Papers and Originals

Varicose Veins in Women Cotton Workers. An Epidemiological Study in England and Egypt*

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British Medical Journal, 1969, **2**, 591–595

Summary : The prevalence of varicose veins was studied in 504 women cotton workers in England and 467 in Egypt, by a standardized questionary and a specially developed method of examination. The English mill population showed a much higher prevalence of varicose veins than the Egyptian, probably owing to environmental rather than ethnic reasons.

Among the European women the prevalence of varicose veins was significantly related to age, parity, body weight, type of corsetry, and occupation—that is, whether or not they stood at their work. After standardizing for the other variables there was a statistically significant excess of varicose veins in women wearing corsets and roll-ons compared with those wearing less-constrictive garments. After a similar standardization a significant excess was found in women who stood at their work compared with those whose jobs entailed walking or sitting.

Introduction

Varicose veins are said to be one of the commonest ailments of people living in Western countries (Dodd and Cockett, 1956), yet they rarely occur in Asia and Africa (Keen, 1908 ; Cleave, 1959 ; Dodd, 1964). Several explanations have been given for this difference.

Thrombosis of the deep veins, rarely seen in Africans but common in Western civilizations (Thomas, Davies, O'Neal, and Dimakulangan, 1960), is accepted as a cause of leg ulcers and varicose veins (Bauer, 1942 ; Lockhart-Mummery and Smitham, 1951 ; Sevitt and Gallagher, 1961 ; Phillips, 1963). Apart from the fact that people stand less in tropical countries because of the heat (Foote, 1960), in Western countries the diet is largely free from vegetable fibres, has less bulk, and is more inclined to produce constipation. It has been suggested that when this goes on over a period of years the descending colon prolapses and pulls on the iliac veins, hindering venous return and raising the intravenous pressure. The valves of the superficial veins eventually yield, causing varicosities (Cleave, 1959 ; Dodd, 1964). In the United States varicose veins are equally common in Negroes and Caucasians, indicating that environmental rather than racial factors may be the cause of this difference between countries (Lewis, 1942 ; Stamler, 1958 ; Cleave, 1960).

All of these comparisons, however, are based on hospital patients and therefore may not give a true picture of the occurrence of varicose veins in the general population, particularly in developing countries, where priority for the limited number of hospital beds must be allotted to emergencies and more serious illnesses.

There have been few epidemiological studies of varicose veins in industrial populations (Pratt, Lake, and Wright, 1942 ; Howard, 1966). So far as is known none has been made for the specific purpose of comparing their prevalence and severity in populations in temperate and tropical or subtropical climates. We report here a comparative study of varicose veins in 504 European and 467 Egyptian women cotton workers undertaken as part of a general survey of their health.

Population Studied

Two mills in England and five in Egypt were chosen for the study. Those in England comprised one in Rochdale, which was thought to be fairly typical of the mills in Lancashire, where most of the industry is concentrated, and another in Carlisle, on the borders of England and Scotland.

Five cotton mills in Egypt were selected to provide a sample of female workers numerically matching the English sample. However, since the recruitment of Egyptian women from agriculture to industry is fairly recent it was not possible to select a sample that would match that in the English mills with respect to age, length of employment, or marital status. The mills were scattered over a wide cotton-manufacturing area in and around the Nile Delta.

In England the women worked in carding, spinning, winding, and weaving processes. In Egypt they were employed in bale-opening and sorting of waste cotton, spinning, winding, and weaving ; no women worked in the card-rooms. Their jobs were therefore similar to those in the English mills, but not identical. The population for this study was defined as all female operatives on the payroll on the day the survey started. Women who had been continuously absent from work for two months or more were excluded.

Method

One of us (S. M.) regularly attended an outpatient clinic for varicose veins to study the latest methods of examination, diagnosis, and classification of simple and complicated types. A surgical consultant at the hospital helped with the planning of the questionary and the method of examination used in the survey. A series of questions was included with the object of

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[1] Copies of the questionary are available at T.U.C. Centenary Institute of Occupational Health, London School of Hygiene and Tropical Medicine, University of London W.C.1.

discovering if varicose veins were related to age, childbirth, thrombophlebitis, body weight, obesity, constipation, family history, and occupation. Inquiry was also made regarding the type of corsetry or stocking support that was worn. The questionary and method of examination were first tried out in pilot surveys of women workers in London and Essex and substantially modified before being used in the main survey.[1]

The women in the English cotton mills were interviewed and examined in 1964 and 1965. The questionary was translated into Arabic for the survey of Egyptian women, which was undertaken in 1965 and 1966. The procedure used for questioning the workers and the method of examination were the same in both countries and were made by one observer (S. M.). Every woman stood in good light with the lower limbs completely exposed from groin to toes. The examination was started at the groin by palpating the internal saphenous vein with the tips of the fingers and following it to the toes to feel any enlargement or tortuosity. The subject was then asked to turn round and stand with her back to the observer so that the external (short) saphenous vein could be examined in the same way.

In recording varicose veins we adhered so far as was possible to the definition of Dodd and Cockett (1956): "A varicose vein is one which has permanently lost its valvular efficiency. . . . As a result of continuous dilation under pressure, in the course of time a varicose vein becomes elongated, tortuous, pouched, thickened." Hair veins and spider web veins were not counted as varicose.

The site of the varicose veins was recorded and their extent classified as: *generalized* if more than two-thirds of the course of the long or short saphenous veins was involved and *localized* if less than two-thirds was involved or if the communicating veins only were affected. Complications such as pigmentation, scarring, oedema, eczema, or ulceration were also recorded.

Results

Response Rates.—In the English mills there were 368 workers in Rochdale and 154 in Carlisle, of whom 358 (97%) and 146 (95%) respectively were seen. All but one of these women were Europeans; they were mostly born in the British Isles, but 71 came from Italy and Eastern Europe.

In the Egyptian mills there were 471 female workers, of whom 467 (99%) were seen in the survey. They were all Egyptians.

Overall Prevalence.—The overall prevalence of varicose veins was slightly higher among the women in Rochdale (33%) than in Carlisle (30%). Among the combined European women the prevalence was 32%, compared with 6% for the Egyptians.

Family History.—A history of varicose veins in one or both parents was given by one in three of the European women and by one in twenty of the Egyptian women. In both countries the women with a positive family history had a higher prevalence of varicose veins than those without a family history. Among the European women the proportions with varicose veins were respectively 44% and 27% in these two groups. The difference between these proportions is highly significant ($P<0.001$) and might be taken as an indication of the importance of heredity previously reported (De Takats and Quint, 1930; Ochsner and Mahorner, 1937; Hawkes and Hewson, 1940; Ludbrook and Beale, 1962). Nevertheless, women with varicose veins may be more likely than those without varicose veins to remember that their parents had the complaint, and mothers and daughters may have similar occupations and other ways of life conducive to the production of varicose veins.

Age.—The European women (Table I) showed an increase in prevalence with increasing age that was statistically significant ($P<0.001$). After standardizing for age, the difference in prevalence between the European and the Egyptian women is highly significant ($P<0.001$).

Childbirth.—In both countries women who had no children had a lower prevalence of varicose veins than those who had borne children (Table II). The difference is statistically significant both for the Europeans ($P<0.05$) and the Egyptians ($P<0.01$).

TABLE I.—*Prevalence of Varicose Veins by Age in Women Employed in English and Egyptian Cotton Mills*

Age Groups	English Mills			Egyptian Mills		
	No. of Women	With Varicose Veins		No. of Women	With Varicose Veins	
		No.	%		No.	%
15–	86	6	7·0	302	12	4·0
25–	74	19	25·7	64	7	10·9
35–	136	49	36·0	50	3	6·0
45–	129	58	45·0	39	5	12·8
55–74	79	30	38·0	12	—	—
All ages	504	162	32·1	467	27	5·8

Statistically significant difference in prevalence between age groups in English mills ($P<0.001$) and between prevalence in English and Egyptian mills after standardizing for age ($P<0.001$).

TABLE II.—*Prevalence of Varicose Veins in Relation to Childbirth in Women Employed in English and Egyptian Cotton Mills*

Parity	English Mills			Egyptian Mills		
	No. of Women	With Varicose Veins		No. of Women	With Varicose Veins	
		No.	%		No.	%
No children	191	50	26·2	348	14	4·0
One or more children	313	112	35·8	119	13	10·9
All women	504	162	32·1	467	27	5·8

Statistically significant difference in prevalence between women with children and those without in English mills ($P<0.05$) and in Egyptian mills ($P<0.01$).

Body Weight and Obesity.—The women were classified according to body weight into four groups (Table III). In both countries the lowest prevalence of varicose veins was found in the lightest group (35–54 kg.) and, except for the six Egyptians in the heaviest group, the prevalence rose with increasing body weight. The differences in prevalence between the groups classified by body weight are statistically significant in the European ($P<0.001$) but not in the Egyptian women. In addition to body weight the effect of obesity on the prevalence of varicose veins was examined in the European women by using the Quetelet index, W/H^2, where W is weight in kilograms and H is height in centimetres (Khosla and Lowe, 1967). Only the youngest age group, 15–34 years, showed a positive association between obesity and prevalence of varicose veins, and the index was not used in further analysis.

TABLE III.—*Prevalence of Varicose Veins by Body Weight in Women Employed in English and Egyptian Cotton Mills*

Body Weight (kg.)	English Mills			Egyptian Mills		
	No. of Women	With Varicose Veins		No. of Women	With Varicose Veins	
		No.	%		No.	%
35–	172	37	21·5	203	8	3·9
55–	279	98	35·1	239	17	7·1
75–	51	25	49·0	19	2	10·5
95+	2	2	100·0	6	0	—
All women	504	162	32·1	467	27	5·8

Statistically significant difference in prevalence between body-weight groups in English mills ($P<0.001$).

Constipation.—Among both Europeans and Egyptians those who said they had difficulty in opening their bowels daily had a higher prevalence of varicose veins than those with no such difficulty, but in neither population was the difference statistically significant. The proportion of women with constipation was slightly higher among the Egyptians than among the Europeans.

Occupation.—In both countries women who sat at their work had the lowest prevalence of varicose veins; it was 18·2% in English mills and 3·0% in Egyptian mills (Table IV). Those

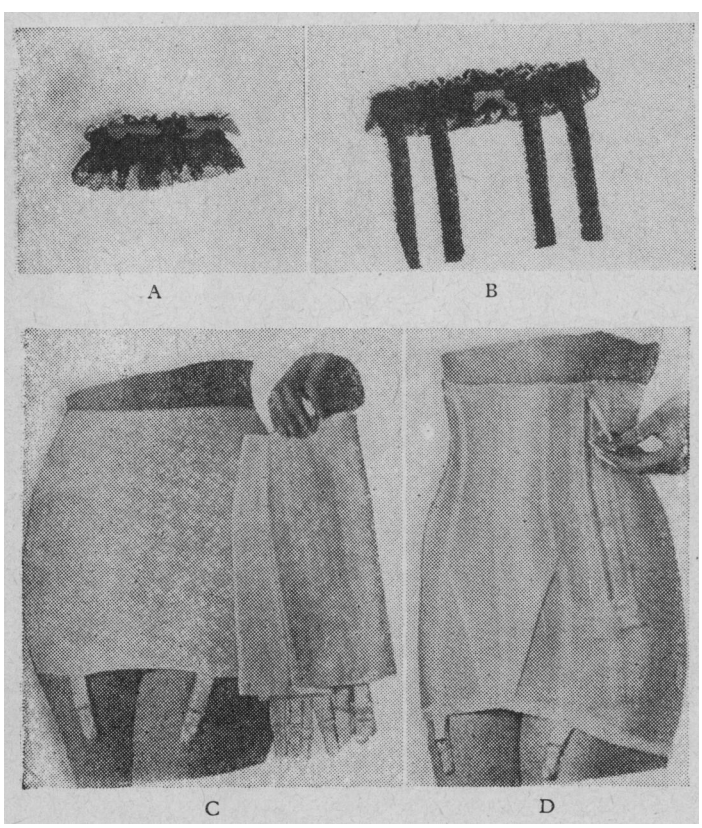
who worked standing up had the highest prevalence, 56·5% in England and 7·9% in Egypt, and others who mostly walked or who stood, sat, and walked occupied an intermediate position in both countries. The difference in prevalence was statistically significant in the English mills only ($P<0.001$).

TABLE IV.—*Prevalence of Varicose Veins by Position at Work in Women Employed in English and Egyptian Cotton Mills*

Position at Work	English Mills			Egyptian Mills		
	No. of Women	With Varicose Veins		No. of Women	With Varicose Veins	
		No.	%		No.	%
Sitting ..	22	4	18·2	133	4	3·0
Walking	337	97	28·7	—	—	—
Mixed jobs	99	35	35·4	145	8	5·5
Standing	46	26	56·5	189	15	7·9
All women	504	162	32·1	467	27	5·8

Statistically significant difference in prevalence in English mills ($P < 0.001$).

Corsetry.—There was a striking difference in the type of foundation garment worn (see Fig.) by the women in the two countries ; 363 (72·1%) of the women working in the English mills wore roll-on belts or corsets. Only 2 (0·4%) of the Egyptians used tight-fitting corsetry to keep their stockings up ; 56·8% used garters when they wore stockings in the winter, and 42·8% wore no stockings at all, summer or winter. In the English mill population only 2·1% never wore stockings, 8·3% used garters, and 17·5% wore suspender belts which give little or no pressure on the abdomen. The prevalence of varicose veins in the Europeans was clearly related to the methods used for stocking support. It increased with the tightness and stiffness of the garment worn (Table V). Nearly half the women wearing corsets had varicose veins ; those wearing roll-ons had the next highest prevalence, with nearly a third affected. The lowest prevalence, 18·2%, occurred among the 88 who wore suspender belts and the 11 women who wore no stockings. These differences in prevalence are statistically significant ($P<0.001$). It might be argued that these results simply reflect the association between varicose veins and weight, since the heavy women will tend to wear corsets and roll-ons for greater support. But our data show that in women of light weight (35–54 kg.) and of medium weight (55–74 kg.) there is an excess of varicose veins among those who wore corsets and roll-ons compared with those using other methods of stocking support. This is particularly pronounced in the older age groups (Table VI).



Types of foundation garment. A, garter. B, suspender belt. C, roll-on. D, corset.

TABLE V.—*Prevalence of Varicose Veins by Type of Garment Used for Stocking Support by Women Employed in English and Egyptian Cotton Mills*

Garment	English Mills			Egyptian Mills		
	No. of Women	With Varicose Veins		No. of Women	With Varicose Veins	
		No.	%		No.	%
None	11	2	18·2	200	11	5·5
Suspender belt	88	16	18·2	—	—	—
Garters (in Egypt worn in winter only) ..	42	9	21·4	265	16	6·0
Roll-on ..	203	62	30·5	1	0	—
Corset ..	160	73	45·6	1	0	—
All women ..	504	162	32·1	467	27	5·8

Statistically significant difference in prevalence between garment groups in English mills ($P < 0.001$).

TABLE VI.—*Prevalence of Varicose Veins by Age, Body Weight, and Stocking Support*

Age		Corsets and Roll-ons		Other	
		No. of Women	% with Varicose Veins	No. of Women	% with Varicose Veins
15–34 years	Light weight ..	45	6·7	24	8·3
	Medium weight ..	63	23·8	20	10·0
35–44 years	Light weight ..	19	42·1	18	22·2
	Medium weight ..	57	40·4	23	21·7
45 years +	Light weight ..	38	36·8	30	20·0
	Medium weight ..	102	50·0	12	16·7

Thrombophlebitis.—Those with varicose veins were asked if they had ever had thrombosis, phlebitis, or white leg ; 16 European women and one Egyptian woman gave a positive history (Table VII).

TABLE VII.—*History of Thrombophlebitis and Severity of Varicose Veins Measured by Their Extent and Complications in Women Employed in English and Egyptian Mills*

Mill	No. of Women with Varicose Veins	History of Thrombo-phlebitis		Bilateral*		Generalized*		Complicated*	
		No.	%	No.	%	No.	%	No.	%
English ..	162	16	9·9	81	50·0	12	7·4	52†	32·1
Egyptian	27	1	3·7	11	40·7	0	—	0	—

* The three categories of severity are not mutually exclusive.
† The 52 complicated cases comprised 24 with pigmentation, 15 with more than one complication without an ulcer, 7 with oedema of ankles, 2 with varicose ulcers and other complications, 2 with varicose ulcers, 1 with scarring of an old ulcer, and 1 with eczema.

Severity of Veins.—The European women not only had a higher prevalence of varicose veins than the Egyptians but they also had the more severe forms of the complaint. Twelve (2%) of the Europeans had generalized varicose veins and 52 (10%) had complications such as pigmentation, varicose ulcer, oedema, and eczema. None of the Egyptian women had either generalized varicose veins or complications (Table VII).

TABLE VIII.—*Number of Women in English Mills with Varicose Veins, Classified by Type of Garment Worn to Support Stockings, and Prevalence Rates Standardized for Age, Weight, Parity, and Position at Work*

Garment	No. of Women	No. with Varicose Veins	Standardized Prevalence Rate
Garters, suspender belts, or none	141	27	22%
Corsets or roll-ons	363	135	36%

Difference between standardized prevalence rates is statistically significant ($P < 0.01$).

Further Analysis of European Data

The results so far show that varicose veins are associated with age, childbirth, body weight, occupation, and corsetry. These factors are not independent of each other; the older women will, on the average, be heavier than the younger women, more likely to have borne children, and also more likely to wear corsets and roll-ons. Since both corsetry and standing at work are amenable to change, and thus offer opportunties for taking preventive measures, we have examined their effects on the prevalence of varicose veins in more detail. This has been done by standardizing for age, body weight, and parity. The data were stratified by these factors and by overall comparisons made by using the χ^2 test with the correction given by Armitage (1966). It was found that the prevalence of varicose veins was associated with parity in the 15–34 age group only, and this factor was therefore ignored in the older ages. After standardizing for age, body weight, and parity there was no statistically significant difference in prevalences between women wearing corsets and those wearing roll-ons, and these two groups were combined. Similarly it was possible to combine the groups wearing garters, suspender belts, or not wearing any foundation garment. No statistically significant differences in prevalence were found between women who worked in mixed jobs and those whose jobs entailed walking or sitting, and these three groups were also combined.

Comparisons were then made between women wearing corsets or roll-ons and all other women, after allowing for differences in age, body weight, parity, and whether or not they stood at their work. The standardized prevalence of varicose veins is 36% for the women wearing corsets or roll-ons and 22% for the others. The difference is statistically significant ($P<0.01$) (Table VIII). Similarly, comparisons were made between the women who stood at work and all other women after standardizing for age, body weight, parity, and the wearing of roll-ons or corsets. The standardized prevalence of varicose veins is 56% for the women who stood at their work and 30% for the others. The difference is statistically significant ($P<0.001$) (Table IX).

TABLE IX.—*Number of Women in English Mills with Varicose Veins, Classified by Position at Work, and Prevalence Rates Standardized for Age, Weight, Parity, and Type of Garment Worn to Support Stockings*

Position at Work	No. of Women	No. with Varicose Veins	Standardized Prevalence Rate
Sitting, walking, or mixed ..	458	136	30%
Standing	46	26	56%

Difference between standardized prevalence rates is statistically significant ($P < 0.001$).

Discussion

Our findings agree with previous observations, that varicose veins are much more common in Europe than in Africa. We think that these differences are environmental rather than ethnic.

As the survey was made by one observer, using carefully standardized techniques for diagnosing and grading the severity of varicose veins, we do not think that the pronounced difference in prevalence between the European and Egyptian women can be explained by observer variation.

The importance of venous thrombosis as a cause of the higher prevalence of varicose veins in the European women cannot be ascertained from this type of survey, as thrombophlebitis is mostly silent (Lockhart-Mummery and Smitham, 1951; Sevitt and Gallagher, 1961).

It has been suggested that the squatting position, which is commonly used in defaecation in Asia and Africa, reduces the risk of developing varicose veins, since it is likely to make the angle between the iliac and femoral veins so acute as to prevent much of the pressure being transferred into the leg veins when straining at stool (H. Dodd and D. Negus, personal communication, 1968). The Egyptian women have pedestal lavatories at the factory, but at home they probably use the squatting position for defaecation. This is one factor which may partially explain their lower prevalence of varicose veins.

Our results, however, do not entirely support the theory of Cleave (1959) and Dodd (1964), who believe that differences in diet are the main cause, that of Western people tending to cause constipation and pressure on the venous return from the lower limbs. In fact, we found a slightly higher prevalence of constipation in the Egyptian than in the European women; however, too much reliance must not be placed on the results of a questionary alone.

The pressure of the pregnant uterus on the pelvic veins is thought to be an important factor in the aetiology (Lake, Pratt, and Wright, 1942). In our study parity was associated with the prevalence of varicose veins only in the 15–34 year age group, and it seems likely that with increasing age its importance is outweighed by other factors.

The European women who worked standing had a much higher prevalence of varicose veins than those who sat or walked, yet compared with the Egyptians proportionally fewer of the Europeans had standing jobs (Table IV). The importance of continual standing was shown by Lake *et al.* (1942) in a survey of women working in a New York department store. They found that 74% of women who stood had varicose veins compared with 57% among those who sat at work. A possible explanation of the higher prevalence of varicose veins in the Europeans is that they stand more than the Egyptians when they are not at work.

A more detailed study of the European women indicated that the wearing of a corset or roll-on is also an important contributing factor in varicose veins, presumably because they constrict the abdominal wall, slow the circulation in the lower limbs, and raise intravenous pressure. This may partly explain the higher prevalence of varicose veins in the European women, since more than 70% of the Europeans, compared with less than 1% of the Egyptians, wore these types of corsetry. We have not seen any other published reports relating varicose veins and corsetry, but Ribaudo and Formato (1965) and Craig and Dvorak (1965) have shown that the panty girdle, made of tight-fitting elastic material, can exert a marked constrictive force on the thighs and cause oedema of the legs.

The conclusions that may be drawn from the survey are that varicose veins among women could be substantially reduced by eliminating the long periods which many of them have to spend standing at work and in their homes, and probably by using alternative methods to the corset and roll-on for stocking support.

We wish to thank Mr. Andrew Monro for the considerable help given in developing the methods used in this study and in preparing this paper, and Mr. Harold Dodd, Mr. David Negus, Dr. T. W. Meade, and members of our department for helpful comments. Thanks are also due to Dr. Mohamed abdel Latif, Dr. Fawzi El-Sayed, Dr. E. Hanafy, Dr. S. Shash, Dr. R. I. McCallum, Dr. F. Tyrer, Mrs. N. Taylor, and Miss J. Hood, who helped in arranging the field surveys in Egypt and England; Professor M. Hassanein for translating the questionary from English to Arabic; and Miss Rosemary Wood for statistical assistance.

We are indebted to the United Arab Republic's Organization of Social Insurance in Cairo for providing the salary of one of us (S. M.) and to the World Health Organization for a research grant to one of us (R. S. F. S.).

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Plasma 11-Hydroxycorticosteroid and Growth Hormone Levels in Acute Medical Illnesses

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British Medical Journal, 1969, **2**, 595–598

Summary: Adrenal cortical response in acute medical illness has been studied by measuring the plasma 11-hydroxycorticosteroid (11-OHCS) concentration in 178 patients. Those with unbalanced diabetes, acute infections, and severe myocardial infarction had high levels. The results obtained suggest that in a patient with a severe infection and hypotension a plasma 11-OHCS level of less than 15 μg./100 ml. indicates an inadequate adrenal cortical response, and one patient with septicaemia and temporary adrenal cortical insufficiency is described. Growth hormone levels were increased in patients with severe diabetic ketosis but not in those with hyperosmolar non-ketotic diabetic coma.

Introduction

Patients with primary or secondary impairment of adrenal cortical function may respond poorly to any acute illness, injury, or surgical operation, and unless adequate steroid cover is given circulatory failure with severe hypotension may occur. Cortisone and its synthetic analogues have been given to patients with acute illnesses and severe hypotension on the assumption that there may be an inadequate adrenal cortical response to the illness. An attempt has therefore been made to determine the magnitude of adrenal cortical response in a wide range of acute medical conditions by measuring plasma 11-OHCS levels. In many of the patients plasma growth hormone concentrations were also measured.

Methods

Most of the patients were studied on admission to medical wards because of acute conditions, and a few were seen in other wards of the hospital when an acute "medical" complication developed. Blood samples were taken into heparinized tubes and centrifuged at once, the plasma being stored at −10° C. until the estimations could be carried out. Serial measurements were made in some patients who required venepuncture in connexion with their illness.

Plasma 11-OHCS were estimated by the sulphuric acid fluorescence method (Mattingly, 1962) which was slightly modified. Only 0·5 ml. of plasma was extracted and an Aminco-Bowman Spectrophotofluorimeter was used which made it possible to check the emission spectrum from samples with low levels of 11-OHCS.

Plasma growth hormone was measured by radio-immunoassay, activated charcoal being used to separate the free from the bound labelled hormone. By this means it is possible to detect 0·4 mμg./ml. of plasma, the precision of the assay being ±20% with 95% confidence (Jacobs, 1969). The results are expressed in terms of human growth hormone (NIH-GH-HS 722A, Wilhelmi, kindly supplied by the National Pituitary Agency), and we are indebted to Dr. A. D. Wright for the antiserum used.

Results

Plasma 11-OHCS

The highest levels of plasma 11-OHCS were found in patients with unbalanced diabetes (Table I); the figures in patients with severe diabetic ketosis were higher than those with hyperosmolar non-ketotic coma (Fig. 1). Serial measurements were made on a number of patients, and the plasma 11-OHCS fell rapidly with treatment (Fig. 2). The patients with myocardial infarction had varying degrees of tissue destruction. Of those with only a minor degree, 13 had plasma 11-OHCS levels of less than 30 μg./100 ml., whereas those with widespread infarction or who had been resuscitated after cardiac arrest usually had levels greater than 50 μg./100 ml. Five of the patients with acute severe infections had unexpectedly low levels (Fig. 3); of these four were receiving steroids in a dosage which had not been increased when the infection developed. Point B in Fig. 3 is the reading from a woman aged 59 who had had a resection of the colon and ureteric reimplantation for malignant disease. She subsequently became very ill with fever and hypotension. Blood cultures grew pseudomonas, and the plasma 11-OHCS level at this time was 10·7 μg./100 ml.

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