

# The Octogenarian Diabetic

## Observations in cases of diabetes before and after the age of eighty years

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### *The Eightieth Year*

If the eightieth year of age be accepted as a dividing line, we may consider in this study three groups of patients. The first group is composed of patients whose diabetes began during or after the eightieth year, a conspicuously small group. Thus, of the 5,239 patients in a 50 per cent sample of cases seen between 1939 and 1947, only twenty-nine or about one-half of 1 per cent, had the onset of age designated as eighty years or over. The second group consists of patients now in the eighth decade of life whose chances of attaining their eightieth birthday are steadily increasing. Of all patients now in the seventies, the proportion who will survive to the age of eighty is about 40 per cent. The third group consists of special patients who have reached their eightieth birthday after surviving diabetes of long duration. In reviewing a long series of diabetic patients, twenty patients were found who attained the age of eighty years or more after having diabetes at least thirty-five years.

### *Incidence of Elderly Diabetics*

The number of elderly diabetic individuals in the community and in the hospital population is greater than ever before. The care of the aged diabetic patient has become an important problem, involving dietary management, the use of insulin in patients, frequently with serious complications affecting their vision and ability to walk. As an example of the age distribution of the hospital population of diabetes, the admissions for 1953 are shown in table 1.

TABLE 1  
Diabetic admissions, New England Deaconess Hospital, 1953

	Male	Female
0-19	130	133
20-39	208	210
40-69	726	854
70-79	115	158
80-89	18	24
	1,197	1,379

It will be seen that a total of forty-two patients were over eighty years of age and 273 were between seventy and seventy-nine years of age.

### *Thirty-Five-Year Diabetics*

A review of the statistical data of 35,000 consecutive diabetic patients in the case registry of the Joslin Clinic from 1898 to 1950 revealed ninety-six patients who had clearly and indubitably survived thirty-five years of diabetes. In this group were seven patients whose diabetes had begun in childhood. In table 2 are listed twenty patients who attained the age of eighty years or more after having diabetes for periods of thirty-five years to a maximum of forty-six years. In the group are sixteen patients who were forty-five years or younger at the onset of diabetes. Actually, in this series only 1,500 patients out of 6,000 cases seen prior to 1925 had the onset of diabetes between forty and fifty years of age. It appears, therefore, that during that period of time the chance of a patient with diabetes originating between the fortieth and fiftieth year of age attaining the age of eighty years was about one in seventy-five. Since patients in this group must necessarily have developed their diabetes several years before the discovery of insulin, the expectancy here estimated must be regarded as the most unfavorable possible. Today, the chance of a patient reaching the age of eighty years with onset of diabetes under the age of forty-five years must have tremendously improved.

What are the characteristics of diabetes which enable the patient to survive thirty-five years of the disease? In this group ten were males and ten were females. Of the group six still remained alive in 1953 at ages eighty and eighty-one. Deaths had occurred in the remainder at ages varying from eighty to eighty-six years.

In each case, the discovery of diabetes had occurred soon after the onset of characteristic symptoms of polyuria, polydipsia, and weight loss. The striking thing was that the discovery of diabetes had been promptly followed

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TABLE 2  
Octogenarian diabetics after thirty-five years

Case no.	Age at last report	Sex	Living or dead	Insulin dose units	Years with insulin	Years without insulin	Age at onset	Cause of death
2,184	86	F	Dead	16*	15	29	41	Arterial heart disease
2,312	84	M	Dead	?	12	25	47	Coronary
3,875	81	M	Living	12*	17	19	44	
7,204	80	F	Dead	20*	1	38	41	Coronary occlusion
20,766	83	M	Dead	20*	10	31	42	Generalized arterio-sclerosis
23,453	84	M	Living	20†	11	25	48	
10,587	81	F	Dead	12-0-8	23	19	39	Cancer of uterus
2,287	81	F	Living	10*	24	16	41	
1,293	86	F	Dead	24-0-14	25	11	50	Congestive failure
1,553	81	M	Dead	27*	11	35	35	Coronary occlusion
2,683	85	M	Dead	32*	2	40	43	Coronary occlusion
3,553	82	M	Dead	21+17*	5	30	47	Coronary occlusion
3,789	80	F	Living	32*	9	30	43	
5,810	81	M	Dead	14-5-8	20	16	45	Pneumonia
6,392	83	F	Dead	10-6-10	18	23	42	Diabetes mellitus
10,470	83	F	Dead	28*	18	22	43	Coronary occlusion
12,974	81	F	Living	15-0-15	20	20	41	
3,016	86	M	Dead	16+40*	14	21	50	Congestive failure
928	80	F	Dead	37-0-27	17	19	43	Coronary occlusion
12,006	81	M	Living	90 u. daily	21	24	36	

by careful dietary treatment. The treatment of the period from 1914 to 1925 employed rigid limitation of calories in the diet, and this group was conspicuous for the intelligence and education of its members. It included professional people such as doctors, lawyers, and teachers. The early discovery of diabetes by vigorous treatment in the early years must be emphasized. Although it is true that every patient sooner or later used insulin, in many instances the period of treatment without insulin was from ten to forty years. The causes of death were predominantly arteriosclerotic, with coronary occlusion predominating. Amputation of the great toe and lower leg occurred in each of two patients. Six remained alive in 1953.

#### *Diabetes in the Eighth and Ninth Decades*

Diabetic patients more than seventy years of age admitted in a two-year period at the New England Deaconess Hospital have been reviewed, including patients reported previously by Miller and Marble.<sup>2</sup> Among the 447 patients who were seventy years of age or older at the time of admission to the hospital, 281, or 62.9 per cent, were females. Thus, females outnumbered males two to one, a fact consistent with the higher incidence of diabetes among females in the older age group and also the greater longevity of females in the general popu-

lation. In table 3 a distribution according to age and sex is shown. Sixty-five were over eighty years of age, thirteen exceeded eighty-five years, and one patient had attained the age of ninety years and had had diabetes for fifteen years.

TABLE 3  
Age and sex of patients at time of hospital admission, 1952-1953

Age years	Sex		No. of patients
	male	female	
70-74	90	161	251
75-79	55	76	131
80-84	18	34	52
85-89	3	9	12
90 or over	0	1	1
	166	281	447

The age at onset and the duration of diabetes are summarized in table 4. The number of patients in whom the onset of diabetes was under fifty years was only forty-eight. In this group, the duration of diabetes ranged from twenty-one to forty-four years, with an average of twenty-eight and one-half years. The duration of diabetes among the forty-seven patients with onset from fifty to fifty-four years ranged from sixteen to thirty years, with an average of twenty-two.

TABLE 4

Age at onset and duration of diabetes at time of study, 1952-1953

Age at Onset (years)	No. of patients	Duration of Diabetes (Yrs.) range	average
Under 50	48	21-44	28.5
50-54	47	16-30	22
55-59	90	11-27	16
60-64	58	7-23	12.5
65-69	88	1-23	8.5
70-74	70	1-16	4.5
75-79	33	1-15	3
80 or more	13	1-3	1.5
	447	1-44	12.5

The onset of diabetes after the age of seventy becomes steadily more rare. The peak of the curve according to the age at onset of diabetes is attained during the fifties. Among the 447 patients in this series, the onset of the disease in its clinical form was estimated at between seventy and seventy-four years of age in only 70 cases, at seventy to seventy-five years in only thirty-three and after eighty years in only thirteen cases. Actually the date of onset in other patients is usually earlier than records indicate. Symptoms at onset are often mild or absent or forgotten. More reliable dates of onset can only be obtained by annual routine examinations of the urine and the blood. This has been recommended for many years and stressed more particularly in the Diabetes Detection Drive of the American Diabetes Association during the last six years.

The average duration of diabetes among the 447 patients was 12.5 years at the time of the hospital ad-

mission. This figure may be compared with average duration of diabetes at time of death with particular reference to the advancing age at death in the various eras of treatment as shown in table 5. It will be seen at all ages that the duration of life has steadily increased. For the group with onset of diabetes over the age of sixty years, however, the average length of life had only reached 10.3 years for the period ending May 11, 1954. The great prolongation of life is naturally to be found in the younger groups with onset of diabetes before the age of forty years.

*Severity of Diabetes*

The usual teaching is that diabetes among the aged is "mild," for the reason that the insulin dosage is relatively small and usually glycosuria may be controlled fairly easily. Although this is true in general, so far as hospitalized diabetic patients in the older age group is concerned the insulin dose is not necessarily small and indeed cases of marked insulin resistance are well-known. As indicated in table 3, 7 patients required 100 units of insulin daily or more, only 25 of the 447 patients were discharged without insulin, and 248, or 55.5 per cent, were advised to take between 20 and 49 units of insulin daily. The insulin requirement was between 50 and 99 units in almost 12 per cent. Such insulin dosages may not be necessary in elderly patients in the community, since in this hospital group the presence of many complications and the difficulty in controlling glycosuria were the reasons for admission.

Various methods were employed in the use of insulin. Seven patients received unmodified or crystalline insulin

TABLE 5

Average duration of life subsequent to onset of diabetes among 14,603 deceased ex-patients in each of the important eras of treatment. By age group at onset. (Experience of Elliott P. Joslin, M.D., 1897-1954)

Age groups at onset	Naunyn Era 1897 to 5/31/14		Allen Era 6/1/14 to 8/6/22		Banting Era				Hagedorn Era 1/1/37 to 12/31/43		Chas. H. Best Era 1/1/44 to 12/31/49		1/1/50 to 5/11/54	
	No. of cases	Duration (yrs.)	No. of cases	Duration (yrs.)	No. of cases	Duration (yrs.)	No. of cases	Duration (yrs.)	No. of cases	Duration (yrs.)	No. of cases	Duration (yrs.)	No. of cases	Duration (yrs.)
All ages	326	4.9*	836	6.1*	1,457	8.0*	2,695	10.3*	3,607	12.2*	3,724	13.9*	1,958	16.4*
0-9	24	1.3	61	2.9	21	2.8	24	7.3	36	10.3	58	18.5	58	21.2
10-19	39	2.7	84	2.7	56	3.4	60	7.4	79	11.4	125	16.2	120	20.3
20-39	85	4.3	215	4.9	198	8.9	275	14.4	398	16.9	444	18.8	317	21.8
40-59	126	7.0	351	8.0	800	9.5	1,457	11.6	1,901	13.5	1,970	15.1	987	16.8
60 and over	51	4.4	117	6.4	379	5.5	859	7.0	1,192	8.6	1,115	9.4	473	10.3
Unknown	1	—	8	—	3	—	20	—	1	—	12	—	3	—

\*Based on cases with known duration.

Note: Deaths reported through May 11, 1954.

Prepared by the Statistical Bureau, Metropolitan Life Insurance Company.

TABLE 6

Daily insulin dose prescribed at time of discharge 1952-1953

Insulin dose (units)	No. of patients	Per cent
0	25	5.6
10-19	114	25.5
20-49	248	55.5
50-99	53	11.8
100 or more	7	1.6
	447	100.0

alone; a few received protamine-zinc insulin in a single daily dose before breakfast. Of the 422 patients for whom insulin was prescribed at the time of discharge, 365, or 87 per cent, were taking NPH insulin daily before breakfast, either alone or in combination with unmodified insulin.

The diet prescribed at discharge contained carbohydrate ranging in amounts from 140 to 200 gm., 60 to 125 gm. of protein, and 40 to 120 gm. of fat. The problems of dietary prescription need the personal interest of physician, nurse, and dietitian. The older patients, particularly those with complications and those who have been long ill, may be frequently helped by careful additions of protein to their diet. It is often surprising how much change in the patient's morale can be brought about by judicious use of selection in food, with particular reference to the total calories required in this older group, compared to younger people who are physically active, and the problems of digestion are added to the problems of constipation or the easy development of what may prove to be serious diarrhea. Lack of good chewing surfaces may be important.

The reasons for admission to the hospital included regulation of diabetes in about one-third of the cases. None of this series was in diabetic coma.

*Vascular Complications*

Although one in five of the patients showed no characteristic clinical lesions of arteriosclerosis as a cause of symptoms or of hospital admission, it is probably fair to say that practically every patient in this series did have arteriosclerosis.

In table 7 are summarized the chief lesions associated with vascular disease. Cerebral arteriosclerosis with clinical evidence was evident in eighty-nine patients, or 19.9 per cent, arteriosclerotic heart disease in 52.1 per cent, and peripheral vascular disease in 28.9 per cent. Many patients had more than one complication and so were included in this series under more than one heading. Chronic nephritis was present in 5.1 per cent. Among the patients with cerebral arteriosclerosis, cerebral vascular accidents occurred in forty-eight patients, or

TABLE 7

Vascular complications

Complication	Number	Patients Per cent of total
Arteriosclerosis		
1. Cerebral	89	19.9
Cerebral vascular accident	48	10.7
Senile deterioration	35	9.2
Other	6	
Parkinson's disease		
2. Cardiac	233	52.1
Coronary sclerosis (Ecc)	132	29.5
Angina pectoris	16	3.6
Myocardial infarction	34	7.6
Congestive heart failure	51	11.4
3. Peripheral	129	28.9
With gangrene	51	11.4
Without gangrene	78	17.5
Hypertension (over 140/90)	267	59.7
Chronic nephritis	26	5.1
Retinitis	101	22.6

10.7 per cent. Senile deterioration was present in thirty-five patients. Six patients were recorded as having Parkinson's disease.

In 333 patients, arteriosclerotic heart disease of significant degree occurred. Myocardial infarction was present in thirty-four patients, congestive heart failure in fifty-one patients and angina pectoris in sixteen. In a considerable number, although no clinical symptoms had been present, very characteristic electrocardiographic changes left no doubt of the existence of coronary arteriosclerosis. In this older group are slight changes, such as lowering of the T waves, which seem to have special diagnostic significance. We have come to give a good deal more serious interpretation to electrocardiographic changes in the elderly diabetic than would be given to the same cases in a nondiabetic. Arteriosclerotic disease of the lower extremities was a major difficulty in 129 cases. However, it is true that in a much larger number of patients, moderate degrees of impaired blood supply due to arteriosclerosis were present. This is a finding of major importance in the so-called mild elderly diabetic patient. It is in this group that slight lesions or burns, if neglected, particularly where the foot may be partially anesthetic, may have the gravest consequences in later osteomyelitis, gangrene, and amputation.

Hypertension, including patients with blood pressure readings over 140/90, occurred in 267 or 59.7 per cent of the total series. Uremia was present in only ten pa-

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tients, or 2.9 per cent, but many other patients had proteinuria of varying degrees. In many, pyelonephritis had occurred in the past. The incidence of the diabetic nephropathy in our hospital population has increased. Thus, in the year 1952 the incidence of pyelonephritis was 3.3 per cent, but in 1953 it had increased to 6.8.

Although retinitis is not primarily due to arteriosclerosis, it is a complication of major importance in diabetic patients, particularly those with disease of long duration. Its frequency appears to have a fairly direct correlation with the degree of poor control of diabetes. Among the 447 patients, it is recorded in 101 cases, or 22.6 per cent, and in only three cases is retinitis proliferans recorded. Nonvascular complications are shown in table 8, although only 93 patients, or 20.1 per cent, are recorded as having the neuropathy of moderately severe type. A very much larger number might have been included had sensory disturbances and particularly loss of reflexes or loss of vibratory sensation been considered as sufficient reason for inclusion. Actually in this group of patients, probably nearly all could be shown to have some evidence of disturbance in the nervous system. The group, included here, presented painful peripheral neuritis, paralyses of the ocular nerves, diabetic tabes with paralysis of the urinary bladder, and severe disturbance in sensation in the feet, accompanied by pressure ulcers and other severe infections of the feet. Infections of one type or another occurred in 24.6 per cent of the series. Cancer was present in 9.2 per cent and gall bladder disease in 5.6 per cent.

TABLE 8  
Nonvascular complications

Complications	Patients	
	Number	Per cent of total
Neuropathy	93	20.1
Infections	110	24.6
Urinary tract	39	8.7
Lower extremities	71	15.9
Cancer	41	9.2
Gall bladder disease	25	5.6

Surgical complications were present in 102 patients, or 22.8 per cent, all of whom were operated on. In fifty-one cases, amputations were carried out as follows:

Supracondylar amputations	22
Lower leg	9
Transmetatarsal	20

Operation on the extremity was carried out with low spinal anesthesia, which has over the years proved to be safest.

Deaths in the hospital occurred in 53 patients. The causes were as follows:

Myocardial infarction	20
Congestive heart failure associated with coronary arteriosclerosis	5
Uremia from nephrosclerosis	3
Cerebral vascular accidents	11
Pulmonary embolism	4
Pulmonary infarction	1
Cancer	9
Total	53

Postmortem findings in thirteen cases are summarized in table 9.

#### Discussion

This series of 447 patients has emphasized to us the serious problem presented by the number of aged diabetic patients, not only in the hospital but in the general population. During these last two years in Boston under the auspices of the Diabetes Committee of the Massachusetts Medical Society, a study of the foot complications of diabetic patients in the hospitals has been carried on. During a twelve-month period, 502 patients were in a group of seven Boston hospitals as inpatients requiring surgical consultation or treatment. The average stay for the group, excluding the small number who were in the hospital for only a few days because of death, was thirty days. The average period of treatment outside the hospital was twenty-seven days. If one takes into count the long period of convalescence and the fact that in ninety patients major amputations were done, the serious character of the foot lesions and the tremendous expense of this problem in the elderly patients become more significant. The important fact in the elderly diabetic patient is the necessity for carrying out treatment with as great care as in younger patients. The discovery of so-called mild diabetes in the elderly patients should be regarded as tremendously important if the crippling complications in the legs and the eyes are to be prevented. The outstanding lesions which cause hospitalization and bring the patient to become a burden to his family are vascular, first in the legs and then in the heart. These vascular lesions, while common in the general population, are of particular importance in frequency in the younger diabetic patients as well as old. Recent studies<sup>3</sup> have clearly indicated that careful and continuous control of the diabetes from its onset will prevent or postpone these sequelae.

#### SUMMARY

A review of 4,690 hospital admissions of diabetic patients in 1952 and 1953 revealed a series of 447 patients between seventy years and ninety-one years.

TABLE 9  
Post-mortem findings in thirteen diabetics

Case No.	Sex	Age	Duration of diabetes	Cause of death	Pancreas	Heart
19,716	M	73	5	Congestive heart failure and gangrenous appendicitis	Islets normal in number. Slight hyaline change	Calcification of mitral annulus
6,493	M	73	15	Myocardial infarction	Islets fibrosed—moderate hyalinization of islets	Myocardial infarction, pulmonary edema (bilateral)
19,265	F	76	1	Uterine adenocarcinoma	Hydropic degeneration of islets	Coronary arteriosclerosis ++
17,447	M	78	3	Myocardial infarction	Partial or complete hyalinization of islets	
14,232	F	77	15	Cerebral infarction	Extensive hyalinization of islets. Ecotopic pancreas in ileum	Calcification of mitral valve ring
15,940	M	70	28	Aspiration pneumonia	Slight fibrosis of islets	
19,337	F	74	Recent	Cerebral infarction and hemorrhage	Numerous lymphocytes	Arteriosclerosis ++
4,203	M	83	33	Pulmonary infarction, pneumonia	Hyalinization of islets; islets fibrosed	
19,955	F	83	2	Myocardial infarction	Partial hyalinization of islets and fibrosis	Arteriosclerosis ++
7,204	M	74	15	Myocardial infarction	Partial hyalinization of islets	Pulmonary edema
13,245	F	76	12	Uremia and nephrosclerosis	Islets decreased in number; partial hyalinization	Coronary sclerosis
16,166	F	71	14	Granulomatous myocarditis and brain stem damage	Hyalinization of islets	Myocardial fibrosis

Among the 447 patients, females outnumbered males two to one. The average duration of diabetes was 12.5 years. In 116 patients, the onset of diabetes was at the age of seventy and in thirteen patients the age at onset was eighty years or higher.

Twenty patients who attained the age of eighty or more years after having diabetes for thirty-five years are discussed. Ten were males and ten were females. All had taken insulin, but in each the diabetes had been discovered before the use of insulin was possible and

therefore a good many years of treatment with dietary restriction alone had been carried out.

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## SUMMARIO IN INTERLINGUA

*Le Diabetico Octogenari**Observationes in Casos de Diabete Ante e Post le Etate de Octanta Annos*

Un revista de 4690 diabeticos hospitalisate inter 1950 e 1953 revelava un serie de 447 patientes de etates inter 70 e 91 annos. Duo tertios del 447 patientes esseva femininas. Le duration median del diabete in iste 447 casos esseva 12,5 annos. In 116 patientes le declaration del morbo habeva occurrite post le etate de 70 annos;

in 13 patientes post le etate de 80 annos.

Nos discute le casos de 20 patientes qui attingeva etates de plus que 80 annos con diabete de 35 annos de duration. Dece de istes esseva masculos e 10 femininas. Omnes habeva prendite insulina, sed in omnes diabete habeva essite establite ante que le uso de insulina esseva possibile. Consequentemente illes habeva habite multe annos de tractamento con solmente restrictiones dietari.