOLAIDES, N. AND STEINBECK, A. W.: *Lancet*, 2: 553, 1956.
9. MILNE, M. D. AND MUEHRCKE, R. C.: *Proc. Roy. Soc. Med.*, 49: 883, 1956.
10. CHALMERS, T. M. *et al.*: *Lancet*, 1: 127, 1956.
11. CONN, J. W. AND LOUIS, L. H.: *Ann. Int. Med.*, 44: 1, 1956.
12. VAN BUCHEM, F. S. P., DOORENBOS, H. AND ELINGS, H. S.: *Acta endocrinol.*, 23: 313, 1956.
13. HOLTEN, C. AND PETERSEN, V. P.: *Lancet*, 2: 918, 1956.
14. VAN BUCHEM, F. S. P., DOORENBOS, H. AND ELINGS, H. S.: *Ibid.*, 2: 335, 1956.
15. RUSSELL, G. F. M., MARSHALL, J. AND STANTON, J. B.: *Scottish M. J.*, 1: 122, 1956.
16. RUSSELL, G. F. M., TUCKER, J. B. AND FRASER, J. D.: *Ibid.*, 2: 403, 1957.
17. BROOKS, R. V. *et al.*: *Am. J. Med.*, 23: 391, 1957.
18. RELMAN, A. AND SCHWARTZ, W. B.: Electrolyte balance and acid-base metabolism in primary aldosteronism. Forty-ninth Annual Meeting, Am. Soc. Clin. Invest., Atlantic City, May 6, 1957.
19. FINE, D. *et al.*: *New England J. Med.*, 256: 147, 1957.
20. SKANSE, B. *et al.*: *Acta med. scandinav.*, 158: 181, 1957.
21. HEWLETT, J. S. *et al.*: *J. A. M. A.*, 164: 719, 1957.
22. MUCIO, G., ROMANELLI, R. AND GIOMINI, M. L.: *Folia endocrinol.*, 10: 407, 1957.
23. ROMANELLI, R. *et al.*: Primi rilievi sul circolo-pulmonare nella sindrome di Conn. *Bolletino della Societa Italiana di Cardiologica.* Vol. II, 1957, No. 1-2.
24. HUDSON, B., BARNETT, A. J. AND BORNSTEIN, J.: *Australasian Ann. Med.*, 6: 250, 1957.
25. MAISTERRENA, J., GONZALES DE COSSIO, A. AND FLETCHER, P. E.: *Rev. invest. clin.*, 9: 255, 1957.
26. CRANE, M. G., SHORT, G. AND PETERSON, J. E.: *Am. J. Med.*, 24: 313, 1958.
27. BARTTER, F. G. AND BIGLIERI, E. G.: *Ann. Int. Med.*, 48: 647, 1958.
28. GOLDSMITH, R. S. *et al.*: *Clin. Res.*, 6: 27, 1958.
29. KENNEDY, B. J. *et al.*: Primary hyperaldosteronism due to hyperfunction of the adrenal cortex corrected by partial adrenalectomy. Paper presented at the 40th annual meeting of the Endocrine Society, June 19-21, 1958, San Francisco, California.
30. GENEST, J. *et al.*: Extensive steroid studies in a case of primary aldosteronism. (Parts have been published in *Modern Medicine of Canada*, 14: 79, 1959.) (To be published in *Metabolism*, Jan. 1960.)
31. SIGUIER, F. *et al.*: *Bull. et mem. Soc. méd. Paris*, 74: 113, 1958.
    BAULIEU, E. E. *et al.*: *Ibid.*, 74: 122, 1958.
    BAULIEU, E. E., SCHLUMBERGER, J. AND JAYLE, M. F.: *Ibid.*, 74: 130, 1958.
32. KJERULF-JENSEN, K., KRARUP, N. B. AND WARMING-LARSEN, A.: *Lancet*, 1: 372, 1951.
33. LUFT, R., RINGERTZ, N. AND SJOGREN, B.: *Acta endocrinol.*, 7: 196, 1951.
34. WYNGAARDEN, J. B., KEITEL, H. G. AND ISSELBACHER, K.: *New England J. Med.*, 250: 597, 1954.
35. EVANS, B. M. AND MILNE, M. D.: *Brit. M. J.*, 2: 1067, 1954.
36. NASSIM, J. R. AND JORY, H.: Quoted by Ayres, P. J. *et al.*: Primary aldosteronism (Conn's syndrome), *In*: International symposium on aldosterone, edited by A. F. Muller and C. M. O'Connor, J. & A. Churchill, Ltd., London, 1958, p. 143.
37. HILTON, J. G. *et al.*: *New England J. Med.*, 260: 202, 1959.
38. CORTES, F. M. *et al.*: *Clin. Res.*, 7: 28, 1959 (abstract).
39. SORCE, R. C. AND WHITSTONE, W. E.: *A.M.A. Arch. Int. Med.*, 102: 131, 1958.
40. NEHER, R.: Aldosterone and other adrenocortical hormones in human adrenals and adrenal tumors, *In*: International symposium on aldosterone, edited by A. F. Muller and C. M. O'Connor, J. & A. Churchill, Ltd., London, 1958, p. 11.
41. THERIEN, B. *et al.*: *A.M.A. J. Dis. Child.*, 98: 90, 1959.

CHIRURGIE DES VOIES BILIAIRES: ETUDE ANALYTIQUE DE 1534 CAS*

GERARD GAGNON, M.D., EMILE SIMARD, M.D., FRANCOIS BRISSON, M.D., EDOUARD BEAUDRY, M.D., and AUBIN CHARBONNEAU, M.D.,
Chicoutimi, Qué.

INTRODUCTION

LA CHIRURGIE des voies biliaires est pratiquée très couramment dans les hôpitaux régionaux et dans les centres universitaires. D'importantes publications[1, 2, 4, 5, 6] ont rapporté et analysé récemment de longues séries de malades. En vue d'établir un parallèle, nous avons fait l'étude des dossiers de 1534 patients traités à l'Hôtel-Dieu St-Vallier de Chicoutimi. Tous les cas de chirurgie des voies biliaires classifiés dans nos archives depuis 1948 au 1er février 1959, ont été étudiés par les membres du service de chirurgie. Lès informations pertinentes et les réponses à un questionnaire envoyé à tous nos patients ont été compilées. Sans l'aide d'appareil électronique, les moyennes et pourcentages ont été établis. Les résultats obtenus font la base de la présente étude.

*De l'Hôtel-Dieu St-Vallier de Chicoutimi. Communication présentée au Congrès de l'Association Médicale Canadienne (Division du Québec) tenu à Chicoutimi, les 7, 8 et 9 mai 1959.

AGE ET SEXE

L'âge des patients varie de 15 jours à 78 ans (Fig. 1); la moyenne se situe à 41.8 ans. Nous avons traité 1374 patients de sexe féminin, dont l'âge est de 41.6 ans et 160 de sexe masculin, d'un âge moyen de 46.6 ans au moment de la chirurgie. On constate une prépondérance féminine importante puisque la proportion s'établit à 9 pour 1. Elle diffère considérablement de celle rapportée dans la littérature. Dans la série d'Adams,[1] elle s'établit à 3 pour 1, à 3.5 pour 1 dans la série de Babcock[6] et à 2 pour 1 dans celle de Colcock.[2] La prépondérance féminine dans notre série est due, croyons-nous, au facteur grossesse. En effet, si 247 femmes étaient nullipares, par contre 1127 avaient eu une moyenne de 6.5 grossesses et 16 parmi elles étaient enceintes au moment de l'intervention.

ANATOMO-PATHOLOGIE (Tableau I)

La cholécystite chronique lithiasique est sans contredit la lésion la plus fréquente: 1350 cas. Par ailleurs, 184 patients, soit 8.7%, étaient porteurs d'une cholécystite aiguë. Ce chiffre est variable selon les cliniques: il est de 5% dans la série d'Adams,[1] de 19% dans celle de Babcock[6] et de 9.8% dans celle de Colcock.[2] La discordance de ces différentes séries peut reposer sur le fait d'une interprétation variable des pathologistes. Pour les